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# ANATOMICAL AND ECOLOGICAL OBSERVATIONS ON MEDITERRANEAN HALOPHYTES: *SUAEDA* Forssk. ex Scop. GENUS

## CONSIDERAȚII ANATOMO-ECOLOGICE LA SPECII DE HALOFITE MEDITERANEENE: GENUL *SUAEDA* Forssk. ex Scop.

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**Abstract.** *In this work, we have anatomically investigated three Suaeda species: S. vera Forssk. ex J. F. Gmel., S. splendens (Pourr.) Gren. & Godr. and S. spicata (Willd.) Moq. (Chenopodiaceae). These taxa were collected from maritime and continental salt marshes from Spain, during July- November, 2010. The obtained results were correlated with some ecological data gathered in the field; they were discussed in order to establish the adaptive value of the evidenced anatomical features*

**Key words:** halophytes, ecology, mediterranean, succulence, successive cambia

**Rezumat.** *În lucrarea de față, am investigat din punct de vedere anatomic trei specii de halofite aparținând genului Suaeda: S. vera Forssk. ex J. F. Gmel., S. splendens (Pourr.) Gren. & Godr. și S. spicata (Willd.) Moq. (Chenopodiaceae). Taxonii au fost colectați de pe sărături maritime și continentale din Spania, în perioada iulie-noiembrie 2010. Rezultatele obținute au fost corelate cu unele date ecologice, expeditiv, din teren și interpretate în sensul stabilirii valorii adaptative a trăsăturilor anatomice observate.*

**Cuvinte cheie:** halofite, ecologie, mediteranean, succulență, policambie

## INTRODUCTION

Halophytes represent a polymorphous ecological group of plants; they include species with a complex set of anatomical features, allowing them to survive in high soil salinity conditions (Grigore, 2008a, 2008b; Grigore and Toma, 2010 a, 2010b; Grigore et al, 2010a).

In the Mediterranean region, the halophytic communities represent two categories – those that belong to the maritime salt marshes and those that belong to the salt deserts (Chapman, 1974). Maritime marshes of the Mediterranean, described in general terms by Rikli (1943) lie behind coastal dunes but are subjected to salt-water inundation.

## MATERIAL AND METHOD

In the present study, we have anatomically investigated three species of

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*Suaeda* (Chenopodiaceae): *S. vera* Forssk. ex J. F. Gmel., *S. splendens* (Pourr.) Gren. & Godr. and *S. spicata* (Willd.) Moq. The two firstly mentioned species were collected from Alicante (Spain), and the last from El Saler (Spain), in the July of 2010.

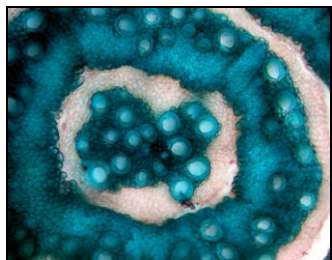
Anatomical investigations were conducted following the method standardized by our group from Faculty of Biology, Iasi (for an extended description of this method, see: Grigore et al, 2010b).

## RESULTS AND DISCUSSIONS

As a result of our investigations, we evidenced the successive cambia phenomenon, located on the level of axial vegetative organs (root, stem) in annual *Suaeda* species (*S. splendens* and *S. spicata*).

Thus, in *S. splendens*, the central cylinder of the **root** is very thick with a particular structure. It comprises: a central massive of secondary xylem (vessels and sclerenchyma fibers) (fig. 1), irregular in shape, surrounded by a thin ring of secondary phloem; 3 (4) concentric rings derived from the activity of additional cambia. Each ring includes: an internal, thicker region of sclerenchyma fibers, where xylemic vessels are partially incorporated and an external, thinner region of phloem, having different thickness following the root's circumference. The external ring, the last generated by the cambium activity is thinner and has only sclerenchyma fibers (with slightly lignified walls) towards interior (xylemic vessels are not yet formed) and phloemic elements towards exterior. We noticed some (4-5) layers of cambial cells, arranged in radiated ranges; these may be found between the phloemic and sclerenchyma fibers rings.

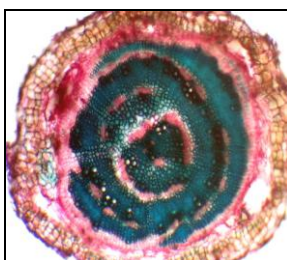
In the same species, at **stem** level, the central cylinder consists of 6-7 vascular bundles, different in size, split up by medullar parenchymatic large rays (fig. 2). The xylemic vessels near to the phloem are separated by sclerenchyma fibers. The central cylinder includes, in addition, an incomplete ring of sclerenchymatic fibers with moderately thickened and lignified walls (having scarce xylemic areas embraced in this ring) and a complete phloemic ring. Close to this, 2-3 layers of cortical small cells may be noticed. Therefore, a successive cambia already has operated.



**Fig.1** - Cross section through the root of *S. splendens* (X400)



**Fig.2** - Cross section through the stem of *S. splendens* (X200)



**Fig.3** - Cross section through the root of *S. spicata* (X200)

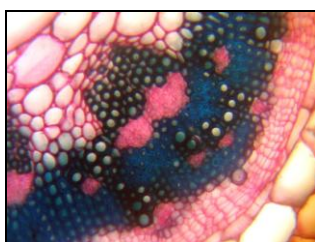
In *S. spicata*, in the **root**, the external additional cambia is very dynamic,



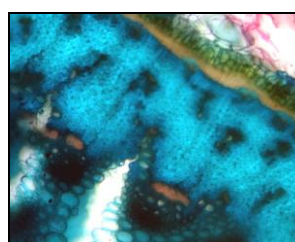
built by 4-6 layers of cells with typical radiate disposition (fig. 3). Its activity generated only a very thin phloemic ring, with sieve tubes, companion cells and few parenchyma cells; all are tangentially prolonged, strongly radially flattened and with cells walls slightly collenchymatous. The xylemic lignified body is very thick and with different organization in its thickness. It consists of an external ring, incomplete and different in size, made by sclerenchyma fibers and vessels.



**Fig.4** - Cross section through the root of *S. spicata* (X400)



**Fig.5** - Cross section through the stem of *S. spicata* (X400)



**Fig.6** - Cross section through the stem of *S. vera* (X200)

In the thickness of this ring some phloemic islands are included. The lignified body also consists of a median thicker and continuous ring of sclerenchyma fibers and vessels as well an internal, thick, more or less spiraled ring of sclerenchyma fibers and vessels; here and there, several phloemic islands, forming a ring almost complete may be found. Therefore, several successive cambia were active, generating intensely lignified rings, which incorporate the phloem island-like shape. In the center of organ, the diarch central cylinder from primary structure is still visible (fig. 4).

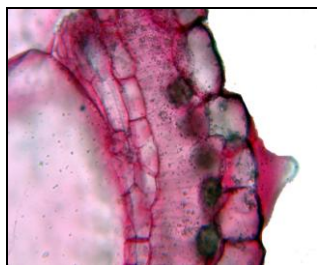
The stele of **stem** begins with a uni-layered pericycle, made by parenchyma cells. On the periphery of central cylinder a thick ring (5-6 layers) of successive cambia is still noticeably, but it is not yet differentiated. At its internal side, from exterior to interior we can distinguish: an internal thicker ring of sclerenchyma, where vascular bundles are encompassed. Here, there and everywhere these bundles are prominent in the adjacent cambial ring, having at the periphery of phloem 1-2 layers of sclerenchyma fibers. The stele also contains a ring with 10-12 big vascular bundles (fig. 5) with phloem in direct contact with the external sclerenchyma ring and xylem with vessels and cellulosic parenchyma cells in some bundles, or with vessels and libriform fibers, in others.

In *S. vera*, a perennial species, at the **stem** level, the central cylinder has the follow configuration: several thick strands of sclerenchyma fibers near to the cortex, two layers of cells with suberized walls – located between the strands of sclerenchyma fibers and phloemic ring. The stele also contains a thin, secondary phloemic ring, having an external, very thick area of sclerenchyma and an internal area with 8 bundles, with the phloem in contact with sclerenchyma area (fig. 6).

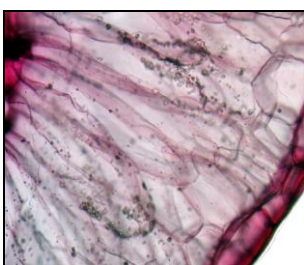
Regarding the structure of **lamina** (a lateral vegetative organ), this has a different configuration in the three investigated taxa. However, all species have

succulent lamina.

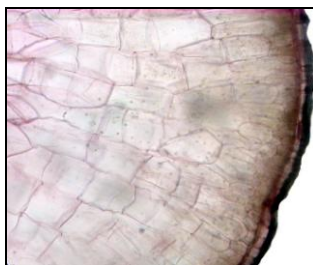
Thus, in *S. splendens*, the lamina is succulent. The palisade parenchyma consists of a single layer of flattened cells; beneath this, we noticed a layer with small, square or rectangular parenchymatic cells with thin walls (fig. 7). The central mesophyll actually represents a very thick water storage fundamental parenchyma, including huge cells, with thin walls. In the center of this tissue a small vascular bundle is noticeable, surrounded by 2-3 layers of parenchymatic cells.



**Fig.7** - Cross section through the lamina of *S. splendens* (X400)



**Fig.8** - Cross section through the lamina of *S. spicata* (X200)



**Fig.9** - Cross section through the lamina of *S. vera* (X200)

In *S. spicata*, the mesophyll comprises 1-2 hypodermal layers of small chlorenchymatic cells rounded or rectangular in shape – projected on epidermis. We also found a layer of huge cells, prolonged towards epidermis, forming a water storage tissue (fig. 8). Between vascular bundles, 1-2 layers of rounded big cells may be noticed.

The lamina of *S. vera* is also succulent. The mesophyll is centric-homogeneous with prolonged cells perpendicular to epidermis (only those of external layers are shorter, chlorenchymatic); these tissues form a water storage tissue (fig. 9).

Referring especially to **ecological implications** of above mentioned adaptations, we can include here some comments. All *Suaeda* species vegetate in saline environments (Edmondson, 1993). We collected *S. spicata* from a wet saline habitat, sometimes exposed also to flooding, due to local soil properties and climatic conditions. The other taxa vegetate also in saline areas, but more dry and elevated that the central part of salt marsh, where the soil salinity is higher.

The successive cambia phenomenon, evidenced by us in these species is considered in “classic” plant anatomy as a structural anomaly. But we dealt with it as an adaptation with an ecological and even evolutive significance in halophytes from *Chenopodiaceae* (Grigore and Toma, 2006, 2007).

The succulence of lamina, in all analyzed species may be correlated, no doubt, with environmental factors occurring in the ecosystems where these species grow. Succulence is regarded as a xeromorphic feature and it is explained by physiological drought theory (Grigore, 2008b; Grigore and Toma, 2010a). Although prefigured by early ecological and anatomical observations (Wiesner, 1889; Henslow, 1895; Schimper, 1903; Warming, 1909; Clements, 1920; McDougall,

1941), this theory has been marginalized for many decades. Recently, we reopened this idea and developed it (Grigore and Toma, 2010a). Succulence may be involved in dilution of salts in excess which might accumulate in plant's organs; it also assures the erect position of vegetative organs in halophytes with less developed stereom (Grigore, 2008b). The evolutive significance of succulence has been recently put into discussion, in the whole general context of adaptive mechanisms in halophytes (Grigore, 2011).

The foliar succulence has been also evidenced in other *Suaeda* species, by Chermezon (1910), Mateu Andres (1989), Polić et al. (2009), Grigore and Toma (2010a).

In addition, *S. splendens* presents Kranz anatomy, a feature related to  $C_4$  photosynthetic pathway (Grigore, 2008b; Grigore and Toma, 2010a). Anyway, *Suaeda* species have a large diversity in this regard: some of them present  $C_3$  pathway while others,  $C_4$  (Frey and Kurschner, 1983; Gamaley, 1985; Fisher et al., 1997; Muhaidat et al., 2007). The other two investigated *Suaeda* species seem to display a foliar anatomy related to  $C_3$  photosynthesis - the *austrobassioid* type evidenced and described by Fisher et al. (1997), Jacobs (2001) and Polić et al. (2009). However, 58 % of *Suaeda* species have  $C_4$  photosynthetic pathway (Sage et al., 1999).

## CONCLUSIONS

Anatomical features evidenced in *Suaeda* species are particular and relevant for halophytes belonging to *Chenopodiaceae*. They reflect a close relation between form, structure and function and ecological factors.

**Acknowledgements.** Supported by the Romanian POSDRU/89/1.5/S/ project 'Developing the innovation capacity and improving the impact of research through post-doctoral programmes' and by COST Action FA0901: 'Putting Halophytes to work – From Genes to Ecosystems'.

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# ECOLOGICAL NOTES ON HALOPHYTES SPECIES FROM MEDITERRANEAN CLIMATE

## OBSERVAȚII ECOLOGICE LA SPECII DE HALOFITE DIN CLIMATUL MEDITERANEAN

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**Abstract.** *Salt marshes represent special ecosystems where plant species adopt different adaptive strategies, according to spatial disposition, association with other species or in terms of accurate specialization related to salinity factor. The aim of this work is to present some ecological notes regarding halophytes occurring in maritime and continental salt marshes from Spain. Our observations were conducted during July-November, 2010. These observations lead to the idea that each species has, in fact, a number of morphological, anatomical and physiological adaptations, strictly correlated with environmental factors. Some of these taxa are dominant in salt marshes, having very efficient adaptive strategies assuring them the stability in hyper saline environments. We discuss, extensively, some examples, in a holistic manner.*

**Key words:** halophytes, ecology, adaptation, mediterranean, integrative.

**Rezumat.** *Sărăturile reprezintă ecosisteme deosebite, în cadrul cărora speciile de plante adoptă strategii adaptative diferite, în funcție de poziția spațială, asocierea cu alte specii sau în funcție de specializarea strictă în relație cu factorul salinitate. Lucrarea de față își propune să prezinte unele observații ecologice la specii de halofite care vegetează pe sărături maritime și continentale din unele regiuni ale Spaniei. Observațiile noastre au fost efectuate în perioada iulie-noiembrie 2010. Am putut constata că fiecare specie prezintă, de fapt, un set de adaptări morfo-anatomice și fiziologice, în deplină concordanță cu factorii de mediu. Unii taxoni sunt dominanți în aceste ecosisteme, prezentând strategii adaptative foarte eficiente care le asigură stabilitatea în cadrul mediilor hipersaline. Pe larg, sunt discutate unele exemple, într-o manieră holistică.*

**Cuvinte cheie:** halofite, ecologie, adaptare, mediteranean, integrativ.

## INTRODUCTION

The Mediterranean climate is characterized by strong seasonality which involves the association of a drought period when temperatures are at their hottest and a cool (and cold in many areas) moist period (Thompson, 2005). The summer drought can limit growth, flowering, and fruiting, and is a major cause of seedling mortality. The Mediterranean ecoregions are usually defined by their particular climates, which are transitional between temperate and dry tropical climates

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(Médail, 2009). These conditions occur on the west coasts of all continents between latitudes 30° and 45°. Rainfall is extremely variable, with mean annual values ranging from 100 to 2000 mm. Aridity and temperature play an essential role in the structure and composition of Mediterranean ecosystem. Five ecoregions of the world possess a Mediterranean climate and form the Mediterranean biome: Mediterranean Basin, California, central Chile, the southern and southwestern Cape Province of South Africa, the southwestern and parts of southern Australia (Joffre et al., 2007; Keddy, 2007; Médail, 2009).

From these regions, Mediterranean Basin occupies the biggest area (2.3 millions km<sup>2</sup>) where vegetate approximately 25.000 plant species (Keddy, 2007).

Due to the high heterogeneity of factors characterizing this type of climate (topographic, climatic, lithological substrate, hydric regime, soil fertility diversity), attention should be paid on the fact that sometimes authors are referring on Mediterranean climate, Mediterranean ecosystem-types, Mediterranean biome, and sometimes on Mediterranean-type environments.

In the present work, our intention is to propose an ecological integrative approach of halophytes; this would imply that ecological observations gathered in the field were correlated with morphology and anatomy of halophytes, and, when possible with physiological and biochemical data (obtained in the lab). In this way, we intended to obtain a complete picture of interrelationships established between halophytes and corresponding environmental factors.

Halophytes are plants adapted to survive in high salinity conditions in soil or water; their biology, as well the great number of difficulties related to their definition and classifications were extensively discussed by our group dealing with halophytology (Grigore, 2008a; 2008b, Grigore and Toma, 2010a; 2010b, Grigore et al, 2010).

## MATERIAL AND METHOD

Our observations in the field were conducted between July and November of 2010, in maritime and inland salt marshes from Spain. We investigated over 30 halophytes collected from these ecosystems. Biochemical investigations were followed in Instituto de Biología Molecular y Celular de Plantas (Universidad Politécnica de Valencia) and anatomical investigations were done in UPV and Plant Morphology and Anatomy Laboratory, from “Alexandru Ioan Cuza University”, Iasi.

## RESULTS AND DISCUSSIONS

In a maritime salt marsh from Alicante (SE Spain), it can be noticed the disposition of vegetation in concentric belts, following the intensity of soil salinization (fig. 1). Thus, the salt marsh is bordered on the lower part by a relatively thin belt with *Phragmites australis* (1), which occupies a lower, less salinized area in the configuration of salt marsh. Towards the interior, few isolated plants of *Tamarix boveana* and *T. canariensis* (3) may be found. The last mentioned species is usually confined to upper, peripheral areas, avoiding thus the waterlogging conditions. This saline ecosystem is dominated by *Sarcocornia*



*fruticosa* and *Arthrocnemum macrostachyum*, which form a relatively large belt towards the center of salt marsh (2), where the salinity is the most elevated. Between patches built by these two species, another species from *Chenopodiaceae* can be noticed: *Salicornia ramosissima*, an annual species that achieve in the late autumn an intense, beautiful red colour (fig. 2).



**Fig. 1** - General appearance of a salt marsh in Alicante (Spain), July of 2010 (original, the explanation of numbers in the text)

These two chenopods are perennial, being - as we will see in the further paragraphs - strictly adapted to high salinity. Right in the center of salt marsh (4), they appear as small patches or even isolated plants (fig. 3).



**Fig. 2-** *Salicornia ramosissima* (original)



**Fig. 3** - Isolated plants of *Sarcocornia fruticosa*, located in the center of salt marsh (Alicante, Spain, July of 2010, original)

In this part of salt marsh salt efflorescence may be formed, especially in the dry season, due to strong variations in the hydric regime of atmosphere and soil; this leads to formation of crusts in soil surface, after the intense evaporation accompanying the end of dry season (fig. 3).

The other peripheral belt, opposite to that formed by *Phragmites* actually represents the transitional zone to an ecosystem less salinized, more elevated in comparatively with the proper salt marsh (fig. 1). As we left behind the salt



**Fig. 4 - *Centaurium spicatum*** (original)

marsh, we can find, gradually species such as: *Suaeda splendens*, *S. vera*, *Salsola oppositifolia*, *Frankenia*, *Limonium* species, which are well adapted to salinity conditions, but mainly dried, due to the soil less permeable to water, facilitating the drainage to lower parts. Returning to this relatively large belt of vegetation (fig. 1, no. 5), it consists of species as: *Limonium furfuraceum*, *L. santapolense*, *L. parvibracteatum*, isolated plants of *Tamarix*, *Mesembryanthemum nodiflorum*, *Juncus acutus*, *J. maritimus*, and *Suaeda vera*. On the slope connecting the zones 5 and 4, in places more shaded and rich in vegetation, we found *Centaurium spicatum* (fig. 4), and *Inula crithmoides* - in the lower parts. This species is succulent, growing in wet

places; we noticed that when occurring as isolated individuals, this species is more robust and branched, in contrast to the individuals grouped in patches.

Sometimes, after abundant rainfalls (especially in the autumn), here are conditions for flooding, which change the general appearance of these ecosystems (fig. 5).



**Fig. 5 - General appearance of a maritime salt marsh, after a rainy seson** (Spain, November of 2010; compare with Fig. 1; original)



It's very interesting to discuss the intensity and relevance of halophytes' adaptations, following the salinity gradient. Thus, *Chenopodiaceae* species, which are well represented in these salt marshes, have the most complex adaptations related to salinity factor. All these taxa are succulent, perennial (almost in all cases), flowering usually in the late autumn (*Sarcocornia*, *Arthrocnemum*, *Salicornia*, *Sueda*). The succulence of vegetative axial organs allow the dilution of salts (Grigore, 2008b; Grigore and Toma, 2010a), as well acting as a compensatory mechanism for the lack of well developed stereome. Biochemically, *Arthrocnemum* and *Sarcocornia* species have high osmotic potentials (Waisel, 1972); our investigations revealed that they accumulate small amount of proline and synthesize high amount of glycine betaine, in elevated salinity conditions (Grigore et al., unpublished data). But other halophytes have built, during the evolution (Grigore, 2011) another mechanisms, allowing them to cope with the toxic effects of salts in excess. We refer on secretion, a complex largely distributed phenomenon among halophytes (Grigore and Toma, 2010b); it may be found in *Limonium* and *Tamarix* species (Grigore and Toma, unpublished data). *Tamarix* (fig. 7) are phreatophytes and posses salt glands having a great capacity to excrete salts and concentrations of salts in the solutions may be 20 times greater than those in the local ground water.



**Fig. 6** - Branches with leaves of *Tamarix canariensis*. It can be noticed the salted drops, secreted by salt glands (Alicante, July of 2010, original)



**Fig. 7** - *Tamarix canariensis*. (Alicante, July of 2010, original)

The special anatomical and ecological features found in *Tamarix* species (Grigore and Toma, 2010b) seem to have very complex and subtle implications in the interrelations established between these plants and other species from a given ecosystem. It is more likely that roots of *Tamarix* species can access the salinized deep ground water and can induce the salinization of the upper parts of the soil, which could lead to elimination of species vegetating in the non-salinized layers of the soil (Grigore and Toma, 2010b). Perhaps due to this kind of interrelations,

under *Tamarix* „canopy” only halophytes – adapted to survive in high concentrations of salts – can vegetate (fig. 6).

## PRELIMINARY CONCLUSIONS

Data presented here – and only in a concise manner – suggest that halophytes from Mediterranean are well specialized species adapted to vegetate in particular ecological conditions. Taking into consideration that we can obtain a complete adaptive profile of halophytes but only using morphological, anatomical, physiological and biochemical information, we propose that this kind of approach to be called *plant integrative ecology*.

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# ON CHARACTERISATION OF A PIGMENT APPARATUS IN INTRODUCED CULTIVARS OF GRAPE IN BELARUS

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**Abstract.** *The photosynthetic apparatus of twenty grape cultivars introduced in Belarus during vegetation period was investigated. An essential intervarietal diversity has been revealed regarding chlorophylls and carotenoids content. For almost all un hardy cultivars, the pigment content gained its maximal value already in June, though for the hardy ones it has been still increasing in August. For most of investigated cultivars, the content of photosynthetic pigments falls short of characteristic values for grape plants vegetating in warmer climate zones. The light harvesting system of photosynthetic machinery during the whole vegetation period resembled that of shade-tolerant plants. Most anthocyanins have been detected exclusively in the leaves of red-fruit cultivars. High content of malonic dialdehyde as indicator of oxidative stress, especially at the early stages of vegetation, is typical for most of grape cultivars introduced in Belarus.*

**Key words:** grape, introduced cultivars, photosynthetic pigments, anthocyanins, lipid peroxidation

## INTRODUCTION

Analysis of empirical data for introduction of grapevines (*Vitis vinifera* L.) in various geographical regions clearly evidences high dependency of a cultivar's appearance on the current ecological conditions. On the other hand, it has been shown that content of the photosynthetic pigments in the grapevine leaves may serve as an indicator of physiological state of plants and thus indicate if the plant fell under the stress (Abdallah F.B. et al., 2006; Blanchfield A.L. et al., 2006; Gornik K. et al., 2008).

Here, we report our efforts to characterize pigment apparatus of grapevine cultivars introduced in Belarus where climate conditions are marginal to those which such a light- and heat-demanding species would ideally require.

## MATERIAL AND METHOD

Twenty different cultivars of grapevines introduced in RB were investigated. The screened cultivars were outdoor-grown and varied by their resistance to low-temperature stress, grape's color and application particulars (Ustinov V.N., Rusovskaja A.V., 2009). Leaves of the middle layers of the plants were analyzed throughout the different vegetation phases of the season 2009. Content of photosynthetic pigments, anthocyanins, and degree of peroxidation of lipids were determined according to (Kabashnikova L.F et al., 2011).

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## RESULTS AND DISCUSSIONS

### 1. Photosynthetic pigments

Quantitative analysis of the photosynthetic pigments in leaves of the screened grapevine cultivars (table 1) shows significant intervarietal dispersion regarding content of chlorophyll ( $a+b$ ) ( $9,5\text{--}33,0\text{ }\mu\text{g}/\text{cm}^2$ ) and carotenoids ( $2,3\text{--}6,5\text{ }\mu\text{g}/\text{cm}^2$ , data not shown).

Table 1

**Chlorophylls content ( $a + b$ ,  $\text{g}/\text{cm}^2$ ) in the middle layer leaves of twenty grape cultivars introduced in Belarus during vegetation period 2009**

Resistens to cold by Ustinov V.N., Rusovskaja A.V., 2009	Cultivar	Vegetation period			
		June	July	August	September
Highly-resistant, technical type	<i>Alfa</i>	11,71±0,99	11,29±1,57	14,67±1,55	12,35±2,98
	<i>Golubok</i>	16,25±0,24	21,72±1,71	18,61±1,38	19,93±2,70
	<i>MN 1094</i>	18,10±0,34	-	16,23±1,01	14,15±0,02
Resistant, technical type	<i>Bianka</i>	13,73±0,56	12,68±0,35	16,43±0,66	-
	<i>Dushisty</i>	10,37±1,03	14,52±2,12	9,51±0,72	16,19±2,85
	<i>Kristall</i>	16,12±1,40	10,99±0,72	16,18±1,15	9,573±2,28
	<i>Platovsky</i>	19,20±0,68	15,55±0,88	10,94±0,41	9,99±0,82
Resistant, table type	<i>Supaga</i>	18,74±1,29	19,26±1,65	27,23±0,25	23,17±0,32
Moderately resistant, technical type	<i>Muskat desertny</i>	20,02±1,47	19,51±2,79	16,61±0,59	17,15±0,00
	<i>Muskat Niny</i>	10,21±0,59	18,93±0,45	10,59±0,02	-
	<i>Suvenir Vaskovskogo</i>	13,82±0,38	13,60±1,56	13,75±0,60	12,07±1,80
Moderately resistant, table type	<i>Viktoria</i>	19,13±0,14	25,59±5,07	33,70±0,64	27,23±0,95
	<i>Iyulsky</i>	20,96±0,95	18,85±0,94	16,20±0,18	12,96±1,83
	<i>Krasa Severa</i>	17,75±1,56	19,49±3,07	14,92±0,79	12,27±0,04
	<i>Neptun</i>	22,20±0,64	19,92±2,11	13,22±0,04	10,83±0
Low-resistant technical type	<i>Portugiser</i>	18,00±1,18	15,69±0,85	12,67±0,49	15,00±1,85
Low-resistant, table type	<i>Aleshenkin</i>	15,96±1,27	20,12±0,42	12,73±0,21	13,07±0,00
	<i>Dekabrsky</i>	17,70±0,28	22,81±3,19	16,12±1,28	13,93±0,46
	<i>Novoukrainsky ranny</i>	13,53±0,91	18,82±1,02	11,59±0,54	12,23±0
Non-resistant, table type	<i>Dunav</i>	13,46±0,75	-	12,00±1,34	15,06±1,50

Nevertheless, for vast majority of the investigated cultivars even the top values were significantly surpassed by those of cultivars usually vegetated in more warm climate zones (Abdallah F.B. et al., 2006; Blanchfield A.L. et al., 2006; Gornik

K. et al., 2008), and appeared to be twice lower than those found in grown up cereal leaves (Abramchik L.M. et al., 2008).

In spite of difference in content of chlorophylls within the group of highly-resistant cultivars, the type of kinetics for uptake of chlorophylls was identical. Its main feature is significantly increased uptake of the chlorophylls in the second half of the vegetating period. For instance, according to this criterion, "*Victoria*" could be classified as hardy cultivar. Within the group of hardy and moderately hardy cultivars of technical type, essential differences in the pigments uptake dynamic were observed. Thus, for all most cold susceptible cultivars, the pigment content reached its peak already in June and then steadily decreased until the end of the season. However, photosynthetic pigments of the vast majority of the examined cultivars didn't degrade drastically even by the end of September. Such a trend is not in line with that which would be expected for the most of mono- and dicots in which chlorophyll decompose even in the leaves of the upper layer quite quickly in course of a harvest maturing. Noteworthy, a fairly low ratio of chlorophyll *a* to chlorophyll *b* featured all investigated cultivars (table 2).

Table 2

**Variation in composition of photosynthetic pigments and correlation indexes (*r*) between total content of chlorophylls and carotenoids (A) and ratio of chlorophyll *a* to chlorophyll *b*, and carotenoids content (B) measured in the middle layer leaves of grape cultivars during vegetation period 2009**

Copr	Chlorophylls a/b		Chlorophylls (a+b)/ Carotenoids		<i>r</i>	
	June	August	June	August	A	B
<i>Alfa</i>	2,51±0,35	2,03±0,65	2,68±0,39	3,36±0,35	0,49	-0,31
<i>Golubok</i>	2,89±0,02	2,46±0,04	3,54±0,09	4,31±0,41	-0,54	-0,68
<i>MN 1094</i>	2,68±0,01	2,58±0,01	3,6±0,16	3,60±0,16	1,00	0,99
<i>Bianka</i>	2,81±0,12	2,51±0,06	3,49±0,32	4,11±0,02	0,99	0,81
<i>Dushisty</i>	2,45±0,28	2,75±0,12	3,07±0,13	2,75±0,16	0,83	-0,47
<i>Kristall</i>	2,81±0,04	2,37±0,01	3,19±0,11	4,20±0,11	0,86	0,77
<i>Platovsky</i>	2,62±0,22	2,43±0,03	3,94±0,39	3,91±0,19	0,99	0,88
<i>Supaga</i>	2,68±0,04	2,52±0,03	3,89±0,28	4,78±0,05	0,86	-0,75
<i>Muskat desertry</i>	2,83±0,05	2,65±0,02	3,95±0,26	4,20±0,17	0,83	-0,12
<i>Muskat Niny</i>	2,02±0,02	2,76±0,06	3,36±0,14	3,07±0,13	0,98	0,77
<i>Suvenir Vaskovskog</i>	2,65±0,02	2,47±0,01	3,59±0,17	3,90±0,01	0,71	0,07
<i>Viktoria</i>	3,02±0,05	2,38±0,04	2,97±0,02	5,44±0,19	-0,46	0,36
<i>Iyulsky</i>	2,8±0,07	2,51±0,01	3,66±0,06	3,87±0,07	0,99	0,59
<i>Krasa Severa</i>	2,84±0,01	2,59±0,05	4,06±0,10	4,10±0,20	0,95	0,57
<i>Neptun</i>	2,96±0,02	2,36±0,06	3,63±0,04	3,96±0,02	0,97	0,97
<i>Portugiser</i>	2,85±0,06	2,25±0,01	3,55±0	4,67±0,17	0,97	0,52
<i>Aleshenkin</i>	3,03±0,02	2,61±0,04	3,48±0,06	3,74±0,05	0,40	0,21
<i>Dekabrsky</i>	2,79±0,08	2,48±0,00	3,18±0,12	4,22±0,07	0,66	0,43
<i>Novoukrain- sky ranny</i>	2,66±0,01	2,58±0,05	3,43±0,28	4,08±0,32	0,57	-0,46
<i>Dunav</i>	2,73±0,02	2,56±0,05	3,2±0,13	3,79±0,12	0,99	0,11

For the most of cultivars it was below 2,6 and notably varied in course of vegetation. The highest variability (from 2.0 to 3.0) was observed for green-fruit

cultivars *Muskat Niny* and *Aleshenkin*. In general, light harvesting system of the cultivars grown in open soil resembled this of shade-resistant plants.

The ratio between chlorophylls and carotenoids content at the early stage of vegetation (table 2) varied within the range of 3,5; in the middle of vegetation period it increased to the value  $\geq 4,5$  without significant cultivar differences, and at the end of vegetation period it lowered for most of cultivars, mainly due to the predominant decrease of chlorophyll content. A tendency was observed towards decreased value of the ratio between net chlorophylls and carotenoids content in grapevine leaves under biotic stress in the field (Blanchfield A.L. et al., 2006).

Under normal growth conditions, correlation index ( $r$ ) between chlorophylls and carotenoids content is usually around 1. But not all the grapevine cultivars revealed such correlative interrelation (table 2, column A). For the cultivars with high chlorophyll content (considering the excess of energy absorbed by chlorophyll), the lack of positive correlation between accumulation of chlorophylls and carotenoids is probably associated with an underbalance between the components of a plant antioxidant system, in which carotenoids play a dominating role in the neutralization of active oxygen forms.

Interplay between light-harvesting and chlorophyll-protecting systems is the important feature of plant cultivars. It is characterized by a correlation index between changes in proportion of chlorophylls  $a$  and  $b$ , and carotenoids content. The data obtained, reveal a significant variability of  $r$  for these parameters (table 2, column B). Thus, high positive values of  $r$  were determined for four hardy cultivars of technical type. Seven cultivars of different cold-resistance groups were characterized by negative values, and another four cultivars did not reveal any correlations. Likely, interplay between two pigment systems can be disharmonized under stress if additionally carotenoids are synthesized, not chlorophylls. If that is the case, detected diversity for the values of  $r$  for different cultivars introduced in the same climate zone can specifically reflect their individual response on temperature stress during the vegetation course.

## **2. Anthocyanins**

The major amount of anthocyanins playing an important role in stress response was found mainly in the leaves of red-fruit cultivars *Neptun* and *Dunav* (15-17  $\mu\text{g}$  per gram of fresh mass, table 3). For the other cultivars in the first half of a vegetation period, this value did not exceed 8,5  $\mu\text{g}$  per gram of fresh mass being next lower order to that for the leaves of rye, triticale, and tomatoes (Kabashnikova L.F. et al., 2011). In the majority of grapevine cultivars, anthocyanins were revealed only at the end of vegetation season. Though being not always evident by direct viewing, the bulk of anthocyanins is localized in petioles.

## **3. Degree of lipid peroxidation**

Degree of lipid peroxidation was evaluated relying on the content of malonic dialdehyde (MDA). In general, degree of lipid peroxidation in severed grapevine leaves (table 3) significantly exceeded the values determined for cereal plants (Abramchik L.M. et al., 2008), especially at the final stage of plant ontogenesis. As no correlation with cold resistance was observed for all examined

cultivars, it is entirely possible that different cultivars of heat-demanding grapevine are similarly affected by rather low night temperatures during outdoor growing.

Table 3

**Content of anthocyanins and products of lipides peroxidation (malonic dialdehyde, MDA) in the middle layer leaves of grape cultivars**

<b>Resistance to cold by Ustinov V.N., Rusovskaja A.V., 2009</b>	<b>Cultivar</b>	<b>Anthocyanins, <math>\mu\text{g}</math> per gram of fresh mass, June</b>	<b>Anthocyanins, <math>\mu\text{g}</math> per gram of fresh mass, September</b>	<b>MDA, <math>\mu\text{mol}</math> per gram of fresh mass, June</b>
Highly-resistant, technical type	<i>Alfa</i>	$4,8 \pm 0,60$	$\leq 0,1$	$15,28 \pm 0,50$
	<i>Golubok</i>	$6,7 \pm 0,70$	$9,58 \pm 0,48$	$6,80 \pm 0,14$
Resistant, technical type	<i>Bianka</i>	$6,1 \pm 0,80$	$\leq 0,1$	$3,92 \pm 0,13$
	<i>Kristall</i>	$2,6 \pm 0,40$	$\leq 0,1$	$17,37 \pm 0,95$
Resistant, table type	<i>Supaga</i>	$\leq 0,1$	$\leq 0,1$	$2,72 \pm 0,74$
Moderately resistant, technical type	<i>Muskat desertny</i>	$\leq 0,1$	$17,36 \pm 1,40$	$6,67 \pm 0,12$
	<i>Muskat Niny</i>	$4,1 \pm 0,30$	$\leq 0,1$	$12,64 \pm 0,04$
	<i>Suvenir Vaskovskogo</i>	$8,5 \pm 1,10$	$36,12 \pm 1,43$	$17,96 \pm 0,95$
	<i>Viktoria</i>	$1,8 \pm 0,20$	$20,89 \pm 0,65$	$14,57 \pm 0,21$
Moderately resistant, table type	<i>Iyulsky</i>	$1,7 \pm 0,10$	$10,56 \pm 0,80$	$6,92 \pm 0,15$
	<i>Krasa Severa</i>	$3,1 \pm 0,50$	$12,91 \pm 0,92$	$8,71 \pm 0,35$
	<i>Neptun</i>	$17,4 \pm 0,20$	$21,11 \pm 0,64$	$15,73 \pm 0,42$
Low-resistant, technical type	<i>Portugiser</i>	$4,3 \pm 0,90$	$19,76 \pm 1,63$	$3,92 \pm 0,15$
Low-resistant, table type	<i>Aleshenkin</i>	$0,9 \pm 0,10$	$15,61 \pm 0,34$	$12,57 \pm 0,22$
	<i>Dekabrsky</i>	$0,8 \pm 0,10$	$13,02 \pm 1,45$	$15,86 \pm 0,12$
Non-resistant, table type	<i>Dunav</i>	$15,6 \pm 0,40$	$15,60 \pm 1,41$	$7,76 \pm 0,28$

## CONCLUSIONS

1. An essential intervarietal diversity has been revealed regarding chlorophylls and carotenoids content. For most of investigated cultivars, the content of photosynthetic pigments falls short of characteristic values for grape plants vegetating in warmer climate zones. Low content of photosynthetic pigments compared to other cultures, e.g. cereals, is indicative for a pigment system of light-demanding grapes grown in Belarusian climate.

2. For almost all unhardy cultivars, the pigment content gained its maximal value already in June, though for the hardy ones it has been still increasing in

August. No pronounced degeneration of photosynthetic pigments has been detected by the end of September.

3. Correlation indexes ( $r$ ) between chlorophylls and carotenoids content have been found to deviate from high positive values for a number of cultivars.

4. The light harvesting system of photosynthetic machinery during the whole vegetation period resembled that of shade-tolerant plants with rather low ratio of chlorophyll *a* to chlorophyll *b* (less than 2, 6).

5. Most of examined grape cultivars demonstrated extremely small content (next lower order compared to the leaves of rye, triticale, and tomatoes) of anthocyanins known to play a major role in stress response.

6. High content of malonic dialdehyde, especially at the early stages of vegetation, is typical for most of grape cultivars introduced in Belarus and indicates intensive oxidative processes in lipid membranes giving evidence that all examined cultivars of heat-loving grapevine have undergone stress. This resulted in increased degree of lipid peroxidation and affected the process of accumulation of photosynthetic pigments.

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# PROLINE CONTENTS IN TWO SOYBEAN CULTIVARS IN RELATION TO NUTRIENT SUPPLY UNDER LOW SOIL MOISTURE REGIME

## CONȚINUTUL DE PROLINĂ A DOUĂ CULTIVARE DE SOIA SUB INFLUENȚA FERTILIZĂRII, ÎN CONDIȚII DE UMIDITATE SCĂZUTĂ A SOLULUI

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**Abstract.** Proline accumulation is a common physiological response in many plants in response to a wide range of biotic and abiotic stresses. Response of free proline accumulation in two soybean (*Glycine max.*L.) cultivars to phosphorus (P) and iron (Fe) application under suboptimal water regime of soil at the critical flowering stage was studied in a pot experiment. P and Fe were applied at rate 100 mg and 5 mg per kg of soil, respectively. Plants were subjected to low water regime for 2 weeks at flowering stage. Plant dry matter accumulation of both cultivars increased with increasing P level regardless of soil water regimes. After two weeks of water stress (35% WHC- water holding capacity) dry matter production was significantly reduced whereas concentrations of free proline was increased in leaves and roots of both cultivars in treatment without fertilization. Cultivar Zodiac maintained higher level of proline accumulation than Licurici. Recovery upon re-watering was evidently in fertilized-plants than unfertilized plants. Cultivar Zodiac had a higher root/plant ratio of dry matter than Licurici under low nutrient and water environment. We suggest that application of nutrients could partially attenuate the adverse effect of drought on soybean productivity.

**Key words:** *Glycine max.* L., iron, phosphorus, proline, water stress.

**Rezumat.** Acumularea prolinei este considerată ca o reacție fiziologică de răspuns a plantei la factorii abiotici nefavorabili. În condițiile casei de vegetație s-au efectuat experiențe cu două cultivare de soia unde s-a examinat acțiunea aplicării fosforului (P) și fierului (Fe) asupra modificărilor conținutului de prolină în organele plantelor, în dependență de regimul de umiditate a solului. Plantele de *Glycine max.*, L. au fost cultivate pe sol cernoziom carbonatat asigurat insuficient cu fosfați mobili. Fosforul și fierul s-au aplicat în doze de 100 mg și 5 mg per kg de sol. După două săptămâni de stres hidric (35% din CTA – capacitatea de apă a solului) acumularea substanței uscate s-a redus semnificativ și a fost asociată cu creșterea concentrației de prolină în frunze și rădăcini la ambele cultivare, indiferent de nivelul nutriției minerale. Cultivarul Zodiac a manifestat o capacitate mai mare de acumulare a prolinei comparativ cu cultivarul Licurici. Reirigarea plantelor stresate a diminuat concentrația prolinei. Plantele cultivarului Zodiac au înregistrat valori mai mari a raportului rădăcini/plantă, în condiții vulnerabile de nutriție și umiditatea solului. Așadar, fertilizarea plantelor de soia poate parțial să reducă efectul advers al secetei asupra productivității.

**Cuvinte cheie:** *Glycine max.* L., fier, fosfor, prolină, stres hidric.

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## INTRODUCTION

Abiotic stresses are believed to cause major problems in agriculture by reducing crop growth and productivity. Phosphorus (P) deficiency and drought are major environmental abiotic factors restricting plant growth and development in many regions of the world, and while the two stresses often occur simultaneously, little is known about how their combination impacts crops (Rizhsky L. et al., 2004). Phosphorus fertilizer application remains the most effective way to increase crop productivity in soils with low levels of available phosphates (Burman U. et al., 2009). Application of large amounts of P fertilizers is also likely to cause a reduction in the bioavailability of micronutrients as well as concentrations in plant tissues. Phosphorus has been shown to have interactive effects with the uptake of iron (Fe) (Raeini-Sarjaz M., Barthakur N., 1995).

Soybean (*Glycine max.*, L.) is the most widely grown leguminous crop providing large amounts of protein and oil for the human diet and animal husbandry. This crop is sensitive to environmental stress situations, such as phosphorus and water deficiency (Sinclair T., Vadez V., 2002; Lakshmi P. et al., 2009). For a legume crop such as soybean, the role of phosphorus and iron nutrition is very critical (O'Hara G. et al., 1988; Gunawrdena S. et al., 1993). In addition to supplying a nutrient for plant growth, P application could improve drought tolerance of crops to increase productivity under water stress environment (Burman U. et al., 2009). Accumulation of compatible solutes is one of the adaptive strategies of plants in response to abiotic environmental stresses. Accumulation of these solutes like proline, glycine betaine and sucrose contributes to osmotic adjustment, prevention of protein denaturation, preservation of enzyme structure and activity and protection of membranes from damage by reactive oxygen species (Hare et al., 1999). Many studies have focused on the interactions of P and Fe on nutrient absorption by higher plants, but little attention has been paid to their interactive impacts on the physiological metabolism in particular on proline contents in plants.

The objective of the present experiment was to investigate the effect of P and Fe supply on plant growth and proline concentrations under suboptimal water regime in two soybean cultivars differing in potential of productivity.

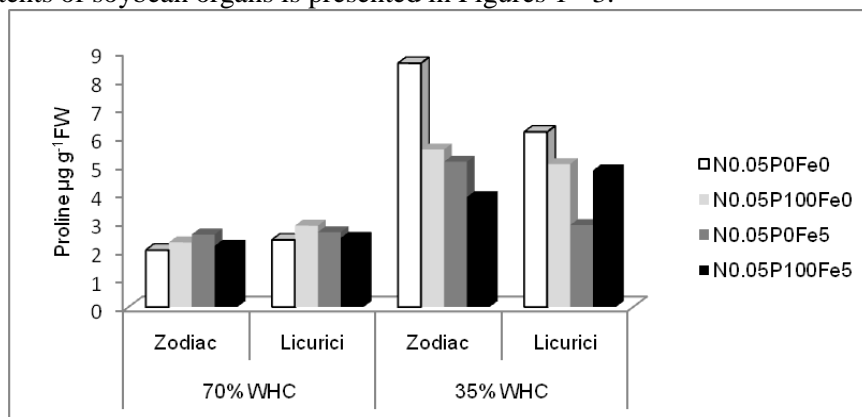
## MATERIAL AND METHOD

The pot experiment was conducted in a glasshouse under controlled conditions with cernoziom carbonate, characterized by low of plant-available phosphates. Treatments included the factorial combination of two P levels, two soil water regimes (control and water stress) and two soybeans (*Glycine max.* L.Merr.) cultivars classified as low productivity (Zodiac) and high productivity (Licurici). Phosphorus was supplied as  $\text{KH}_2\text{PO}_4$  at 0 and 100 mg per kg of soil (P0 and P100, respectively). Iron was supplied as Fe-EDTA at 0 and 5 mg per kg of soil (Fe0 and Fe5, respectively). All the treatments had four replicates. Each replication was the average of three plants per pot. Seeds of soybean were treated with *Bradyrhizobium japonicum* at sowing time.). At flowering stage of plant development half of pots were brought to 70% WHC and the other half to 35% WHC as suboptimal moisture level. Normal and low water

supplies were maintained by weighing the pots and on the basis of weight loss, re-watering them to corresponding weights. Suboptimal moisture of soil was imposed for 2 weeks. Free proline content in leaves and roots was determined according to the methodology of Bates B. et al., (1973), and expressed as  $\mu\text{g proline g}^{-1}$  fresh matter.

## RESULTS AND DISCUSSIONS

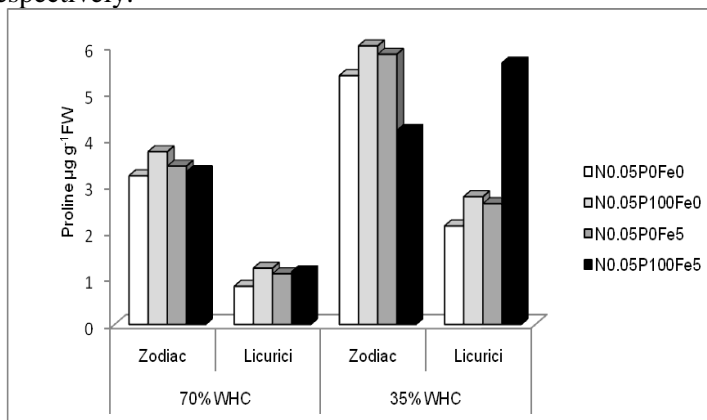
One of important characteristics of plant metabolism under stress environment might be attributed to an accumulation of free proline which play an essential role in osmoregulation and osmotolerance as well as protection of proteins to overcome adverse responses from water stress (Ashraf M., Foolad M., 2007). The impact of nutrients supply and soil moisture regime on proline contents of soybean organs is presented in Figures 1 - 3.



**Fig. 1** - Proline concentrations in leaves of soybean cultivars in relation to nutrient supply under well-watered and drought conditions

The results have been shown that concentration of free proline was obviously increased under unfavorable moisture conditions. Proline accumulation in plant tissue under stressful conditions has been suggested to be result of a decrease in proline degradation, increase in proline biosynthesis, a decrease in protein synthesis or proline utilization and increased hydrolysis of proteins (Hare P. et al., 1999). Thus, both cultivars had higher proline accumulation during water-stressed than under non water-stressed conditions, but they differed in their response to added P. In this respect cultivar Zodiac overcame Licurici and these trends were consistent for both leaves and roots. Such a drought tolerance of cultivar can possess a good capacity to osmotic regulation under water stress. Phosphorus application increased its concentration in leaves by 13,5% in Zodiac and by 21,2% in Licurici in normal water soil regime. The alleviation of water stress by means of P application was confirmed for cluster bean and wheat species (Burman U. et al., 2009; Gutierrez-Boem F., Thomas G., 1998). The increase of free proline concentrations in cultivar Zodiac was superior than in Licurici under limited water conditions. Likewise, iron supplemental nutrition increased this

physiological parameter by average 21,6% and 17,5% in leaves of Zodiac and Licurici, respectively.



**Fig. 2** - Proline concentrations in roots of soybean cultivars in relation to nutrient supply and soil water regime

Abiotic factors affected also the pattern of proline allocation to the roots (fig. 2). Under limited water supply in treatment without nutrient fertilization cultivar Zodiac accumulated greater free proline in roots approximately by 3 fold than Licurici. Experimental results revealed that iron addition in combination with P decreased its concentration in roots of Zodiac and did not affect its contents in Licurici. It was well documented that levels of soluble osmotic nitrides in plant tissues might be responsible for maintaining better water status and maintain the growth at higher level (Hare P. et al., 1999). Two days after plants were relieved of water stress proline accumulation in leaves decreased extensively, while proline accumulation in Licurici leaves decreased to the level for non water-stressed plants (data are not presented). Several investigators had reported similar observations. Therefore, high proline accumulation in leaves of water-stressed plants might be an adaptive response to drought.

Phosphorus deficiency as well water deficit is one of the important abiotic stresses and substantially affects productivity of crops. In this study plant growth was evaluated by measuring dry matter (DM) accumulation. Nutrient deficiency as well as shortage of water significantly decreased dry mass production in both cultivars (table 1). The application of nutrients separately or in combination increased the plant growth of both control and water stress plants. There was observed a cultivar difference in this regard. The reduction of plant growth was decreased by drought more evidently in Licurici than in Zodiac. According to registered data the differences between cultivars in term of dry matter production were negligible in treatment with sufficient P and Fe supply compared to treatment P0Fe0. Likewise, the iron supplemental nutrition had some beneficial influence on plant development in scarce water environment but at lower extent than application of phosphorus.

Table 1

**Effects of phosphorus and iron application on dry matter (DM) of two soybean cultivars under suboptimal soil moisture conditions, g/pot**

Treatments	70% WHC				35% WHC			
	Zodiac		Licurici		Zodiac		Licurici	
	DM	R/P*	DM	R/P	DM	R/P	DM	R/P
N0.05P0Fe0	10,72±0,13	0,24	14,75±0,19	0,24	8,64±0,09	0,29	10,12±0,33	0,27
N0.05P100Fe0	15,99±0,28	0,22	23,11±0,14	0,21	13,40±0,16	0,26	14,63±0,08	0,21
N0.05P0Fe5	11,89±0,11	0,24	16,10±0,22	0,25	8,90±0,14	0,27	11,52±0,27	0,21
N0.05P100Fe5	17,97±0,11	0,21	23,69±0,31	0,19	13,84±0,15	0,22	14,82±0,14	0,21

R/P\* - root/plant ratio

There was not any antagonism interaction between P and Fe on plant development. The positive impacts of P fertilization on plant growth have also been demonstrated in a range of crops such as wheat (*Triticum aestivum* L.), cluster bean (*Cyamopsis tetragonoloba* L.) and others species. Some researchers revealed that P nutrition contributes to improvement of growth and yields of crops in low water conditions (Gutierrez-Boem and Thomas, 1998, Burman et al., 2009). Phosphorus and iron supply had a relatively smaller effect on root weight ratio (i.e., root weight to total plant weight) of the soybean cultivars (table 1). The root/plant DM ratio was higher in the P0Fe0 plants as compared to those supplied with adequate nutrition P100Fe5, this trend being, however, more pronounced in Zodiac than in Licurici. The trait values were relatively less affected by soil moisture regime. The difference in root/plant ratio between cultivars under normal water regime was very small. But this parameter slightly increased under low nutrient supply in plants subjected to water stress conditions. Thus, it was found that application of phosphorus separately or in combination with iron could obviously reduced the negative effect of drought on plant growth and increased osmolyte proline accumulation, which could exhibited its some anti-drought roles to protect cells and physiological machinery at whole plant level under water stress conditions. Having been drowning from pot experiments these conclusions must await validation under field conditions.

## CONCLUSIONS

1. Phosphorus deficiency combined with low water regime of soil increased the concentration of proline in leaves and there were genotype difference in capacity to accumulate proline. The response of Licurici cultivar to water stress was more pronounced than of Zodiac.

2. Nutrient-deficit plants had a low plant biomass. Drought has less detrimental effects on soybean genotypes in treatment with balanced nutrition of phosphorus and iron. Root/plant ratio of dry matter decreased in response to phosphorus and iron supply.

3. The significant effects of interactions between nutrients and soil moisture regimes on both proline accumulation and plant growth indicate that balanced mineral nutrition enhances the ability of the plants to cope with a mild water stress.

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# THE IMPACT OF MICRONUTRIENTS IN THE PROTECTIVE COMPOUNDS ACCUMULATION IN THE VINE ORGANS

## ACUMULAREA COMPUȘILOR PROTECTORI ÎN ORGANELE VIȚEI DE VIE ÎN FUNCȚIE DE FERTILIZAREA EXTRARADICULARĂ CU MICROELEMENTE

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**Abstract.** *The unfavorable conditions of growth cause significant deviation in intensity of absorption and inclusion of nutrients in the metabolism. Realization of the potential of vine frost resistance and wintering can be enhanced by micronutrients applying, which may serve as a trigger for the accumulation of protective compounds in plant tissues. It has been shown in conditions of production that foliar fertilization of plants in vegetation period contributes to essential changes in the content of free amino acids and carbohydrates in leaves and shoots, the composition of the sap after the winter. The accumulation of stress protective substances (prolin, glutamic acid, glutamine, monosaccharides) after fertilization of plants with complex of micronutrients leads to the formation and fuller manifestation of potential of vine resistance to wintering.*

**Key words:** resistance, vine, trace elements, xylem exudates, free amino acids, carbohydrates.

**Rezumat.** *Realizarea potențialului de rezistență la ger și la iernare a plantelor de viță de vie poate fi sporită prin aplicarea micronutrienților, care pot servi ca un trigger pentru acumularea compușilor protectori în țesuturile plantelor. În condiții de producere a fost evidențiat că fertilizarea foliară a plantelor în perioadă de vegetație contribuie la schimbări esențiale în conținutul acizilor aminici liberi și carbohidraților în frunze și lăstari, precum și în componența sevei. Acumularea substanțelor stres-protectoare (prolină, acid glutamic, glutamină, monozaharide), după fertilizarea plantelor cu complexul de microelemente, a contribuit la formarea și manifestarea mai amplă a rezistenței viței de vie la iernare.*

**Cuvinte cheie:** rezistență, viță de vie, microelemente, sevă, aminoacizi liberi, carbohidrați.

## INTRODUCTION

The winters in Moldova are extremely severe for grape plant dormancy, the temperatures dropping down to -25°C – -27°C and sometimes even to 33°C -36°C. The winter of 2009-2010 is an eloquent prove of that. The meteorological and agrometeorological conditions of that winter in the Republic of Moldova were special, with the temperatures that were lower than usual and plenty of snow. The absolute minimal air temperature during the winter constituted minus 31°C (January 26, Bălți), the phenomenon registered on the average once per 25-30 years. But the critical minimum for the recognized noble cultivars, especially table ones, is within the range of

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-18°C – -22°C. This fact is a vivid demonstration of the importance and necessity to fortify researches on the physiology and biochemistry of the grape resistance to frost and hibernation. The literature data and those obtained at the Institute of Genetics and Plant Physiology of the Moldovan Academy of Sciences prove that the plant resistance to the action of unfavorable factors may be enhanced through the improvement of nutrient regime and regulation of the photosynthetic process. The accumulation of vegetative mass, yield amount, and production quality are conditioned by the degree of macro- and microelement involvement in metabolism. The mechanisms ensuring trace element actions in the formation and realization of plant resistance are multiple and need further studies. One of them can be accomplished through participation of the compounds with a stress protective action, i.e. glucides, free amino acids etc. in the accumulation in plant.

The aim of this study is to reveal the contribution of the micronutrients that are applied individually and in combination for grape foliar fertilization to the accumulation of protective compounds in grape organs in order to realize the wintering resistance potential.

## **MATERIAL AND METHOD**

The research was carried out on grape (cv. Codrinschi) in the years 2008 to 2010. The foliar microfertilizer treatment was conducted in three terms (1 – before flowering, 2 and 3 – at the stage of intensive growth with an interval of 12 to 14 days). Unfertilized plants served as control. Leaves for analyses were sampled three and six days after the foliar treatment, annual and perennial shoots - in March, sap- at the budding stage. The following analytical methods were used: the content of free amino acids using an AAA-300 analyzer, the carbohydrate content according to Bertan; the shoot growth and maturation was determined according to the M.A.Lazarevskii (1963) and Ion Alexandrescu (1998) method. The evaluation of the plant resistance to wintering was performed in field conditions after the dormancy according to the method developed by M.V.Cernomoreț, particularly for the grape crop (1995).

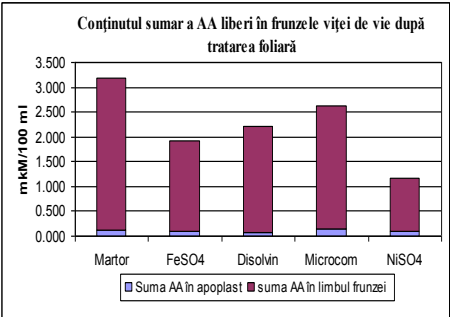
## **RESULTS AND DISCUSSIONS**

1. The content of free amino acids (FAA) and glucides in grape leaves. The total content of FAA in plant issues is quite a mobile indicator and depends on many factors including the plant condition, vegetation stage, nutrition conditions etc. The FAA content was measured during the vegetation in plant blade (alcohol extract) and in apoplast (water extract). The findings demonstrate that the total content of FAA, especially that of non-essential ones, decreases in leaves three days after foliar microelement fertilization; the same trend is observed in apoplasts, where 3% to 8% of the total content is present in leaf blade, with the exception of the treatment where the Microcom-V complex is applied (figure 1). A tendency of increase in the tryptophan, proline, histidine, glycine, cystic acid content is observed. The FAA level grows in the leaves of the fertilized treatments during the vegetation, in comparison with the witness.

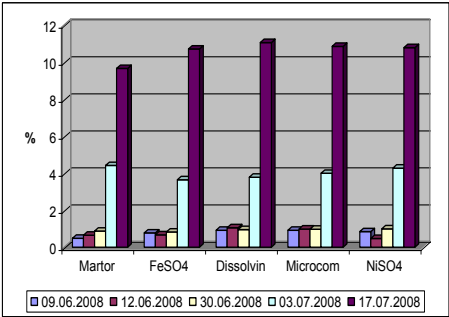
The total glucide content in grape leaves changes quite significantly during the vegetation. The estimation of mono- and disaccharides in dynamics demonstrated a positive impact of the microfertilizers containing Fe, Ni or the six-microelement complex, Microcom-V, in the process of glucides synthesis (figure 2). The



application of microelements in combination (Microcom-V) or in a chelate form (Dissolvin) is more effective according to the findings.



**Fig. 1** - The fertilizer effect on the free content amino acid content in grape leaves three days following plan t treatment



**Fig. 2** - The fertilizer effect on the glucide in grape leaves

The analyses performed three and six days after foliar fertilization of plants demonstrate that treatment with Fe-containing solutions contributes to a decrease of glucides, especially disaccharides in leaves immediately after treatment and a subsequent increase in leaves and grape berries. The ratio of di- and monosaccharides in the Fe treatment is lower in leaves and higher in grape berries in comparison with the control. The Ni influence on the carbohydrate compound content and the ratio is less significant in grape organs.

2. FAA content in wintering organs. The estimation of free amino acids in grape organs at the end of the rest period demonstrates that the total content is significantly higher in annual shoots than in perennial ones. Grape foliar fertilization at the critical developmental stages during plant vegetation has been shown to influence the content of FAA in wintering organs (table 1).

Table 1

**The total free amino acid content in annual and perennial grape shoots, 17.02.2010, mμ/100 mg**

Treatments/Indices	Σ Free AA	Σ non-essential AA	Σ essential AA	Σ S-containingAA
Annual shoots				
1. Witness	2,2151	1,2408	0,5132	0,0238
2. FeSO <sub>4</sub>	2,2096	1,1861	0,7214	0,0183
3. Dissolvin	1,6514	1,0451	0,3189	0,0186
4. Microcom	3,2194	2,0479	0,7245	0,0268
5. NiSO <sub>4</sub>	3,4189	2,1749	0,7297	0,0244
Perennial shoots				
1. Witness	1,5347	0,8861	0,3509	0,0103
2. FeSO <sub>4</sub>	1,4004	0,8516	0,2967	0,0089
3. Dissolvin	1,4126	0,8141	0,3373	0,0153
4. Microcom	1,9271	1,1529	0,4722	0,0193
5. NiSO <sub>4</sub>	1,4315	0,8054	0,3537	0,0141

The Microcom-V fertilization enhanced the FAA amount in wintering organs, especially in annual shoots. The growth of FAA content in wintering shoots might be a

protective reaction of plants to a strong previous drop in the air temperature. Our earlier findings demonstrated that foliar microelement fertilization during preceding vegetation accelerated the hydrolysis of sugars in grape wintering shoots (Veliksar S., Toma S., 2003; Veliksar et al., 2007), the resistance to freezing increasing.

The qualitative FAA analysis has demonstrated that glutamic acid makes 40.89% of the total content in annual shoots, which confirms the main role of this AA in grape metabolism (table 2). A considerable growth of this FAA in plant shoots is observed in the treatments fertilized with the microelement complex and NiSO<sub>4</sub>. The content of  $\gamma$ -aminobutyric acid in plant tissues is usually reduced, but grows at the action of stressogenic abiotic factors. An increased amount of this acid, making 0.2866 m $\mu$ /100 mg (20.08% of the total FAA content) was found in annual shoots, which might be associated with the action of lower temperatures that occurred in January. It is important that the relative content of  $\gamma$ -aminobutyric acid decreased in the fertilized treatments. The problem of decarboxylation of glutamate and the role of  $\gamma$ -aminobutyric acid as an osmoprotector in the plant resistance to lower temperatures is discussed in the paper of E. Mazzucotelli et al. (2006). The increase of the so called stress acids (Haldemann et al., 1988) – proline, alanine – in shoots is in favor of our supposition about the positive role of Microcom in plant adaptation to lower temperatures. The quantitative FAA analysis in perennial shoots demonstrated the same tendency as in annual shoots (table 3).

3. The content of FAA and glucides in grape sap. Table 4 summarizes the findings of the FAA content estimation in grape sap in spring (30.03.2010) in an ascendent flow. The reduction of the total FFA content in plant sap from the treatments fertilized with Microcom-V observed during three years (2008-2010) allows us to assume that the microelements, especially the microelement complex, Microcom-V applied during vegetation intensify the processes of protein synthesis in wintering organs, that takes place during the period of exit from vegetative rest (Burzo et al., 1999). The results of the qualitative FAA content analysis in sap demonstrates an increased content of S-containing amino acids – glutamic acid, proline, valine, alanine. Noteworthy, the absolute and relative content of glutamic acid, which is a general type of N transport with the ascendent flow at the beginning of vegetation, increases significantly in the treatments fertilized with Fe, Microcom-V and N.

Table 4

**Total free amino acid content in grape sap, m $\mu$ /100mg**

Treatments/indices	$\Sigma$ free AA	$\Sigma$ non-essential AA	$\Sigma$ essential AA	$\Sigma$ S-containing AA
1 Witness	1,3979	0,2455	0,2835	0,9404
2 FeSO <sub>4</sub>	4,7394	2,1674	1,2538	1,5585
3 Dissolvin	0,4047	0,1202	0,0990	0,2283
4 Microcom	0,9891	0,4341	0,2419	0,3494
5 NiSO <sub>4</sub>	0,5839	0,2378	0,1541	0,2033

Table 2

## Content of FAA in annal grape shoots, cv. Codrinskii, 17.02.2010

Treatment Amino acids	Witness $\mu\mu/100\text{mg}$	% of $\Sigma$	$\text{FeSO}_4$ $\mu\mu/100\text{mg}$	% of $\Sigma$	Dissolvin $\mu\mu/100\text{mg}$	% of $\Sigma$	Microcom-V $\mu\mu/100\text{mg}$	% din $\Sigma$	$\text{NiSO}_4$ $\text{mkM}/100\text{mg}$	% din $\Sigma$
Cystic acid	0.0082	0.37	0.0045	0.20	0.0028	0.17	0.0063	0.20	0.0053	0.16
Aspartic acid	0.0841	3.80	0.1006	4.55	0.0811	4.91	0.1379	4.28	0.1112	3.25
Glutamic acid	0.9058	40.89	0.8883	40.20	0.6964	42.17	1.5207	47.24	1.6258	47.55
Proline	0.0329	1.49	0.0328	1.48	0.0457	2.77	0.0747	2.32	0.0830	2.43
Valine	0.0285	1.29	0.019	0.86	0.0214	1.30	0.0285	0.89	0.0379	1.11
Phenylalanine	0.0112	0.51	0.0094	0.43	0.0075	0.45	0.0099	0.31	0.0137	0.40
$\gamma$ -aminobutyric acid	0.4448	20.08	0.2891	13.08	0.2777	16.82	0.4293	13.33	0.4995	14.61
Arginine	0.3606	16.28	0.6017	27.23	0.1929	11.68	0.5505	17.10	0.5403	15.80
$\Sigma$ FAA	2.2151	100.00	2.2096	100.00	1.6514	100.00	3.2194	100.00	3.4189	100.00

Table 3

## The qualitative amino acid content in grape perennial shoots, cv. Codrinskii, 17.02.2010

Treatments Amino acids	Witness $\mu\mu/100\text{mg}$	% of $\Sigma$	$\text{FeSO}_4$ $\mu\mu/100\text{mg}$	% of $\Sigma$	Dissolvin $\mu\mu/100\text{mg}$	% of $\Sigma$	Microcom $\mu\mu/100\text{mg}$	% din $\Sigma$	$\text{NiSO}_4$ $\text{mkM}/100\text{mg}$	% din $\Sigma$
Cystic acid	0.0034	0.02	0.0016	0.11	0.0040	0.28	0.0047	0.24	0.0032	0.22
Aspartic acid	0.0989	0.64	0.0841	6.01	0.1256	8.89	0.1890	9.81	0.0854	5.97
Glutamic acid	0.5935	38.7	0.5596	39.96	0.4513	31.95	0.7369	38.24	0.5231	36.54
Proline	0.0290	0.19	0.0301	2.15	0.0256	1.81	0.0400	2.08	0.0428	2.99
Valine	0.0096	0.06	0.0079	0.56	0.0161	1.14	0.0177	0.92	0.0109	0.76
Phenylalanine	0.0149	0.10	0.0085	0.61	0.0155	1.10	0.0129	0.67	0.0106	0.74
$\gamma$ -aminobutyric acid	0.2866	18.73	0.2445	17.46	0.2460	17.41	0.2843	14.75	0.2614	18.26
Arginine	0.2720	1.77	0.2390	17.07	0.2354	16.66	0.3766	19.54	0.2843	19.86
$\Sigma$ AA	1.5347	100.00	1.4004	100.00	1.4126	100.00	1.9271	100.00	1.4315	100.00

The content of glucides in grape sap at the budding stage in relation to plant fertilization during the precedent vegetation period grows in comparison with the control, specially in the treatment with chelate form Fe (Dissolvin) and with the microelement complex (Microcom-V).

It has been found that the number of viable buds constituted only 38.39% in the control (the plants that were not treated with fertilizer). In the plants treated with Microcom-V, this index reached a value of 44.56%, a significant increase of 16.07% being recorded. It should be also mentioned that a high number of injured buds making 44.56% was detected in the treated plants, by 11.88% higher in comparison with the control. The action of the negative critical temperature of -27° registered on January 26, 2010 has been found to provoke a loss of 39.13% of buds in the control, while in the treated plants it made only 30.29%, which is by 22.59% lower in comparison with the control. The resistance to wintering was studied in the grape plants under study in field conditions in the middle of the third decade of May. It has been revealed that the number of the buds developed on annual shoots in the witness treatment constituted 56.86%, while in that with the plants treated with Microcom-V it was 68.15%, the increase making 19.9%.

## CONCLUSIONS

1. Foliar treatment of grape with the complex microelement product Microcom-V induces significant modifications in the processes of synthesis, accumulation, translocation, and storage of protective substances (glucides, free amino acids) in the organs and tissues of the plants exposed to the action of low negative temperatures during winter.

2. The microelement complex Microcom-V as a post-action is suggested to serve a trigger in starting the transition proces from vegetative rest to the vegetative period.

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# DETERMINING THE GENETIC DIVERSITY OF COMMERCIAL SUNFLOWER HYBRIDS BY RAPD ANALYSIS

## DETERMINAREA DIVERSITATII GENETICE A UNOR HIBRIZI COMERCIALI DE FLOAREA-SOARELUI PRIN ANALIZA RAPD

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**Abstract.** *The aim of this study was to determine the genetic similarity among 17 commercial hybrids acquired from Pioneer-Hi-Bred International, Limagrain Romanian and two autentic romanian hybrids Fundulea 225 and Favorit. In order to determine the genetic similarity, these hybrids were analysed at the DNA level using RAPD technique. For this purpose an initial screening of 30 decamer primers was made, from which only seven gave polymorphis bands and were used for furhter analisys. Based on the polymorphic band obtained, dendrogram was constructed based on UPGMA cluster analysis according to Lei and Ni similarity index.*

**Key words:** DNA markers, genetic diversity, RAPD

**Rezumat.** *Scopul acestui studiu a fost determinarea diversității genetice la Șaptesprezece hibrizi comerciali de floarea soarelui, procurăți de la firmele Pioneer-Hi-Bred International, Limagrain România, și doi hibrizi autohtoni Fundulea 225 și Favorit. Pentru determinarea similarității genetice, s-au efectuat analize la nivel molecular prin tehnica RAPD (Random amplified lengh polymorphism). În acest scop s-a realizat un screening a treizeci de primeri decameri din care, doar Șapte au dat benzi polimorfice si au fost utilizate in continuare. Similaritatea genetică a fost determinată cu ajutorul coeficientului Lei si Ni. Pe baza rezultatelor obținute s-a realizat o dendogramă UPGMA a celor Șaptesprezece hibrizi analizați.*

**Cuvinte cheie:** markerii ADN, diversitatea genetică, RAPD

## INTRODUCTION

Sunflower (*Heliantus annuus*) is as plant oils of great importance economic and food industry. The sunflower cultivated area in Romania occupy the third place, after maize and wheat. The seeds fats contents (33-56%), and high quality of oil resulting from the extraction plant, is one the main sources of vegetable fats used in human nutrition, that is the most important source of oil to Romania (Bîlteanu Gh., 1991). Tehnique RAPD was first described by Williams et al. (1990)

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and is based on the allelic polymorphism at the parental forms in the presence or absence of amplifications products. Generally each primer used will determine the amplification of sequences from different loci of the genome, provides an effective method to investigate DNA polymorphisms between individuals (Tingei and del Tufo, 1993). Tehnique RAPD applications are: study of genetic diversity, germplasm characterization, determining the genetic structure of populations, somaclonal variability, identification of cultivars and hybrids purity (Iuoras Monica, Vrânceanu A. V., 1998).

This study shows that RAPD markers can be used successfully to determine the genetic diversity.

## MATERIAL AND METHOD

To determine the genetic diversity of 17 commercial sunflower hybrids of different origin were analysed at the DNA level by RAPD technique. Details of hybrids sources can be seen in table 1. The plant material was grown in field crop year 2009-2010 at the Ezăreni farm to multiply number of seeds.

*Table 1*

**Name and provenience at hybrids**

Nr. crt	Hybrid name	Firm
H1	PR 63A50	Pioneer România
H2	PR 63A90	Pioneer România
H3	PR 63A62	Pioneer România
H4	PR 63A15	Pioneer România
H5	PR 64E83	Pioneer România
H6	PR 63A86	Pioneer România
H7	LG 56.58 CL	Limagrain România
H8	PR 64A83	Pioneer România
H9	PR 64A71	Pioneer România
H10	PR 64E71	Pioneer România
H11	PR 64H45	Pioneer România
H12	PR 64G46	Pioneer România
H13	LG 56.65 M	Limagrain România
H14	PR 64F50	Pioneer România
H15	FUNDULEA 225	Comert
H16	FAVORIT	Comert
H17	PR 64J80	Pioneer România

## DNA extraction and analyzing RAPD

CTAB method used for DNA extraction was modified by Doyle & Doyle in 1987. Harvesting of plant material was performed at 6 weeks after emergence. The biological material used for DNA isolation was the young sunflower leaves after harvest which were introduced in tubes printed and then immediately frozen in liquid nitrogen. Preservation of samples was done in a freezer at - 20°C. DNA content of the solutions resulting from the extraction method following the protocol

described and modified Doyle & Doyle, was determined using a Nano Drop type fluorospectofotometru 3300. Based on reading levels determined to proceed to achieve the necessary dilutions RAPD method, the DNA bringing the solution at a concentration of 5 ng / ml. To obtain PCR reaction was necessary: 5 ng genomic DNA, 10 mm of each dNTP, 25 mM MgCl<sub>2</sub>, 5pmol / ml decamer primer (Roth), 0.1 units Taq DNA polymerase (Taq polymerase Go - Promega) and 10X buffer. Amplification was performed in Corbett thermocycler. The conditions for PCR amplification were: 2 min at 94°C an initial denaturation, followed a total by 40 cycles, each of the following steps: 1 min denaturation at 94°C, 1 min at 36°C attaching primers (annealing), 2 min extension and 7 min at 72°C final elongation. Amplification products were separated in agarose gel 2% concentration, and were analyzed by staining with ethidium bromide.

Resulting image analysis was performed using 2.1 RFLPscan program based on the assumption that each band has a different length single locus. For analysis of fragments were considered clear only those parts which could not be parsed (Iqbal A., et al., 2010). Following gel analysis was obtained binary matrix was used to calculate genetic distances. To calculate genetic distances and dendrogram achievement NTSYS pc 1.7 software was used coefficient application using Nei and Li method UPGMA (Un-weighted Pair Group Method with Arithmetic Mean) for genetic distances and Neighbor Joining Tree method for dendrogram.

## RESULTS AND DISCUSSIONS

To determine the genetic diversity of the 17 sunflower hybrids were used a total of seven RAPD decamers primers to observe genetic polymorphism (Karp A., et al., 1997a). The gels obtained by amplifying DNA analysis were taken into account only those bands that were due to polymorphism clear. After analysis of all gels have received a total of 69 fragments between 120 and 956 bp fragments of which 45 were polymorphic.

*Table 2*

**Decamers primers used for analysed RAPD for sunflower genotypes**

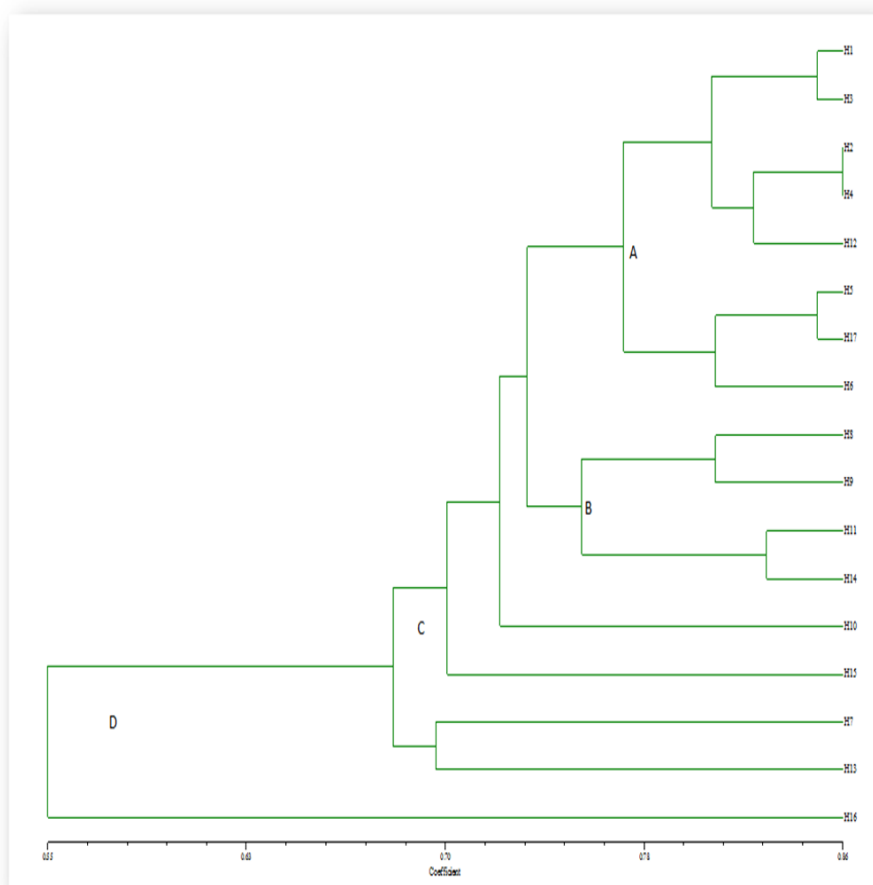
Nr. Crt.	Name of primer	Sequence (5'-3')
1	ROTH A01	CAG GCC CTT C
2	ROTH A09	GGG TAA CGC C
3	ROTH A13	CAG CAC CCA C
4	ROTH A15	TTC CGA ACC C
5	ROTH A17	GAC CGC TTG T
6	ROTH B04	GGA CTG GAG T
7	ROTH B07	GGT GAC GCA G

To calculate the percentage of polymorphic fragments for each primer in part, and it varied between 44 and 77% as shown in the table 3. The number of amplified fragments ranged from 6 to 17 primer ROTH A15 and ROTH A01. The highest number of polymorphic band generated by primer A01 ROTH and obvious, showed polymorphism.

Table 3

The number and amplified fragments, the number of polymorphic fragments and percentage with polymorphic fragments amplified with seven primers

Primer name	Amplified fragments	Polimorphic bands	Percentage (%)
ROTH A01	17	12	70%
ROTH A09	9	4	44%
ROTH A13	9	7	77%
ROTH A15	6	3	50%
ROTH A17	8	6	75%
ROTH B04	9	7	77%



**Fig. 1** - Dendrogram UPGMA method (Un-weighted Pair Group Method with Arithmetic Mean)



Analyzing data from genetic distances were calculated using the formula for the similarity coefficient of Nei and Li (1979). Based on similarity index was made a dendrogram based on UPGMA method (Un-weighted Pair Group Method with Arithmetic Mean) (fig. 1).

Following the results obtained and analyzed dendrogram can be observed that genotypes appear divided into four distinct groups denoted by uppercase „A, B, C and D” (Serene Maragatham Isaacs, et al., 2003).

As it was expected, commercial hybrids were grouped in terms of business after producing genetically. So, the Pioneer hybrids appear grouped in the first group, is joining the group the largest number of genotypes in the dendrogram. Genotypes closest genetically are: H2 (PR63A90) and H4 (PR64A15) at a genetic distance of 0.86. At the same genetic distance with the two hybrids is the hybrid H12 (PR64G46) which means that probably three hybrids common ancestry. The distance values are smaller, the genotypes are closely related (genetically closer). Most hybrids different from Pioneer hybrids appear H1 (PR63A50) and H14 (PR64F50) who are most genetically removed from the first being in group A (PR63A50) the other being in group C (PR64F50), and also notice that the genotype may form a separate group Favorit to other hybrids, it is found in Group D, one can say that it is genetically different from the other growing at a genetic distance of 0.86.

## CONCLUSIONS

1. Clustering analysis allowed to determined genetics similarity and degree relatedness cultivars of sunflower

2. Based on data analysed RAPD method can say ease of use in determining the genetic polymorphism analysis and the detection of hybrids single fragments, which may be included in future studies in the genus *Helianthus* variability.

3. Our study shows that RAPD analysis revealed a highest level in terms of genetic variability, using a limited number of primers.

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# THE INFLUENCE OF SPRUCE BARK AQUEOUS EXTRACT IN COMBINATION WITH DEUTERIUM DEPLETED WATER (DDW) ON *GLYCINE MAX L.* PLANT

## INFLUENȚA EXTRACTULUI APOS DIN COAJĂ DE MOLID ÎN COMBINAȚIE CU APA SĂRACĂ ÎN DEUTERIU (ASD) ASUPRA PLANTEI *GLYCINE MAX L.*

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**Abstract.** *The aim of this study was to evaluate the influence of deuterium depleted water (DDW) in combination with spruce bark aqueous extract on soybean plantlet growth and development. Taking this into account, germination tests were carried out in the presence of distilled water (DW-control), DDW, spruce bark extract, and polyphenolic extract in combination with DW and DDW respectively. The characteristic effects of each tested treatment was assessed after ten days from the beginning of the experiment through biometrics analysis and quantitative determinations of plant biomass and by setting the total content of assimilatory pigments. The obtained results have shown that in the presence of DDW a stimulatory effect was evidenced on germination energy and capacity (100%) followed by an increasing trend in primary leaves growth and development. It was observed that the combination of polyphenolic extract with DDW has had a beneficial effect both on the radicles (30%) and stemlet (10%) growth.*

**Key words:** deuterium depleted water (DDW), spruce bark, polyphenolic compounds, *Glycine max L.*, germination, plantlets characteristics.

**Rezumat.** *În acest studiu s-a urmărit evidențierea rolului apei sărace în deuteriu (ASD) în combinație cu extractul apos obținut din coajă de molid în creșterea și dezvoltarea plantulelor de soia. În acest scop au fost realizate teste de germinare a semințelor de soia în prezența apei distilate (AD- martor), ASD, a extractului de molid, și a extractului polifenolic în combinație cu apă distilată /ASD. Influența tratamentelor a fost apreciată după zece zile de la inițierea testului prin efectuarea de analize biometrice și gravimetrice privind evoluția plantelor, precum și prin stabilirea conținutului în pigmenți fotoasimilatori. Rezultatele au evidențiat că în prezența ASD se înregistrează o stimulare a energiei și facultății germinative (100%) a semințelor de soia însoțită de o creștere a protofilelor. Totodată, s-a constatat că asocierea extractului din coajă de molid cu ASD a fost benefică atât pentru creșterea radiclei (30%) cât și a tulpiniței (10%) plantulelor.*

**Cuvinte cheie:** apa săracă în deuteriu, coajă de molid, compuși polifenolici, *Glycine max L.*, germinație, caracteristicile plantulelor.

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## INTRODUCTION

Deuterium depleted water or light water is a distilled water microbiologically pure, with an isotopic concentration of 25 ppm, obtained by isotopic distillation, in vacuum, of natural water with an isotopic concentration of 145 ppm D / (D + H ) (Somlyai G., 2001). It was demonstrated that while normal concentrations (140-150 ppm) had no adverse effects on biological systems, increased ambient deuterium content by various methods over 15-20% cause structural alterations, metabolic and functional in various degrees. With the discovery of deuterium depleted water, we obtained a quick and easy way to reduce the deuterium in biological systems by simply utilization in the growth medium or in the drinking water of deuterium depleted water. Studies in the recent years shows that deuterium depleted water has a great influence on the development and multiplication of plant and animal cells, cellular transport, DNA synthesis and antioxidant activity (Somlyai et al. 1993; Somlyai et al 1998).

In the present study was assessed the role of deuterium depleted water combined with an aqueous extract of spruce bark, on seeds and seedlings of soybean (*Glycine max L.*). Extract of spruce bark containing polyphenolic compounds that are substances widespread in the vegetal kingdom having an important role in metabolic processes on plants (and animals). The many benefits of polyphenolic compounds and the necessity to replace synthetic antioxidants with natural compounds, have intensified efforts of researchers to discover and use bioactive compounds from natural sources (Zhang et al., 2009). Information on the effects of polyphenolic compounds on the processes of germination and plant development are important in determining potential uses in agriculture as a natural bioregulators growth. The most modern methods used in agricultural science and technology, gives an important place on processes of acceleration or inhibition temporary of physiological processes in plants by with help certain physical and chemical factors. Among these factors, substances that act as stimulators have received in the last time, a wide applicability in plant cultivation. Research undertaken in recent years, which were aimed at finding new biostimulating products compatible with the ambiental environment, drew attention to the possible involvement of aromatic natural products, isolated from biomass to reagent chemicals, in metabolic processes of plant. It was established that aqueous extract of spruce bark, rich in polyphenolic compounds, has a stimulating effect in the processes of germination, growth and development of seedlings of rape (Stîngu et al. 2010, Ignat et al. 2009). The aim of this study was to evaluate influence of deuterium depleted water and aqueous extract of spruce bark in combination with deuterium depleted water, in the processes of germination, plant growth and development of *Glycine max L.*

## MATERIAL AND METHOD

Deuterium depleted wather was purchased from INCDTCI Râmnicu Vâlcea, Romania. To obtain an aqueous polyphenolic extract was used as a vegetable raw

material the spruce bark of industry origin. After drying at room temperature and under conditions of normal aeration, the bark was ground, followed by a new stage of drying.

1. Extraction. Ground spruce bark was subjected to extraction using procedure properly on aqueous extraction namely: 5 g dried vegetal material is brought into a 250 mL Erlenmeyer flask in which there are 125 mL distilled water. Erlenmeyer flask covered with a watch glass and heat on a water bath so that the temperature in the vessel to 85-90 ° C. Leave it at that temperature for 45 min. shaking from time to time. The material is allowed to settle and passed the clear solution through a crucible of glass or porcelain funnel. This operation is repeated 3-4 times until it obtained a colorless extract. All extracts are made in a 500 mL volumetric flask and make up to volume mark with distilled water (Rozmarin et al., 1984).

2. Germination tests were carried out going through a standard procedure, using increments of 5 petri dishes for each solution studied (distilled water - control, ASD, extract of spruce, and spruce bark extract in combination with distilled water / ASD). On a filter paper were placed every five soybean seeds, carefully selected to no present major damage. For starters, the vegetal material has undergone a process presterilizare, which consisted of submerged seed absolute ethanol for 10 seconds, following the sterilization in the presence of sodium hypochlorite 10% for 20-30 minutes (Cachita et al., 2004). The volume of solution added was 10 mL / dishes. Petri dishes thus prepared were incubated in the dark in a thermostat set at 27 ° C. After a period of seven days, Petri dishes were kept in daylight for 3 days to allow the seedlings synthesize assimilatory pigments. Finally, were made the biometric and quantitative measurements on components of seedlings (root, stem, primary leaves) and spectrophotometric measurements to determine the concentration of photoassimilatory pigments.

3. Quantification of assimilating pigments. 0.05 g fresh vegetal material was extracted in 80% acetone by grinding with a spatula tip of quartz sand. Chlorophyll extract was analyzed spectrophotometrically by reading absorbance at various specific wavelengths: 470, 646, 663 nm. In order to determine the concentration of chlorophyll pigments (chlorophyll a and b) and carotenoid pigments were used formula proposed by Lichtenthaler and Welburn (1983):

Chlorophyll a ( $\mu\text{g} / \text{mL}$ ) =  $12.21 (A_{663}) - 2.81 (A_{646})$

Chlorophyll b ( $\mu\text{g} / \text{mL}$ ) =  $20.31 (A_{646}) - 5.03 (A_{663})$

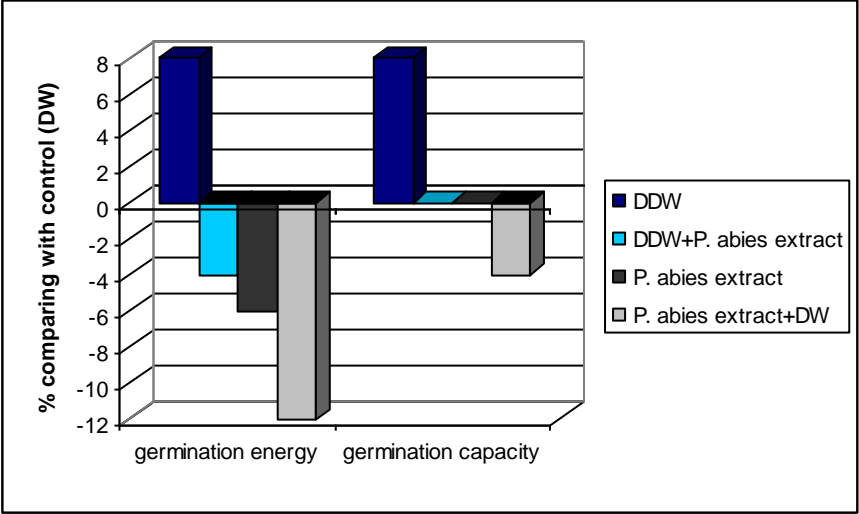
Carotenoids ( $\mu\text{g} / \text{mL}$ ) =  $(100 \cdot A_{470} - 3.27 [\text{chl a}] - 104 [\text{chl b}]) / 22$

## RESULTS AND DISCUSSIONS

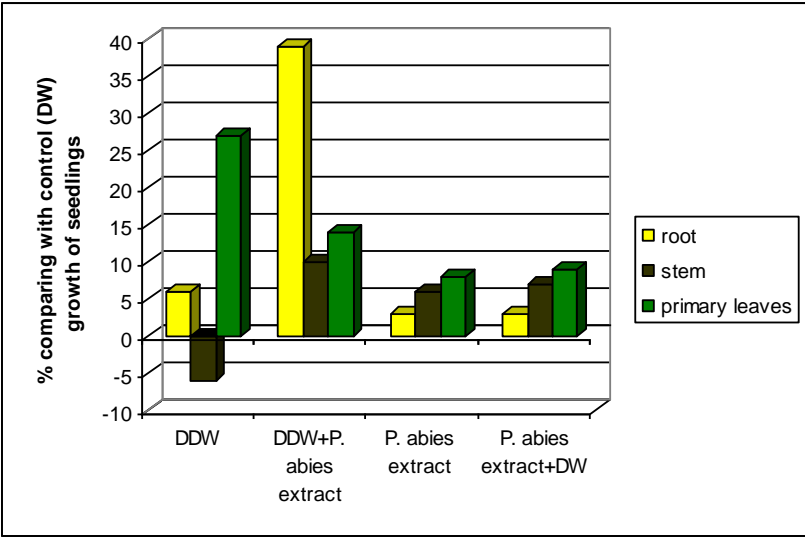
After testing the germination of soybean seed can be observed that the presence of ASD have as stimulating effect on germination energy and capacity by 8% higher compared to the control (distilled water), as opposed to simply extract of spruce bark or in combination with distilled water / ASD, which slows the process of seed germination by 12% for spruce bark extract combined with distilled water (fig. 1).

Deuterium depleted water, present in the growth medium determines the root elongation of 6% and as leaves with 27%, and in combination with extract of spruce bark, produces an elongation of the main radicle by 39% prompting a lesser extent, the elongation of stem and primary leaves. Aqueous extract of spruce bark 1% concentration or diluted by half with distilled water, influences slightly positive elongation of seedlings vegetative organs (fig. 2).

Referring to the accumulation of biomass, reporting to us the three parts of soybean seedlings is found that ASD stimulates the accumulation of biomass in primary leaves with 27% more than in controls. For the other plant parts are not recorded significant changes.



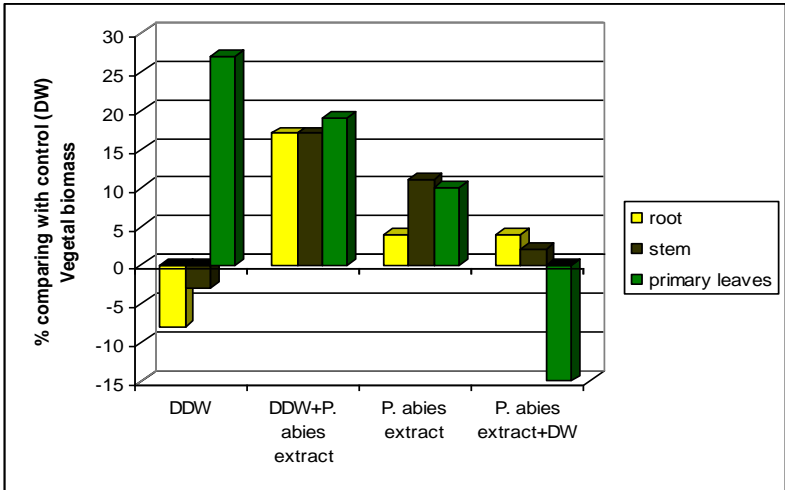
**Fig. 1** -The influence of DDW and aqueous extract from the bark of spruce in combination with DDW on seed germination of *Glycine max* L. plant



**Fig. 2** -The influence of DDW and aqueous extract from the bark of spruce in combination with DDW on plantlet growth of *Glycine max* L. plant

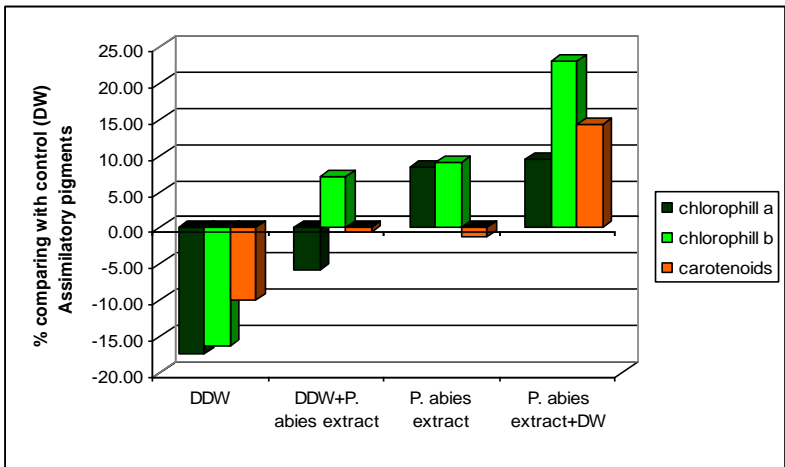
However, in combination with spruce bark extract there is a stimulation of biomass accumulation in all parts of the seedlings at a rate of over 15% compared to the control. In the case of spruce bark extract shows that biomass is slightly

higher it decreased with dilution half of the extract and even inhibiting the accumulation of biomass in primary leaves (fig. 3).



**Fig. 3** - The influence of DDW and aqueous extract from the bark of spruce in combination with DDW on vegetal biomass accumulation of *Glycine max* L. plant

Thus, evaluating the data for the synthesis of photoassimilatory pigments, it appears that DDW inhibit this process with a rate of 17% for chlorophyll a, 16% for chlorophyll b and 10% for carotenoid pigments. The percentage of inhibition for the synthesis of photoassimilatory pigments will be much reduced, or even positively influenced if we refer to the percentage for chlorophyll b, when DDW is combined with extract of spruce bark (fig. 4).



**Fig. 4** - The influence of DDW and aqueous extract from the bark of spruce in combination with DDW on assimilatory pigments accumulation of *Glycine max* L. plant

It was found that the spruce bark extract is effect in stimulating the biosynthesis of photoassimilatory pigments, the percentage of stimulation was

inversely proportional to the concentration of spruce bark extract. The most noticeable effect of stimulating the spruce bark extract at a concentration of 0.5 % is observed for chlorophyll b, its content increased up to 23% compared to the control.

## CONCLUSIONS

1. Obtained data show that deuterium depleted water, acts on the plant *Glycine max* L stimulating seed germination energy and capacity, root and leaf growth, biomass accumulation in leaves, inhibiting the synthesis of photoassimilatory pigments.

2. Aqueous extract of spruce bark reduces seed germination energy and capacity, inhibit the accumulation of biomass in leaves and stimulates photoassimilating pigments synthesis.

3. Deuterium depleted water in combination with polyphenolic extract of spruce bark stimulates growth of soybean seedlings, especially root and favorably influence biomass accumulation in all organs of seedlings, and chlorophyll b synthesis, inhibit the synthesis of chlorophyll a.

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# USING MOODLE TO BUILD A COURSE IN APPLIED MATHEMATICS FOR STUDENTS IN AGRICULTURAL SCIENCES

## UTILIZAREA MOODLE ÎN CONSTRUIREA UNUI CURS DE MATEMATICĂ PENTRU STUDENȚII ÎN ȘTIINȚE AGRICOLE

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**Abstract.** *The curricula in different branches of agricultural sciences (Horticulture, Agronomy etc.) include courses in applied mathematics. Previous expertise shows that teaching such a discipline is quite difficult, as the core knowledge of students in agricultural sciences is remote from this area and their skills in dealing with the respective concepts are not always very strong. Such difficulties are more visible when working with distance learning students. Nowadays, e-learning technologies are considered to be among the most efficient ways to improve the quality of teaching and studying. The paper presents an e-learning project for teaching applied mathematics. The software used to build such a course was Moodle.*

**Key words:** e-learning, Moodle, distance learning

**Rezumat.** *Programele diferitelor specialități din științele agricole includ cursuri de matematică aplicată. Experiența arată că predarea acestor cursuri prezintă dificultăți specifice care sunt generate de nivelul anterior de cunoștințe pe care îl posedă studenții la aceste specializări. Aceste dificultăți se constată cu atât mai mult la studenții de la învățământ la distanță. Tehnologiile e-learning pot fi un ajutor în creșterea accesibilității acestor cursuri. Articolul prezintă proiectul de realizare a unui astfel de curs de matematică aplicată folosind ca suport tehnic pachetul software Moodle.*

**Cuvinte cheie:** e-learning, Moodle, învățământ la distanță

## INTRODUCTION

E-learning means education via the Internet, network, or standalone computer. However, e-learning would not be possible without a modern computer infrastructure, as it uses electronic applications and processes to learn, and transfers skills and knowledge via network. E-learning applications and processes include Web-based learning, computer-based learning, virtual classrooms, and digital collaboration (Höhle J.).

The e-learning platforms represent virtual environments that change the way people work and interact within the educational process. The virtual environments can be used in the field of education, as a technology having the potential to facilitate more active student and instructor collaboration and learning, and help to provide distance education. They allow the instructor to

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teach courses at their own technological comfort level by providing templates for course management. A student should get the real classroom experience even while accessing the courses remotely (Jeffery C. et al., 2005).

## **MOODLE**

The design and implementation of courseware, allowing remote student-teacher interactions, can be achieved by using the features of **Moodle** a software package for producing internet-based courses and web sites. As its developers present it [3], Moodle is an Open Source Course Management System (CMS) that educators can use as a tool for creating online dynamic web sites for their students. The most recent Moodle version 2.0.2 was made available in February 2011.

Moodle supplements the traditional face-to-face learning by providing online-classes, is user friendly, simple, efficient, easy to install on any platform that supports PHP. It can be installed either on a web server or on a personal computer. Moodle has the following main modules.

There are three categories of people that use Moodle:

The **administrator** is the one that has complete control of the installed package and assigns different access rights to the others

The **teacher** is the one that designs a courseware, provides resources within, designs quizzes and tests. The teacher keeps in touch with students, and makes everything needed for them to perform the learning tasks.

The **student** is somebody that enrolls in a course, uses all its resources to learn, co-operates with other students, with the teacher, makes homework, and passes tests.

These three categories of users have different access rights to use the various courseware modules like **Site Management, Course Management, Resource, Forum, and Quiz.**

## **THE STRUCTURE OF A COURSEWARE IN APPLIED MATHEMATICS FOR STUDENTS IN AGRICULTURAL SCIENCES**

Teaching applied math to students in agricultural sciences can be made more efficient if the courseware is built using a large variety of teaching resources like intuitive examples, self testing procedures, chatting with the other students, keeping in touch with the teacher etc. Moodle provides such resources.

Following is a discussion on the features that Moodle has and their application in an ongoing project of a math course.

The chapters names accompanied by brief explanations would be firstly displayed such as the student can get acquainted with the contents (figure 1).

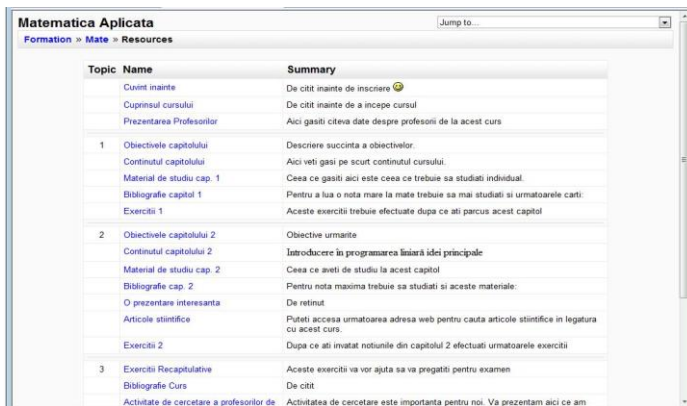


Fig. 1 – The course contents with brief descriptions

The resources that the student has access to appear to him on the first page. All of the links the he needs are here: teachers' profiles, teachers contact, course and tests calendar, the course itself, homework (figure 2).



Fig. 2 – The starting page of the course

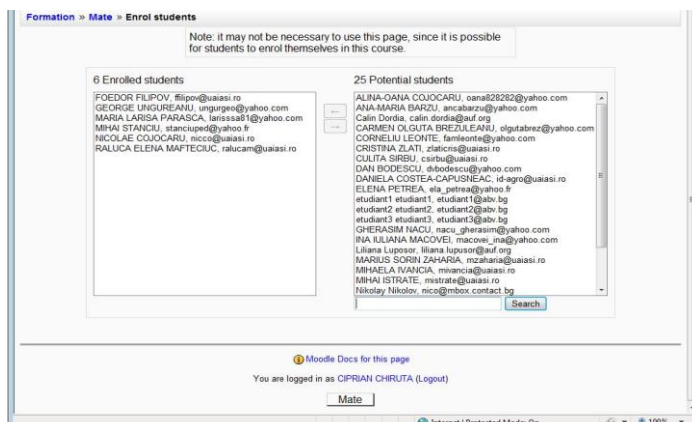


Fig. 3 – Students can be enrolled and grouped in various ways

The teacher can enroll and organize students, supervise the amount of time that each student spends with different activities (figure 3)

Students can download the different study materials, can follow links and upload their essays and homework (figure 4).

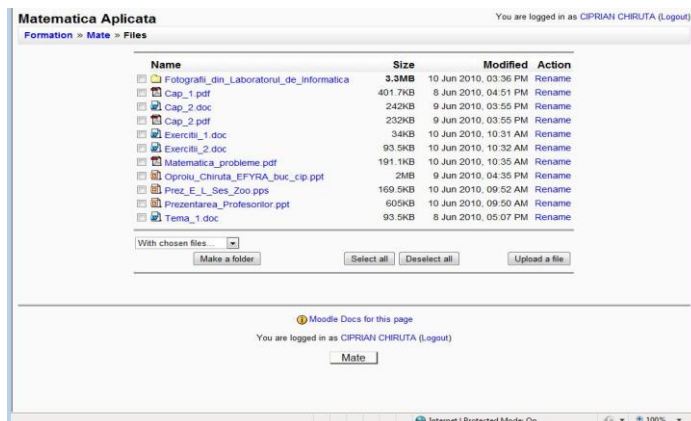


Fig. 4 – Students can download learning support documents

Several advantages arise: the teacher can use various techniques in building his course (pdf documents, PowerPoint presentations, video clips etc.). Moreover, the teacher posts links to different Internet resources that can offer more explanations and points of view (figure 5).

Tests and quizzes can have various forms according to different pedagogical methods. Features like fixed solving time, or online notification of results are available (figure 6).

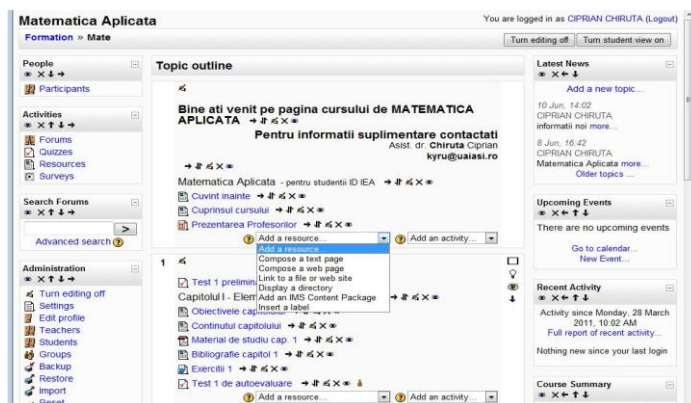


Fig. 5 – Learning resources that can be used by the student

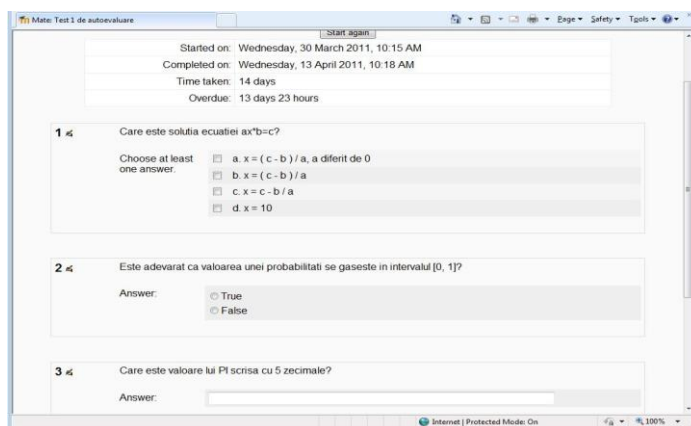


Fig. 6 – Different types of questions within a quiz

The teacher can perform statistics on the results obtained during the testing activities and draw conclusions for the future teaching (figure 7).

Item Analysis Table									
Q#	Question text	Answer's text	partial credit	R. Counts	R. %	% Correct Facility	SD	Disc. Index	Disc. Coeff.
(130)	Intrebare 1: Care este ordinea corecta a culorilor ce apar in drapelul national roman?	ros, galben, albastru	(0.00)	2/6	(33%)	30 %	0.469	0.60	0.62
		albastru, galben, rosu	(1.00)	2/6	(33%)				
		galben, rosu, albastru	(0.00)	0/6	(0%)				
		roz, galben, violet	(0.00)	2/6	(33%)				
(132)	Intrebare 2: Este adevarat ca Pamanintul este perfect rotund?	Fals	(1.00)	4/6	(67%)	67 %	0.516	0.67	0.69
		Adevărat	(0.00)	0/6	(0%)				
(135)	Intrebare 4: Care este nota cea mai mare in Romania?	10 (9.95..10.05)	(1.00)	3/6	(50%)	50 %	0.548	1.00	0.79
		4	(0.00)	1/6	(17%)				
(136)	Intrebare 5: Care este sportul cel mai popular in Romania?	fotbal							

Fig. 7 – Statistics on the test results

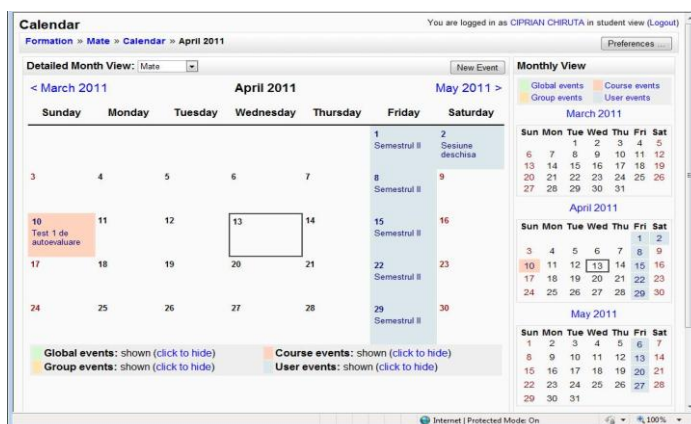


Fig. 8- The calendar

Each student can have his own calendar to keep of the duties and activities he has to perform within the course (learning, homework, testing, teacher contacting etc.). Figure 8 shows such a calendar.

## CONCLUSIONS

Nowadays, e-learning technologies are considered to be among the most efficient ways to improve the quality of teaching and studying.

Moodle is a suitable Open Source development environment for creating and using e-learning course materials.

E-learning can improve the efficiency of teaching in all areas of agricultural sciences, but would have a special effect in teaching topics in sciences like applied mathematics.

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# OJIP FLUORESCENCE TRANSIENT ANALYSIS – A RAPID AND NON-INVASIVE METHOD TO DETECT GENOTYPIC VARIATIONS IN THE RESPONSE TO SOIL CHARACTERISTICS OF RASPBERRY AND BLACKBERRY CULTIVARS

## ANALIZA FAZELOR DE FLUORESCENȚĂ O-J-I-P – METODĂ RAPIDĂ ȘI NON-INVAZIVĂ DE MONITORIZARE ÎN TIMP REAL A RĂSPUNSULUI UNOR GENOTIPURI DE ZMEUR ȘI MUR LA CONDIȚIILE DE CULTURĂ

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**Abstract:** The fast O-J-I-P fluorescence transients and their quantification by JIP-test provide a rapid, reliable and non-invasive tool to detect real time changes in the functionality of the photosynthetic apparatus and plant vitality in physiological or stress conditions. In this communication, we have used for the first time the fast Chl a fluorescence transients to assess genotypic variations in the response of two raspberry (Opal and Cayuga) and two blackberry (Thornfree and Lochness) cultivars to soil characteristics. The plants were maintained in the greenhouse at 25±5°C on two different substrates: soil with pH 5.8 and a soil:peat mixture (1:2) with pH 4.7. The kinetics of Chl a fluorescence showed genotypic variations in the magnitudes and rise of O-J, J-I, and I-P phases in response to soil conditions mainly in raspberry. On a soil:peat mixture, Cayuga showed inhibition of the J-I phase of fluorescence and a lower P-step whereas in Opal both O-J and J-I steps were largely inhibited with a highly suppressed P-step. In blackberry, genotypic variations were mainly obtained for I step which was much lower in Thornfree. The Jip-test revealed that the two raspberry cultivars have different responsiveness to soil pH with Opal being more responsive than Cayuga. Similarly, Thornfree was more responsive to soil pH than Lochness.

**Key words:** chlorophyll fluorescence, JIP test, soil pH, raspberry, blackberry

**Rezumat:** În ultimii ani analiza fluorescenței clorofilei a devenit una dintre cele mai folosite tehnici de detectare în timp real a schimbărilor survenite în structura moleculară și funcționalitatea aparatului fotosintetic ca răspuns la acțiunea factorilor de mediu biotici sau abiotici. Scopul acestei lucrări este monitorizarea răspunsului unor genotipuri de mur și zmeur la condițiile de pH al solului, prin analiza fazelor de fluorescență O-J-I-P induse în urma excitării centrilor de reacție foliari cu un puls de lumină roșie cu intensitatea de 3000  $\mu\text{mol m}^{-2} \text{s}^{-1}$ . Materialul vegetal folosit a fost reprezentat din 2 soiuri de zmeur (Opal și Cayuga) și respectiv, 2 soiuri de mur (Lochness și Thornfree) care au fost plantate în seră pe două variante de substrat cu pH diferit (4.7 și 5.8). În urma analizei parametrilor derivați din valorile fluorescenței clorofilei a la anumiți timpi s-a constatat că la variantele cultivate pe substrat mai acid există o scădere a eficienței fotosintetice ca urmare a amplificării ratei de disipare a energiei luminoase sub formă de căldură.

**Cuvinte cheie:** fluorescența clorofilei, Test JIP, pH-ul solului, mur, zmeur

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## INTRODUCTION

Raspberry and blackberry are two species largely cultured in Northern Hemisphere due to their ability to synthesize health-related compounds. Therefore, many studies have been focused on the effect of growth conditions on berry fruit quality and plant productivity. Soil pH is one of the abiotic factors that may limit the culture areal of these species because they require a slight acidic soil (5.5 – 6.2) with good permeability properties. Inappropriate soil conditions may affect photosynthesis and, consequently, plant growth and productivity as well as fruit quality. Therefore, it is important to use fast and simple methods to test the response of plants to soil in order to detect any situation that could alter the photosynthetic processes. Application of chlorophyll a (Chl a) fluorescence is a simple and non-invasive tool to monitor photosynthesis *in vivo* and *in vitro*. In a dark-adapted sample, most excitation energy is consumed by photochemistry, thus lowering fluorescence yield through a process termed photochemical quenching. When PS II centers are in their open states, fluorescence yield is low, whereas when they are blocked, particularly by the reduction of the primary quinone electron acceptor (QA) in photosystem II (PS II), fluorescence yield increases. In addition to photochemical quenching, various regulatory or inhibitory processes can lower fluorescence yield, and these are generally termed non- photochemical quenching. Thus, chlorophyll assays were used as indicators of the efficiency or turnover rate of PS II. The fluorescence rise exhibited during the first second of illumination by dark-adapted plants shows a sequence of steps from the initial ( $F_0$ ) to the maximal ( $F_m$ ) fluorescence value. As reported by many authors, these steps labeled O, J, I, P show changes under different environmental conditions such as UV light (Sfichi-Duke et al, 2008), low temperature (Sfakianakis et al., 2006) etc. The JIP-test is a quantification of these transients and provides a constellation of structural and functional parameters characterizing the PSII behavior (Strasser et al., 2000). It has been widely and successfully used for the study of PSII activity in various photosynthetic organisms under physiological and stress conditions allowing the rapid screening of many samples in field of laboratory experimental conditions. In the present contribution we applied for the first time the OJIP-test to test the response of some raspberry and blackberry cultivars to soil conditions (pH and texture) and also to detect genotypic variations in this response.

## MATERIAL AND METHOD

**Plant material.** Raspberry (Opal and Cayuga) and blackberry (Lochness and Thornfree) cultivars have been planted in the greenhouse in 6L pots in soil (pH 5.8) and a soil:peat mixture (1:2) (pH 4.7). The pots have been maintained for a month at  $25\pm 5^\circ\text{C}$  temperature and photo-period of 18 h/6 h. In addition to the ambient light, 40W fluorescent lamps which provided a light intensity of  $140\ \mu\text{mol}\ \text{m}^{-2}\text{s}^{-1}$  have been used for illumination. The fluorescence measurements were conducted after a month of plant adaptation to growing conditions on fully-expanded leaves.

**Chl a fluorescence measurements.** Chl a fluorescence transients of intact leaves were measured by a HandyPea fluorimeter (built by Hansatech Instruments,



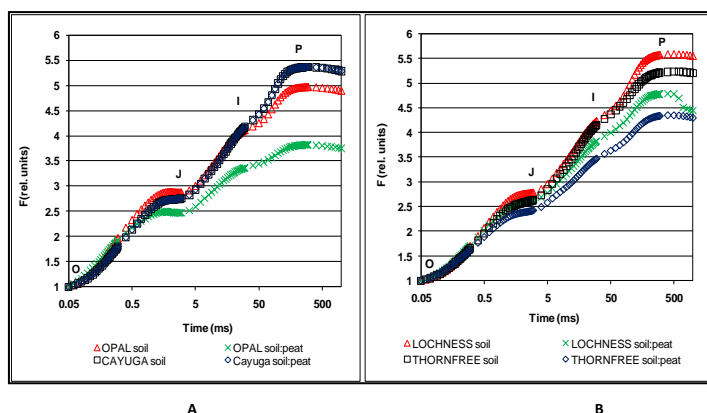
King's Lynn Norfolk, PE 30 4NE, GB). The transients were induced by a red light (peak at 650 nm) of  $3000 \mu\text{mol m}^{-2}\text{s}^{-1}$  provided by an array of six light-emitting diodes; they were recorded for 1 s, starting from 50 ms after the onset of illumination, with 12 bit resolution; the data acquisition was every 10 ms for the first 2 ms and every 1 ms thereafter (for details see Strasser et al., 1995). The leaves were dark-adapted for 30 min before the fluorescence measurements. The fluorescence signal at 50  $\mu\text{s}$  after the onset of illumination was considered as  $F_o$  (Strasser and Strasser 1995). The J step was the fluorescence measured at 2 ms while the I step was the fluorescence value recorder at 30 ms. The maximal fluorescence intensity denotes the  $F_m$  values where all the reaction centers (RCs) are physiologically closed. The  $F_o$  state indicates the physiological state when all the RCs are open. From the values obtained for  $F_o$  and  $F_m$  the maximum yield pf PSII photochemistry ( $F_v/F_m$ ) has been calculated.

**The JIP-test.** It was used to calculate several parameters such as; absorbance per reaction centers (ABS/RC), energy trapped in the reaction center (TRo/RC), electron transfer rate per reaction center (ETo/RC), energy dissipation per reaction center (Dlo/RC) and the density of active reaction centers (RC/CS) (for details see Strasser and Strasser, 1995).

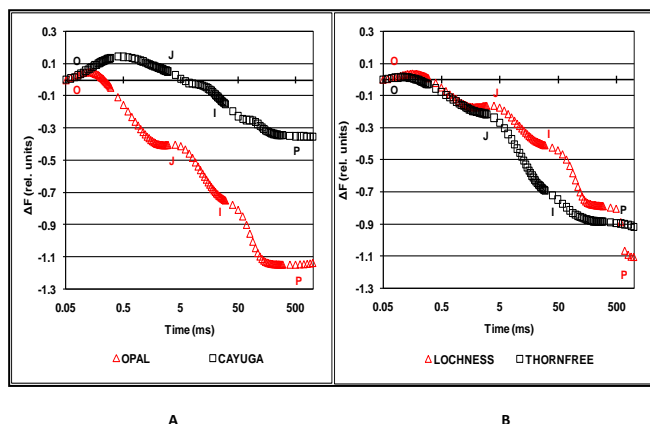
**Statistical analysis.** For each experimental category, five leaves of each plant were measured. Three independent experiments have been performed. The average fluorescence values and standard deviations were also calculated using Excel.

## RESULTS AND DISCUSSIONS

Figure 1 shows fluorescence induction curves for dark-adapted samples. In raspberry (fig. 1A) Cayuga showed overlapped transients on both substrates. Opal grown in soil exhibited a higher O-J rise than Cayuga, but the I-P step was lower. In blackberry, Thornfree shows a lower I-P rise than Lochness on both substrates. However, at lower soil pH, the fluorescence highly decreased in Opal and also in both blackberry cultivars, with Thornfree showing a higher sensitivity than Lochness (fig. 1B). The transients obtained for  $\Delta F$ , expressed as the difference between the fluorescence values measured for soil:peat and those measured for soil showed much clearly genotypic variations in the response to low pH of both species.



**Fig. 1** -OJIP transients in raspberry (A) and blackberry (B) grown on soil (pH 5.8) and a soil:peat mixture (pH 4.7). Chl a fluorescence values are normalized to  $F_o$ .  $F_o$  is the value measured at 50  $\mu\text{s}$



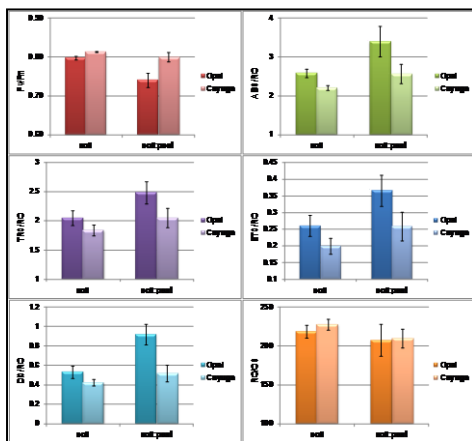
**Fig. 2** - Genotypic variations in  $\Delta F$  (calculated as  $F_{\text{soil:peat pH 4.7}} - F_{\text{soil pH 5.8}}$ ) in raspberry (A) and blackberry (B) in response to soil conditions

In raspberry (fig. 2A), the O-I phase was influenced by genotype and recorded positive values in Cayuga and negative in Opal. This suggests that a lower pH does not affect the electron donation from the oxygen evolving complex in Cayuga as it does in Opal. In spite of the positive O-J rise, the next steps were negative in both raspberry cultivars and this resulted in lower P (corresponding to  $F_m$ ) peaks. However, the whole fluorescence transient was clearly much inhibited in Opal than in Cayuga. Thus we can assume that Opal is more sensitive to soil pH than Cayuga.

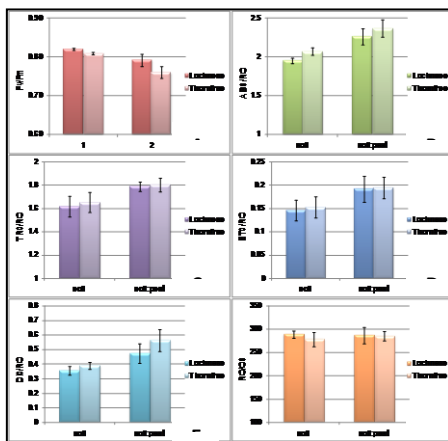
In blackberry, negative values of  $\Delta F$  and thus  $F_m$  were obtained for both cultivars. The O-J phase appears overlapped which suggest that this response is not influenced by genotype (fig 2B). However, genotypic variations were obtained for I-P step that corresponds to the reduction of quinone molecule acceptors (QA and QB) which was more suppressed in Thornfree than in Lochness. In general, the fluorescence transients recorded on the two soil substrates indicate that both species are sensitive to a lower pH but the degree of sensitivity is influenced by cultivar.

From the fluorescence values several parameters relevant for the estimation of PSII behavior have been calculated using the JIP-test. In raspberry (fig. 3A), the maximum yield of PSII photochemistry ( $F_v/F_m$ ) showed higher values in Cayuga than in Opal. It also highly decreased in Opal plants grown at lower pH. This supports the hypothesis that Opal is more sensitive to soil pH variations than Cayuga.

A similar response was obtained for blackberry where Thornfree showed a higher sensitivity to soil pH than Lochness (fig. 4A). The decrease in  $F_v/F_m$  seems to be related to the increase in antenna size. Absorbance per reaction center (ABS/RC) refers to the photon absorbed by the antenna pigment molecules and it is an indirect measure of antenna size. At lower pH the antenna increased in Opal and Thornfree as compared to Cayuga (fig. 3B) and Lochness, respectively (fig. 4B). Beside antenna size, several other parameters also recorded higher values in Opal plants grown at lower pH. These are the energy trapped in the reaction center ( $Tr_o/RC$ ) (fig. 3C) and the electron transport rate (fig. 3D). It seems that these changes act as a compensatory mechanism to minimize the energetic losses caused by the increase in antenna.



**Fig. 3** Genotypic variations of Jip-parameters in raspberry in response to soil characteristics



**Fig. 4** Genotypic variations of Jip-parameters in blackberry in response to soil characteristics

Fig. 3D shows clearly that the rate of energy dissipation increased in parallel to antenna in Opal plants grown on a more acidic pH. In spite of this loss, the density of active reaction centers remained more or less constant irrespective of plants growing conditions (fig. 3F). The above parameters showed similar changes but in a less extent in Cayuga. However, these adaptive responses of Cayuga plants to lower pH impacted in a relatively less significant manner on the density of active reaction centers which recorded similar values to those obtained for Opal (fig. 3B-F). Thus, Opal plants show a higher responsiveness to pH soil variations than Cayuga and also possess adequate mechanisms to adjust their photosynthetic apparatus in order to keep stable the amount of active reaction centers. In this case, the decrease in  $F_v/F_m$  may be an adaptive response to soil pH and not a stress response (fig. 3A). In blackberry the genotypic variations in JIP-parameters were less pronounced as those obtained for raspberry. Both cultivars showed lower values of  $F_v/F_m$  at pH 4.7 (fig. 4A) but Thornfree exhibited a higher sensitivity of  $F_v/F_m$  to soil pH than Lochness. The decrease in  $F_v/F_m$  seems to be the result of an enhancement in energy dissipation (fig. 4E) due to the increase in antenna (fig. 4B). Due to the ability of blackberry cultivars to maintain increased trapping (fig. 4C) and electron transport (fig. 4D) rates, the density of active reaction centers is not significantly affected by alterations in soil pH (fig. 4F).

## CONCLUSIONS

1. Chlorophyll a fluorescence transients may be used to detect genotypic variations in the response of raspberry and blackberry cultivars to soil pH.

2. Opal and Thornfree showed higher responsiveness to alterations in soil pH than Cayuga and Lochness, respectively.

3. Although all cultivars showed decreased photochemistry at lower pH, the alterations in the JIP-test parameters indicate that these are adaptive (and not stress) responses to soil pH lowering.

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# THE CONTRIBUTION OF ALIEN WEEDS IN CROP INFESTATION, AT EZĂRENI FARM, IAȘI COUNTY

## CONTRIBUȚIA BURUIENILOR ADVENTIVE LA INFESTAREA CULTURILOR AGRICOLE DE LA FERMA EZĂRENI, JUDEȚUL IAȘI

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**Abstract.** *The segetal flora of agricultural crops from Ezăreni farm, Iași County, includes a total number of 107 weed species. Only 10% of these species are alien weeds, but they contribute to a significant degree of weeds infestation, especially in row crops. *Amaranthus retroflexus*, *A. powellii*, *Xanthium orientale* ssp. *italicum*, *Sorghum halepense*, *Conyza canadensis*, and *Panicum miliaceum* are the most important alien weeds in the studied crops.*

**Key words:** alien weeds, segetal flora, weed infestation level

**Rezumat.** *În culturile agricole ale fermei Ezăreni, județul Iași, au fost identificate 107 specii de buruieni segetale. Doar o zecime dintre specii sunt adventive, dar acestea contribuie într-un grad însemnat la infestarea cu buruieni, mai ales în culturile de prășitoare. Cele mai importante buruieni adventive sunt: *Amaranthus retroflexus*, *A. powellii*, *Xanthium orientale* ssp. *italicum*, *Sorghum halepense*, *Conyza canadensis* și *Panicum miliaceum*.*

**Cuvinte cheie:** buruieni adventive, flora segetală, grad de îmburuienare

### INTRODUCTION

The damages caused by weeds in agricultural crops depend on the segetal flora type, the biological features and propagation way of weeds, as well as the quality of applied agro-technical works (Canțar et al. 1955). Therefore, the knowledge of segetal flora structure is particularly important for effectively weeds control, in accordance with the principles of integrated pest management. Some of the most important components of segetal flora are alien species, they causing significant damage to agricultural crops worldwide (Pimentel et al., 2000). In general, spontaneous and sub-spontaneous plant species whose presence in a certain area is due to accidental or deliberate introduction, as a result of human activity, are considered alien plants (Richardson et al., 2000). According to Sîrbu (2004), the alien flora of the Moldavia territory includes a total number of 249 species, and almost 24% of these species invade agricultural crops, as segetal weeds. The objectives of this paper were: a) to record the structure of segetal flora from a representative agricultural area of Moldavian Plain; b) to determine the frequency of these species and their share in weed infestation to the different types of crops; c) to identify the main alien and native weed species which infest these agricultural crops.

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## MATERIAL AND METHOD

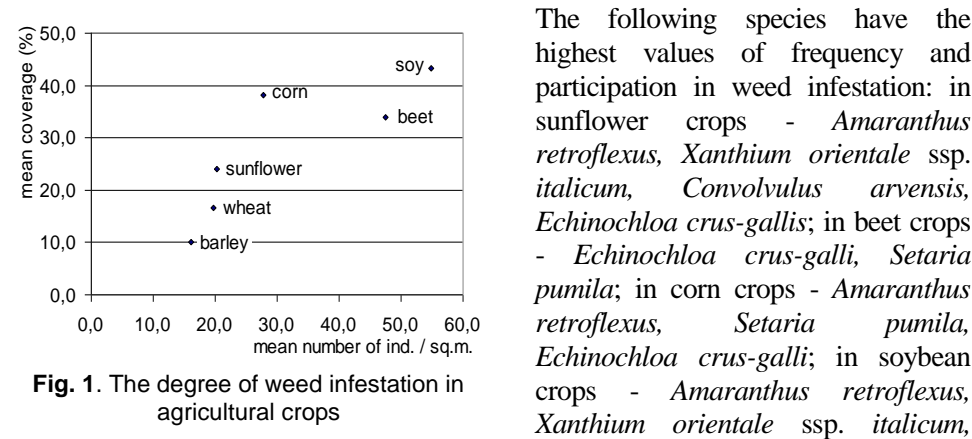
The research has been performed on the Ezăreni farm (Iași County), in June 2009 and 2010, in sunflower, corn, beet, soybean, wheat and barley crops. For each agricultural plot, a number of 10 determinations were performed, using a frame of 0.5 × 0.5 m. Within each frame, individuals of weeds species were counted, and their projective coverage (%) were estimated. The degree of weed infestation level was determined based on the average number of individuals/m<sup>2</sup> and their medium coverage. The frequency of each species is expressed by the ratio between the number of determinations in which the species occurs and the total number of determinations. Within each crop type, the participation of each species in weed infestation is expressed by the ratio between its average number of individuals / m<sup>2</sup>, and the average number of individuals/m<sup>2</sup> of all weed species (Anghel et al., 1972).

## RESULTS AND DISCUSSIONS

The segetal flora from investigated agricultural crops includes a total number of 107 weed species, which are listed below, in alphabetical order: *Adonis aestivalis*, *Amaranthus powellii*, *A. retroflexus*, *Anagallis arvensis*, *Anchusa ochroleuca*, *Aristolochia clematitis*, *Artemisia vulgaris*, *Asperugo procumbens*, *Atriplex tatarica*, *Bromus arvensis*, *B. japonicus*, *B. tectorum*, *Camelina microcarpa*, *Capsella bursa-pastoris*, *Cardaria draba*, *Centaurea cyanus*, *Chenopodium album*, *Ch. hybridum*, *Chondrilla juncea*, *Cichorium intybus*, *Cirsium arvense*, *Conium maculatum*, *Consolida regalis*, *Convolvulus arvensis*, *Conyza canadensis*, *Crepis biennis*, *C. foetida* ssp. *rhoeadifolia*, *C. setosa*, *Cynodon dactylon*, *Datura stramonium*, *Daucus carota*, *Descurainia sophia*, *Digitaria sanguinalis*, *Echinochloa crus-galli*, *Echium vulgare*, *Elymus repens*, *Eragrostis minor*, *Erigeron annuus* ssp. *annuus*, *Erysimum repandum*, *Euphorbia agraria*, *E. falcata* ssp. *acuminata*, *E. helioscopia*, *E. platyphyllos*, *Falcaria vulgaris*, *Fumaria schleicheri*, *Galinsoga parviflora*, *Galium aparine*, *Hibiscus trionum*, *Hordeum murinum*, *Iva xanthifolia*, *Kickxia elatine*, *Lactuca seriolla*, *Lamium purpureum*, *L. amplexicaule*, *Lappula squarrosa*, *Lathyrus tuberosus*, *Lepidium ruderalis*, *Linaria vulgaris*, *Lithospermum arvensis*, *Lolium perenne*, *Malva neglecta*, *Matricaria perforata*, *Medicago lupulina*, *Melilotus officinalis*, *Neslia paniculata*, *Nonea pulla*, *Panicum miliaceum*, *Papaver dubium*, *P. rhoeas* ssp. *rhoeas*, *Phragmites australis*, *Plantago lanceolata*, *P. media*, *Polygonum aviculare*, *P. convolvulus*, *P. lapathifolium*, *P. persicaria*, *Portulaca oleracea*, *Raphanus raphanistrum* ssp. *raphanistrum*, *Reseda lutea*, *Rubus caesius*, *Sambucus ebulus*, *Senecio vernalis*, *S. vulgaris*, *Setaria pumila*, *S. verticillata*, *S. viridis*, *Sinapis arvensis*, *Solanum nigrum*, *Sonchus arvensis* ssp. *arvensis*, *S. asper* ssp. *asper*, *S. oleraceus*, *Sorghum halepense*, *Stachys annua*, *Stellaria media*, *Tanacetum vulgare*, *Taraxacum officinale*, *Thlaspi arvense*, *Th. perfoliatum*, *Torilis arvensis*, *Tragopogon dubius*, *Trifolium arvense*, *T. repens*, *Veronica hederifolia*, *V. polita*, *V. persica*, *Vicia cracca*, *Viola arvensis*, *Xanthium orientale* ssp. *italicum*.

The weed infestation level varies depending on the crop type (fig. 1), soy and beet crops being most heavily infested (mean coverage of 43.3%, respectively 34%; mean number of ind. / m<sup>2</sup> of 54.8, respectively 47.5), while cereal crops are less infested. The frequency, and degree of participation in weed infestation of

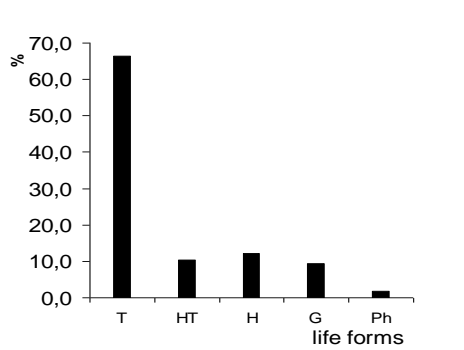
alien weeds and major native weed species from the crops on the Ezăreni farm, are shown in table 1.



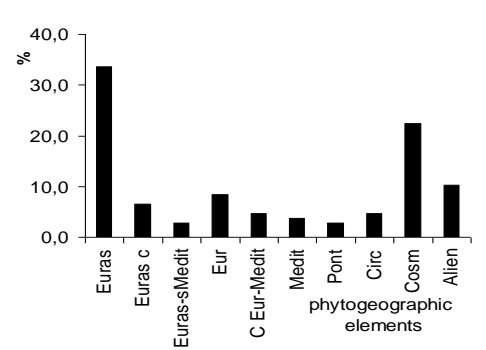
**Fig. 1.** The degree of weed infestation in agricultural crops

*Convolvulus arvensis*, *Setaria pumila*; in wheat crops - *Phragmites australis*, *Cirsium arvense*, *Consolida regalis*; in barley crops - *Cirsium arvense*, *Polygonum convolvulus*, *Consolida regalis*.

Therophytes are dominant in the biological spectrum of segetal flora (fig. 2). Hemitherophytes, hemicryptophytes, phanerophytes, and geophytes are less represented. However, geophytes include some of the most important weeds in the investigated crops, such as *Sorghum halepense*, *Cirsium arvense*, *Convolvulus*



**Fig. 2 -** Biological spectrum of segetal flora (T-therophytes; HT-hemitherophytes; H-hemicryptophytes; G-geophytes; Ph-phanerophytes)



**Fig. 3 -** Phytogeographic spectrum of segetal flora (Euras-Eurasian; Medit-Mediterranean; Eur-European; Pont-Pontic; Circ-Circumpolar; Cosm-Cosmopolitan; c-continental)

*arvensis*, *Phragmites australis* etc. Of the phytogeographic elements, the most numerous in the structure of segetal flora are the Eurasian ones. Cosmopolitan, alien, European and other elements are less represented (fig. 3). The alien element is represented by a relatively small number of species (10.3%), but it contributes to a significant degree of weed infestation on sunflower (40.6%), soybean (39.7%) and corn (29.1%) crops. The beet crops and those of cereals are mainly infested by native weeds, the alien ones having a contribution of only

Table 1

## The contribution of alien and native plant species in weed infestation of crops (Ezăreni farm, Iași County)

Weed species	Average frequency (%)						Participation of mean weed infestation (Wm%)					
	Sunfl.	Beet	Corn	Soy	Wheat	Barley	Sunfl.	Beet	Corn	Soy	Wheat	Barley
Alien weeds:												
<i>Amaranthus retroflexus</i>	80.0	80.0	94.0	96.7	46.7	5.5	15.2	4.2	14.4	14.2	2.2	0.1
<i>Xanthium orientale</i> ssp. <i>italicum</i>	76.7	50.0	84.0	66.7	-	-	10.0	3.0	5.0	13.1	-	-
<i>Amaranthus powellii</i>	76.7	10.0	40.0	45.0	-	40.0	4.7	0.3	3.8	6.8	-	3.8
<i>Sorghum halepense</i>	40.5	30.0	28.0	23.3	43.3	20.0	4.1	1.0	1.5	2.5	4.8	1.0
<i>Galinsoga parviflora</i>	40.5	40.0	44.0	30.0	-	-	3.8	0.8	2.0	2.1	-	-
<i>Panicum miliaceum</i>	36.7	30.0	12.0	10.0	13.3	20.2	2.6	1.5	0.8	0.4	1.7	1.0
<i>Conyza canadensis</i>	6.7	40.0	28.0	3.3	60.0	40.0	0.1	1.5	1.3	0.5	4.7	2.1
<i>Iva xanthifolia</i>	6.7	-	-	-	-	-	0.1	-	-	-	-	-
<i>Veronica persica</i>	-	10.0	12.0	-	20.0	-	-	0.1	0.1	-	1.1	-
<i>Datura stramonium</i>	-	-	6.0	-	-	-	-	-	0.1	-	-	-
<i>Erigeron annuus</i> ssp. <i>annuus</i>	-	-	6.0	10.0	-	5.5	-	-	0.1	0.1	-	0.1
Total alien weeds (10 species)							40.6	14.4	29.1	39.7	14.5	8.1
<i>Echinochloa crus-galli</i>	70.0	100.0	80.0	50.0	6.7	10.0	8.7	26.7	11.1	2.2	0.1	0.2
<i>Convolvulus arvensis</i>	86.9	70.0	64.0	96.7	66.7	50.0	9.8	6.9	8.3	13.1	2.8	3.7
<i>Cirsium arvense</i>	80.0	40.0	80.0	66.7	56.7	50.0	7.5	3.9	8.3	7.3	13.2	10.3
<i>Setaria pumila</i>	53.3	100.0	80.0	86.9	6.7	15.0	4.4	17.6	12.5	11.6	0.4	1.5
<i>Sonchus arvensis</i>	53.3	10.0	28.0	23.3	6.7	-	5.7	0.3	1.2	2.0	0.4	-
<i>Setaria viridis</i>	30.0	40.0	60.0	66.7	-	10.0	1.5	5.9	6.1	3.0	-	0.1
<i>Chenopodium album</i>	33.3	70.0	62.0	50.0	20.0	30.0	3.7	5.2	5.3	4.0	1.7	2.9
<i>Phragmites australis</i>	20.0	20.0	28.0	26.7	43.3	50.0	1.2	2.7	4.0	2.1	16.3	7.7
<i>Hibiscus trionum</i>	30.0	50.0	22.0	66.7	-	-	2.6	3.7	1.3	5.0	-	-
<i>Matricaria perforata</i>	3.3	-	20.0	-	60.0	50.0	0.2	-	0.5	-	7.2	4.7
<i>Consolida regalis</i>	-	-	2.0	-	56.7	50.0	-	-	0.1	-	6.1	8.0
<i>Polygonum convolvulus</i>	3.3	40.0	20.0	10.0	66.7	60.0	0.1	2.6	1.2	1.2	7.1	8.3
<i>Lathyrus tuberosus</i>	3.3	-	20.0	26.7	46.7	60.0	0.1	-	1.2	1.2	2.9	5.8
Other native species							13.9	10.1	9.8	7.6	27.3	38.7
Total native weeds (97 species)							59.4	85.6	70.9	60.3	85.5	91.9



14.4% (beet), 14.5% (wheat) and 8.1% (barley) (table 1). Of the 11 alien weed species identified at the Ezăreni farm, the most important are the following:

***Amaranthus retroflexus*** is very common especially in row crops, the average number of ind./m<sup>2</sup> ranging from 0.1 (barley crops) and 34 (soybean crops); it ranks first place in crop infestation of sunflower, corn and soybean crops. It is a weed originating from North America (Ciocârlan, 2009), recognized as one of the most common and harmful weeds worldwide (Anghel et al., 1972, Weaver & Williams, 1980, Costea et al., 2004).

***Amaranthus powellii*** is less common than *A. retroflexus*, which is normally associated, infesting mainly soybean and sunflower crops, but also those of corn or barley, on the Ezăreni farm. It is native from North America, but it is now almost a cosmopolitan weed (Costea et al., 2004). In our country, it is a common weed, widespread from steppe zone, to sessile oak floor (Ciocârlan et al., 2004).

***Sorghum halepense*** is a weed booming in the in agricultural crops from the Moldavian Plain. It spreads both by seed and vegetatively through rhizomes, forming dense populations at the Ezăreni farm, both in row crops (mainly sunflower and soybean) and in cereals (wheat). It is a native species to Mediterranean regions, known in our country since the nineteenth century, and in Moldavia since the first half of the last century (Răvăruț, 1941). It is one of the most aggressive weed species in the world, causing serious losses in agricultural crops (Howard, 2004).

***Conyza canadensis*** forms dense, often monodominante communities on fallows or at the heads of agricultural plots, wherefrom they often extend in the crops. At the Ezăreni farm, it invades in a more important measure less successful wheat crops. It is a weed originating from North America (Ciocârlan, 2009), more ruderal, but with a very high capacity for reproduction and dispersion and a high tolerance to environmental factors, often invading the poorly maintained crops (Weaver, 2001).

***Xanthium orientale* ssp. *italicum*** is frequent (more than 50%) in row crops, being on second place in weed infestation of sunflower and soybean crops, on the Ezăreni farm, also heavily infesting corn crops. It often forms dense and monodominante clumps, completely stifling the crop plants. The number of individual / m<sup>2</sup> ranges from 0.1 (in beet crops) and 68 (in soybean crops). Currently, its invasive area includes actually the entire country, from steppe zone, to the sessile oak floor (Ciocârlan et al., 2004).

Another alien weed, currently with a lower degree of crops infestation at the Ezăreni farm, but with a clear trend of expansion, is ***Panicum miliaceum***. It forms dense populations, with high coverage, mainly at the heads of the plots. It is a Central Asian species (Ciocârlan, 2009), which was much cultivated in the past in our country. As a sub-spontaneous plant, it was first mentioned by Răvăruț (1941), from Mârzești (Iași County). It is one of the most drought-resistant plants (Emendack et al. 2005), reason why this species is expected to spread more and more in the future in agricultural crops from arid regions of Moldavia.

## CONCLUSIONS

1. The segetal flora of agricultural crops from Ezăreni (Iași County) includes a number of 107 species of vascular plants;
2. Although the alien plants represent only one tenth of the segetal flora, they contribute significantly to weeds infestation, especially in row crops;
3. *Amaranthus retroflexus*, *A. powellii*, *Xanthium orientale* ssp. *italicum*, *Sorghum halepense*, *Conyza canadensis* and *Panicum miliaceum* are the most important alien weeds in the studied crops.

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# POSSIBILITIES OF STIMULATING THE STUDENTS' CREATIVITY BY THE STUDY OF BIOLOGY

## POSSIBILITĂȚI DE STIMULARE A CREATIVITĂȚII ELEVILOR PRIN STUDIAREA BIOLOGIEI

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**Abstract.** Human creativity stands at the base of all the progress made by the humankind during the time, in all fields of knowledge and social life. In school, the creativity potential of students can be positively or negatively influenced, depending on the methods used by the teacher within the lesson. Avoidance of the excessive use of methods centered on stimulation of memory and opting instead for the use of some active-participative and interactive methods within the biology lessons, elaboration of some products (rebuses, materials with interdisciplinary character, etc.) by the independent work in class or at home, as well as the organization of out of school activities aiming at realization of some artistic and literary creations, of some student's exhibitions on various themes, realization of posters, collages, etc., represent possibilities of stimulating the students' creativity by the study of biology in gymnasium and high school. Our paper is aiming at presenting a full range of such possibilities.

**Key words:** students' creativity, biology lessons, didactical methods, creations

**Rezumat.** Creativitatea umană stă la baza tuturor progreselor realizate de omenire de-a lungul timpului, în toate domeniile cunoașterii și vieții sociale. În școală, potențialul creator al elevilor poate fi influențat pozitiv sau negativ, în funcție de metodele utilizate către profesor în lecție. Evitarea folosirii excesive a metodelor axate pe stimularea memoriei și optarea pentru utilizarea în lecțiile de biologie a unor metode activ-participative și interactive, elaborarea unor produse (rebusuri, materiale cu caracter interdisciplinar, etc.) prin munca independentă în clasă sau acasă, precum și organizarea unor activități extrașcolare ce vizează realizarea unor creații artistice și literare, a unor expoziții ale elevilor pe diferite teme, realizarea unor postere, afișe, colaje, etc. reprezintă posibilități de stimulare a creativității elevilor prin studierea biologiei la gimnaziu și liceu. În articol, se urmărește prezentarea unei game complete de astfel de posibilități.

**Cuvinte cheie:** creativitatea elevilor, lecții de biologie, metode didactice, creații

### INTRODUCTION

From the psychological perspective, creativity comes into four acceptations: 1) as a product; 2) as a process; 3) as a disponibility, human general potentiality; as a capability and creative ability; 4) as a complex dimension of personality (Zlate M., 2006). Is the ability to produce something new, original, valuable, scientifically efficient and socially-useful, which relies on previous data and solutions. It can

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manifest itself in all stages of age, during the human life and in all fields of knowledge and social life, thus talking about scientific, technical, economical, artistic, organizatory, pedagogical creativity (Bontaş I, 2001). Stimulation, education and exercising the school children creativity should be permanently in the teacher's attention. The teacher must to know the creative potential of each pupil and modalities for its stimulation, to seize the creative manifestations of the school children, to make them aware of their own capabilities and to develop their ability and habit of selfevaluation (Oprea C. L., 2009). Adequate attitude of the teacher towards the behavior specific to creative school children and the help given in order to pass over the different blockages of creativity have an important role in stimulating the school children to be original, inovative, creative.

Education of creativity involves the improvement of some intelectual abilities and features of personality to the school children, such as: 1) perceptive faculty; 2) ability to interpretate, redefine, reformulate; 3) ability to analyse and synthesize; 4) ability to perceive immediate links between the available data, to make associations and correlations; 5) ability to structure and restructure the ideational contents; 6) flexibility and fluidity of thinking; 7) operational psychic structures required to solve the problems into an unprecedented manner; 8) intra- and interdisciplinary conexions; 9) courage to have personal initiative and perseverance in pursuing the proposed aims; 10) epistemic curiosity, intrinsec motivation, interest, passions, attitudes (Albulescu I., 2008).

Taking into consideration the fact that teaching-learning the scientific content specific to different study matters can contribute to the development of school children creativity to a lesser or higher extent, we initiated a research aiming at emphasizing some possibilities for stimulating the school children creativity by the study of biology in gymnasium and high school. When carrying out this research we were aiming at the following objectives: 1) Identification and exemplification of the use of some didactic methods in order to stimulate the school children's creativity within the lessons of biology; 2) Identification of some products which can be created by the school children; 3) Pointing out some modalities of stimulation the school children's creativity within some extracurricular activities.

## **MATERIAL AND METHOD**

For emphasizing the biology teacher's possibility to stimulate the school children creativity, we have analysed the present content of Biology school manuals used in gymnasium and high school, and in the specialty literature, concerning the creativity. Thus, we have identified different possibilities of stimulating creativity of the school children, both with the ocassion of studying some biology themes, and within some extracurricular activities.

## **RESULTS AND DISCUSSIONS**

Within the lessons of biology, the teacher can stimule the school children creativity with the help of some didactic methods. One of these methods is the method of brainstorming. In applying this method, the issue of new ideas or finding the best

solution for a problem to be solved must be taken into consideration, for instance: How do you explain the present normal chromosome make up?, What consequences does have the mutations affecting the plant, animal and human genome?, How do you explain the great number of insects existing on the Earth?, What experiences can you realize in order to demonstrate the respiration of plants at light and respectively in darkness?, What implications would have cloning on the humans?, What implications have the use of modern technologies on the human life? etc. (Petruta G.P., 2010). This is applied more often in the high school and contribute to formation and development of school children imagination, of the scientific language, of some personality features (spontaneity, courage to express a point of view), of the interpersonal relations, by valorization of the each one's ideas (and, consequently, by understanding of the qualities of the peoples around), etc. A method of the type of brainstorming, which allows the approach in a limited time interval (6 minutes) of more aspects of a problem, is the "Phillips 6/6" method. Can be taken into consideration problems such as: What is the potato tubers, root, stem or fruit? (the theme "Potato", V<sup>th</sup> grade); Why the lake frog dies in certain environmental conditions – lack of water, or lack of air? (the theme "Lake frog", VI<sup>th</sup> grade). The use of this method in lessons contribute to the development of school children's ability to analyze and synthesize, of their ability to make associations and correlations between the knowledges acquired previously. A method similar to that of brainstorming is the method of brainwriting, or 6.3.5. As problems which can be given to the school children to solve, can be the following: What would happen if the bees disappears from the Terra? (the theme "Bees, bumble bees, wasps, ants", the VI<sup>th</sup> grade); Which would be the consequences of decomposers disappearance from a deciduous forest? (the theme "Forrest", VIII<sup>th</sup> grade).

Another method with which the school children discover solutions to certain problems, situation from the real life, is the method of case study. By using this method, the school children can analyze pollution of an aquatic or terrestrial ecosystem, natural or artificial, situated in the locality where the school is located, or close to this (the VIII<sup>th</sup> grade) and propose solutions for its removal.

The role-playing game is a method which can be used in order to emphasize the mode in which can be solved different problem-situations which the school children will be facing in the future. For instance, the consequences of getting married with a person who have a certain hereditary disease (sindactily, polydactily, color blindness, haemophilia, sickle cell disease etc.), in what concern the health of progeny (the theme "Normal and pathological human cariotype, IX<sup>th</sup> grade"). Another situation which can be simulated by the role-playing game is the existence of a child with blue or green eyes in a family in which both parents have black eyes (the theme "Genetic determinism of some normal and pathological traits in humans", XII<sup>th</sup> grade). Direct participation of the school children to the scenario design, interpretation of roles by the school children-actors (schoolgirl-mother, schoolboy-father, school children-parents in law and schoolchild-doctor), reflection and colective debate of the role-playing game, contribute to formation of attitudes, behaviors, adequate beliefs.

Another possibility of stimulating the school children creativity consist in asking them to elaborate new, original products. Thus, at school, if the teacher used rebus

within the lessons, as modality of verifying and fixing the school children's knowledges, or before passing to the new lesson, then, within some recapitulation lessons, the school children can be requested to elaborate by themselves a rebus. For instance, within the recapitulation lesson "Plant nutrition – vegetative organs" (V<sup>th</sup> grade), the school children can create, in groups, a rebus for the words "root", "stem" and "leaf", respectively. The school children will be requested to use own formulations for the concepts used in building the rebus.

At home, the school children can realize independently various works, which can contain elements of originality, own points of view: compositions poems, puzzles and essays (in gymnasium), papers and essays (in high school). The titles of essays can be selected from the manual, or can be proposed by either the teacher or school children, for instance, "Photosynthesis, the most impressive process in nature" (IX<sup>th</sup> grade) or "Chemical and physical processes involved in the proper functioning of analyzers of humans" (IX<sup>th</sup> grade). Literary and scientific creations realized by the school children can be presented within some scientific communication sessions organized in the school.

Within the extracurricular activities, organized on themes of environment protection during the entire school year, school children can realize and display numerous artistic creations. Thus, with the occasion of celebrating some special events, such as: "World Water Day", "Birds Day", "Earth Day", "International Biodiversity Day", "World Environment Day" etc., poster exhibitions, drawings, paintings, ecological posters, collages, pictures realized from spring or autumn pressed flowers and leaves, created by the school children, can be organized in the school. These can be realized within the biology circle or at home.

## CONCLUSIONS

1. The creativity of school children can be stimulated within the biology lessons by the use of certain didactic methods (brainstorming, "Phillips 6/6", brainwriting, case study, role-playing game).

2. Requesting the school children to elaborate different new, original products (scientific, literary, artistic creations), within the lessons and extracurricular activities, contribute to the development of their creative potential.

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# ASSESSMENT OF THE CARDENOLIDE CONTENTS IN SOME MEDICINAL PLANTS FROM MOLDOVIANS SPONTANEOUS FLORA

## EVALUAREA CONȚINUTULUI CARDENOLIDELOR ÎN UNELE PLANTE MEDICINALE DIN FLORA SPONTANĂ A MOLDOVEI

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**Abstract.** Research carried out the potential of Moldavian plant. The various contents of cardenolide compounds in different medicinal plants were established. Phylogenetic distribution of cardenolide area has been expanded.

**Key words.** cardenolide, filogenetic, medicinal plants.

**Rezumat.** Cercetările scot în evidență potențialul farmaceutic al unor specii de plante medicinale din flora spontană a R.Moldova. S-a studiat conținutul cardenolidelor în diferite specii de plante. A fost lărgită aria filogenetică de răspândire a cardenolidelor.

**Cuvinte cheie.** cardenolide, filogenie, plante medicinale.

### INTRODUCTION

Medicinal plants represent one of the most active essential bioactive substances from medicines which are the base of fitotherapy. The use in medicine of local plants, especially the one from spontaneous flora, represent a perspective direction which has great economic importance for Republic of Moldova, a such flora that contains an important diversity of species which can be use in control of diseases like cardiovascular disease, infections disease, oncologic etc.

Cardenolides are secondary metabolites, sterolic nature whit cardio toxic effects, known from antiquities (Ziskind et. al., 2004; Wade, 1986). They display a large set of action including excitability, contractibility and tonicity on the heart (Balthazart et. al., 2006; Losel et. al., 2003; Wehling et. al., 2006). They are used in heart failure in shape of pharmaceutical products and only under medical observation. Olso they perform cardiotonic and diuretic actions.

Recent studies showed their effect in cancer treatment (Prassas, Diamandis, 2008; Newman, Yang, 2008). According to scientific data (Luckner, Wich 2000) this type of substances are find in plants like: *Adonis vernalis*, *Convallaria majalis*, *Digitalis purpurea*, *Digitalis lanata*, *Erysimum* sp., *Euonymus europaeus*, *Nerium oleander*, *Periploca graeca*, *Strophanthus* sp., *Thevetia neriifolia*. Depending on associated glycosidic residue and the presence of some free radicals in different position there are a wide range of compounds that differ in structure and physiologic effect on human body

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Cardenolides have been found in approximately 60 genders of angiosperm angiosperms (Singh and Rastogi, 1970; Melero et al., 2000; Kreis and Müller-Uri, 2010). Until currently has been reported the presence of such compounds in order Poales, Asparagales, Liliales, Ranunculales, Crossosomatales, Myrtales, Celastrales, Malpighiales, Fabales, Rosales, Brassicales, Malvales, Gentianales, Lamiales, Solanales, Asterales. Roughly half of the investigated gender until today belongs to Gentianales. It seems that cardenolides have a greater prevalence in younger phylogenetic angiosperm. Barely recently, cardenolides have been reported in Asterales (Wang et al., 2007) and Crossosomatales (Klausmeyer et al., 2009). Consequently, these compounds can have a greater distribution than previously estimated.

## MATERIAL AND METHOD

Extraction of cardenolides had been made from dry plants whit 70% methanol from 50 mg of dry material. Hydrolyzed extract whit mixture of acetone and HCL (100:1) kept in dark for 12 hours have been run trough HPTLC chromatography on Kieselgel 60 F254 (10X10cm) glass plates, using methanol:chloroform: water (60:39:1) as mobile phase. Standards from Merck (RFG) have been used. Chromatograms have been visualized in UV (254nm) (fig.1.)



1. lanatosid C,
2. lanatosid B,
3. gitoxigenin,
4. lanatosid A,
5. mixture,
6. digoxin,
7. digitoxigenin,
8. digoxigenin,
9. acetildigoxin

Fig. 1 – HPTLC of cardenolide standard

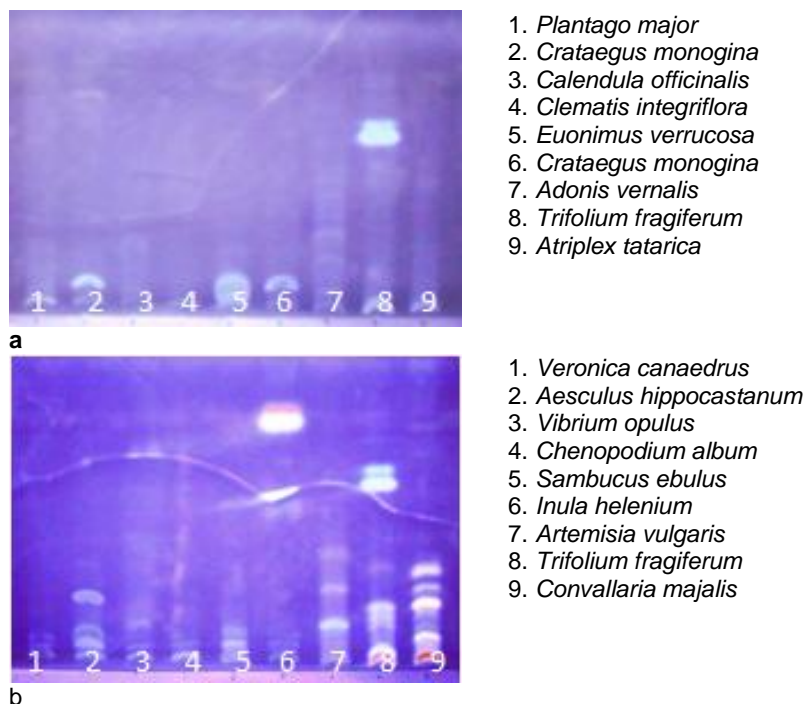
## RESULTS AND DISCUSSIONS

16 species of plants have been researched: *Adonis vernalis*, *Aesculus hippocastanum*, *Artemisia vulgaris*, *Atriplex tatarica*, *Calendula officinalis*, *Chenopodium album*, *Clematis integriflora*, *Convallaria majalis*, *Crataegus monogina*, *Euonymus verrucosa*, *Inula helenium*, *Plantago major*, *Sambucus ebulus*, *Trifolium fragiferum*, *Veronica canaedruss*, *Vibrium opulus*. On the exposed one it was interested to study the presence of cardenolides compounds in medicinal plants from Moldavia which belong to different taxonomic groups

After the end of investigation it has been assessed the presence of cardenolides in the following species of plants: *Crataegus monogina* (Rosaceae), *Euonymus verrucosa* (Celastraceae), *Trifolium fragiferum* (Fabaceae), *Aesculus hippocastanum* (Sapindaceae), *Sambucus ebulus* (Adoxaceae), *Inula helenium*



(Asteraceae), *Artemisia vulgaris* (Asteraceae), *Convallaria majalis* (Ruscaceae) (fig.2).



**Fig. 2** – HPTLC of cardenolide extract

## CONCLUSIONS

It has been detected the presence of cardenolides compound in eight species of plants from 16 species collected from Moldavia flora.

Cardenolides have been detected in medicinal plants from spontaneous flora of Moldavian Republic which belong to different taxonomic groups

Researching the filogenetic distribution on these secondary metabolites has been determined in Rosaceae, Fabaceae, Sapindaceae, Adoxaceae, Asteraceae, and Ruscaceae. This confirms in most part the data collected from literature.

The presence of this compound in, Adoxaceae and Ruscaceae extends the filogenetic area of spreading the cardenolides.

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# ECHOPHYSIOLOGICAL REACTION OF SOME VINE VARIETIES FROM IASI, TARGU BUJOR AND COTNARI IN WINTER 2010-2011 CONDITIONS

## CERCETĂRI PRIVIND REACȚIA ECOFIZIOLOGICĂ A UNOR SOIURI DE VIȚĂ DE VIE DIN PODGORIILE IAȘI, COTNARI ȘI TÂRGU BUJOR, ÎN PERIOADA DE REPAUS VEGETATIV

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**Abstract.** *The determinations made in this paper are part of a comprehensive study conducted on some vine varieties ( White Feteasca, Royal Feteasca, Italian Riesling, Grey Băbească, Francusa, Cotnari Grasa, Romanian Tamaioasa), vines grown in three regions of Moldova: Iași, Cotnari and Târgu Bujor. The research conducted in the climatic conditions of November 2010 - February 2011 enabled us to highlight, in the case of the studied varieties, aspects of tissue aging (wood maturation) - premise of resistance to negative temperatures in winter and bud viability. The maturation degree of the wood can be assessed by determining the water content of the shoots, which varies depending on variety and the wood / bone ratio. The water content of the cells is correlated with the amount of osmotic pressure - another indicator for maturation and assessing of the frost resistance - led by the carbohydrate content, free ions or amino acids, especially proline.*

**Key words:** vine varieties, frost resistance, starch, protein

**Rezumat.** *Determinările realizate în prezenta lucrare fac parte dintr-un studiu complex realizat asupra unor soiuri de viță de vie (Fetească albă, Fetească regală, Riesling italian, Băbească gri, Frâncușă, Grasă de Cotnari, Tămâioasă românească) cultivate în trei zone viticole ale Moldovei: Iași, Cotnari și Târgu Bujor. Cercetările efectuate în condițiile climatice ale lunilor noiembrie 2010 - februarie 2011, ne-au permis să evidențiem la soiurilor luate în studiu, aspecte referitoare la maturarea țesuturilor (maturarea lemnului) - premiză a rezistenței la temperaturile negative din timpul iernii, precum și viabilitatea mugurilor. Gradului de maturare a lemnului poate fi apreciat și prin determinarea conținutului de apă al lăstarilor, care variază în funcție de soi și de raportul lemn/măduvă. Conținutul de apă al celulelor este corelată cu valoarea presiunii osmotice - un alt indicator al gradului de maturare și de apreciere a rezistenței la îngheț - determinat de conținutul în glucide, ioni liberi sau aminoacizi liberi, în special prolina.*

**Cuvinte cheie:** ecofiziologie, viță de vie, rezistență ger, amidon, proteine

## INTRODUCTION

In order to establish the areas where grapevine can be cultivated on the one side and the appropriate wine assortments on the other side, an important element

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that must be bared in mind is represented by the ecologic characteristics of the areas. The pedoclimatic conditions influence the length of the vegetation period (precociousity), conditions the quantity and the quality of crops, offering originality to the grapes and the wines resulted in a specific area (Jitareanu Carmen-Doina, 2007).

The capacity to resist to negative temperatures is obtained over a long and complex process that starts before the first frost; it is related to the accumulation of the reducing glucides, the amidines' hydrolysis, the modification of the tissues' resistance to dehydration and their capacity to regenerate (Howell, G.S. 2003).

The grapevine's capacity to adjust and its strength to resist to low temperatures is related to a series of physiological and biochemical changes that are influenced by the accumulation and the dynamic of some chemical compounds that protect the cellular protoplasm from the irreversible coagulation of proteins, that is caused by the mechanical and destructive action of intracellular freezing (Burzo, 1999; Fennell Anne, 2004).

Starting with the second part of October, the enzymatic hydrolysis process of amidines intensifies, leading to the growth of the content of soluble glucides, growth that is related to the decrease of the frost temperature. In December and January, the content of soluble glucides reaches its maximum (10-12% s.u.), period in which there are also recorded the lowest temperatures. In February – March, the concentration level of glucides decreases as they take part at the respiratory process (the respiratory process intensifies in this period).

## **MATERIAL AND METHOD**

**Determining the vine buds viability** was used to the sectioning method.

Each bud is sectioned with a blade or a very sharp knife, starting from the base of the tendril towards its top (Rotaru Liliana, Petrea Gabriela, 2006).

**Wood maturation.** To determine the starch presence in the annual branches it was used the color reaction/test with the help of the Lugol reactive, I in KI. The branches were sectioned with the microtome and the materials were analyzed at the microscope.

**Water content and its forms: free water – bound water.**

The tendrils for fruit production, recently harvested and were stored into a drying stove, up to a constant weight to a temperature of 40°C to determine the content of free water and at 105°C for the total content of water.

**Determining the quantity of nitrogen and calculating the amount of raw protein** from the grapevine's tendrils in December 2010 – was performed after a standard identical to the International Standard Project ISO 5983:1992, which replaces STAS 9597/3-74.

## **RESULTS AND DISCUSSIONS**

**Determining the grapevine buds viability**

The bud's viability was appreciated according to the color of the tissues. If the entire group of buds that form the winter bud was green, color characteristic to living tissues, the bud was considered to be viable. The bud was considered non-

viable and lost if the tissues of the main bud were grey – black, color characteristic to dead tissues. (fig. 1 a and b).



**Fig. 1** - Image at the Binocular magnifier of the grapevine bud complex

After analyzing the buds from the grapevines species included in this study, in the conditions of the winter of 2010 – 2011, it was noticed that the “White Feteasca” variety had a high percent of viable buds in all the three vineyards. (82-100%), and it was followed by “Italian Riesling”, “Frâncușa” and “Royal Feteasca”, the lowest potential fertility being present at the “Grey Babeasca” variety (58-60%) (fig. 2).

A distinct case is represented by the variety “Grasa de Cotnari” that in the winter of 2010-2011 presented a high percent of viable buds in the Cotnari vineyard (94%) but a very low percent (38%) in Iași.

Referring to the areas from where the analyzed species come from, the Cotnari vineyard results to be very favorable since both “White Feteasca” and “Romanian Tămâioasă” presented 100% viable buds, potentially fertile. Thee other two species included in the study have high percentage of potentially fertile buds.

### **Wood maturation – the amount of starch in the grapevine shoots**

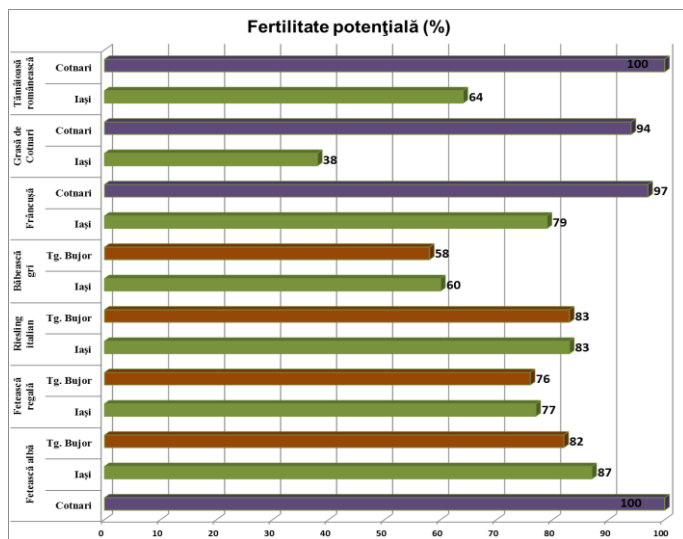
Starch accumulates mainly in the inner layers of the xylem, the starch level starts decreasing in autumn and continues until January; this period is followed by growth with a spring maximum. The moment temperature decreases, the starch level diminishes because of hydrolysis and the glucides level grows correspondingly (fig. 3).

Observing the starch level in the shoots during dormancy, it was noticed that all grapevines varieties presented lower quantities of starch in February 2011. The differences were due to temperature values and to the metabolic characteristics of the species.

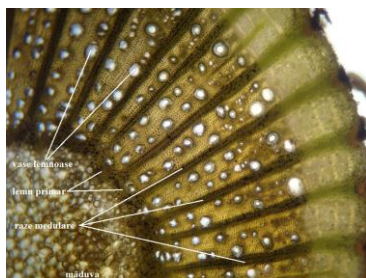
### **Water content and its forms: free water – bound water**

One clue regarding the grapevines’ resistance to frosty weather is offered by the proportion of the two types of water that exists in the shoots, free water – bound water, the superior values of this relation indicating the grapevine’s sensibility to low negative temperatures.

In November, free water – bound water report presented values that were superior in the middle parts of the shoots, comparatively with the basal internodes that are generally more resistant to frost.

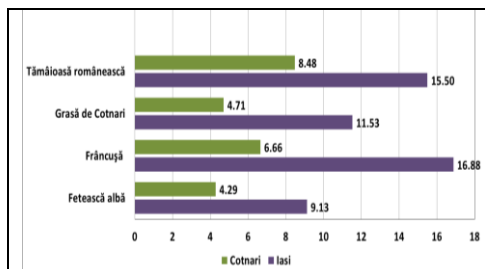


**Fig. 2** - Bud losses at the species included in the study, in the winter of 2010-2011

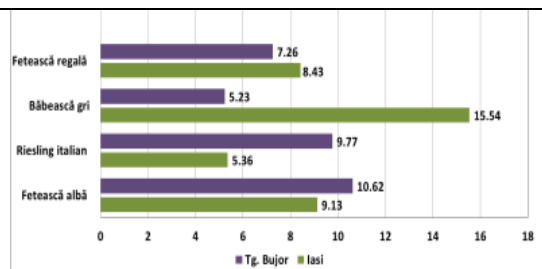


**Fig. 3** – Starch distribution in grapevine shoots

The lowest values of this parameter were recorded at the grapevine species cultivated at Cotnari, demonstrating that these species adapted better to the difficult conditions of winter than the species cultivated in Iași. This fact was also confirmed by the analysis of the viability of the fruit buds that reached values of 100% (fig. 4).

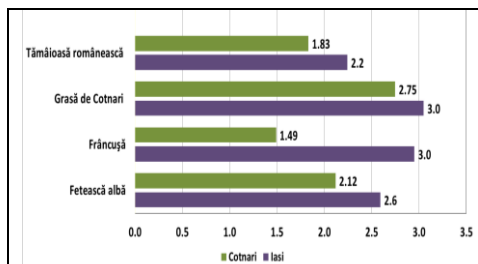


**Fig. 4** - The effect of pedoclimatic conditions on the free water – bound water report in November, in the shoots of the grapevine species cultivated in the vineyards from Iași and Cotnari

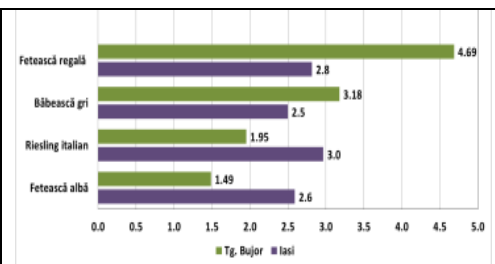


**Fig. 5** - The effect of pedoclimatic conditions on the free water – bound water report in November, in the shoots of the grapevine species cultivated in the vineyards from Iași and Târgu Bujor

In the case of the species cultivated at Târgu Bujor, just like in the case of those cultivated at Cotnari, the free water – bound water report is lower if we compare it with that from Iași, and this shows that they are more resistant to freezing (fig. 5). The free water – bound water report showed in November values between 16.88% - 26.43 % at the “Frâncușă” variety that was cultivated in Iași and the lowest values at “White Feteasca” from Cotnari vineyard.



**Fig. 6** - The effect of pedoclimatic conditions on the free water – bound water report in February, in the tendrils of the grapevine species cultivated in the vineyards from Iași and Cotnari



**Fig. 7** - The effect of pedoclimatic conditions on the free water – bound water report in February, in the tendrils of the grapevine species cultivated in the vineyards from Iași and Târgu Bujor

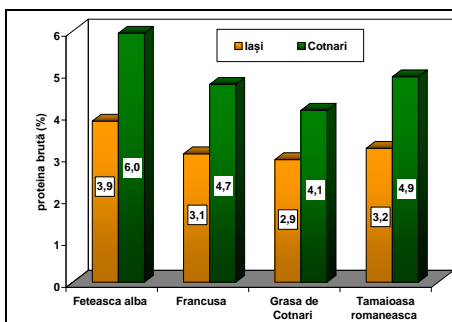
In February, after the annealing process, after the shoots got through the period with negative temperatures it can be seen a decrease of the total amount of water at all the species included in the study (fig. 6).

All species presented lower values at the free water – bound water report comparatively to those from November and this proves that they have moved on to the 3rd phase of the annealing process that consists in cell dehydration, the transfer of free water to the intracellular areas and water loss during transpiration (fig. 6 and 7).

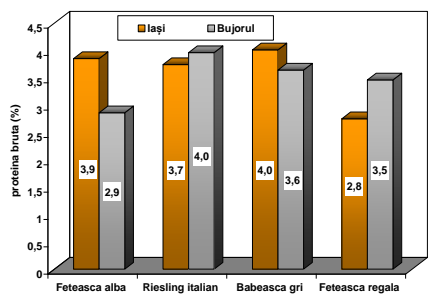
### **The total protein content from the grapevine tendrils in December 2010**

After determining the total protein level at the species included in the study, the results of the analysis show that in the shoots, the grapevine species from the vineyard situated in Iași, the raw protein level varies from 2,9% at “Grasa de Cotnari” to 3,9% at “White Feteasca” (fig. 8). Comparing the grapevines cultivated in Iași to those cultivated at Cotnari resulted that the latter one stored more raw protein than the first one, the values varying from 4,1% at “Grasa” and 6,0% at “White Feteasca”. Since the concentration level was higher, this contributed to improving the buds capacity to resist to cold and these species had practically no bud losses during winter.

Analyzing the species cultivated at Târgu Bujor and comparing them to those cultivated in Iași results that only between two species - “Royal Feteasca” and “White Feteasca” – there are significant differences as far as the total amount of protein is concerned. These differences are positive in the case of “Royal Feteasca” where the values varied from 3.5% at Târgu Bujor and 2.8% at Iași and negative for “White Feteasca” with values of 3.9% in Iași and 2.9% at Târgu Bujor. For the “Italian Riesling” and “Grey Babeasca” there were not significant differences from one vineyard to the other (fig. 9).



**Fig. 8 -** Raw protein concentration level in the tendrils from the grapeyards in Iași and Cotnari



**Fig. 9 -** Raw protein concentration level in the tendrils from the grapeyards in Iași and Târgu Bujor

## CONCLUSIONS

1. After analyzing the buds from the grapevines species included in this study, in the conditions of the winter of 2010 – 2011, it was noticed that the “White Feteasca” variety had a high percent of viable buds in all the three vineyards. (82-100%). Referring to the areas from where the analyzed species come from, the Cotnari vineyard presents itself as a very favorable one for both species.

2. The species cultivated at Cotnari presented the lowest values of report free water – bound water, if we compare them to those cultivated in Iași; this proves that the species cultivated at Cotnari adjusted better to the inauspicious winter conditions, fact that was also confirmed by the analysis of viability of the fruit buds that presented values of 100%. In February, after annealing and after the shoots got over the negative temperatures it can be seen a decrease of the total amount of water for all the species included in the study.

3. The results for determining the total quantity of protein for the species included in the study from the three vineyards mentioned, point out that the grapevines cultivated at Cotnari presented more raw protein, the higher concentration influencing the buds capacity to face the cold and these species did not present bud losses during winter.

**Acknowledgments.** This study was realised and published within the research project POSCCE-A2-O2.1.2-2009-2 ID.653, code SMIS-CSNR 12596.

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# PRELIMINARY STUDIES CONCERNING THE AMINOACIDS INFLUENCE ON SOME DEHYDROGENASES AT *MONILINIA LAXA* (ADERH. & RUHL.) HONEY PARASITE ON PLUM TREE

## STUDII PRELIMINARE PRIVIND INFLUENȚA UNOR AMINOACIZI ASUPRA UNOR DEHIDROGENAZE LA SPECIA *MONILINIA LAXA* (ADERH. & RUHL.) HONEY PARAZITĂ PE PRUN

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**Abstract.** This study aimed the evaluation of the activity of some dehydrogenases from the Krebs cycle, as the principal energy supplier that assures the fabrication of mediators and products so that they may maintain the equilibrium between cells and to avoid the uneconomic supraproduction of metabolites and, respective, of glucose-6-phosphate dehydrogenase, ubiquitous enzyme that catalysis the conversion of glucose-6-phosphate in glucono-lactone-6-phosphate with NADP<sup>+</sup>. The experiments were made using cultures of *Monilinia laxa* (Aderh.&Ruhl.) Honey on mediums supplemented with different types of aminoacids. The enzymes activity was determinated using the spectrophotometric method of Sisoiev and Krasna (modified by Artenie) and some semnificative differences were recorded, variations influenced by the age of the culture and the aminoacid type used in working samples, compared with the control sample.

**Key words:** dehydrogenases, amino acids, *Monilinia laxa*

**Rezumat.** Studiul de față a urmărit evaluarea activității unor dehidrogenaze ale ciclului Krebs, ca principal furnizor de energie ce asigură producerea de intermediari si produși astfel încât sa mențină starea de echilibru a celulelor si pentru a evita supraproducția neeconomică de metaboliți și, respectiv, a glucozo-6-fosfat dehidrogenazei, enzimă ubicuitară ce catalizează conversia glucozo-6-fosfatului în glucono-lacton-6-fosfat în prezența NADP<sup>+</sup>. Experimentele s-au derulat în condițiile cultivării fungului *Monilinia laxa* (Aderh. & Ruhl.) Honey pe medii suplimentate cu diferite surse de aminoacizi. Activitatea enzimelor, urmărită în dinamică, a fost determinată prin metoda spectrofotometrică Sisoiev și Krasna (modificată de Artenie), fiind constatate diferențe semnificative în funcție de vârsta culturii și de tipul aminoacidului la variantele de lucru în comparație cu martorul.

**Cuvinte cheie:** dehidrogenaze, aminoacizi, *Monilinia laxa*

## INTRODUCTION

Ubiquitous organisms, the fungi, have developed along time various nutritional strategies which allowed them to adapt in all conditions of the environment and this, due to the genetic background of the fungal cell which enabled the expression a phenotype that allows use of any organic compounds or inorganic nitrogen from the living environment. Data from literature indicates, however, that the mixtures of

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amino acids generally allows a greater and more rapid growth than a single amino acid (Griffin, D.H., 1996), but the basis for this phenomenon are unknown. Some fungi cannot use the inorganic nitrogen sources, requiring glutamate, asparagine and other amino acids for growth and development (Griffin, D.H., 1996).

The tricarboxylic acid cycle is the central point of the metabolism-related to processes that are not part of energy production. One of its enzymes ( $\alpha$ -ketoglutarate-dehydrogenase) is a gateway to one of these processes, allowing entry of amino acids in the Krebs cycle, with energy production. Sometimes, the amino acids entering in the structure of some enzymes of the citric acid cycle, as is the case of the isocitrat-dehydrogenase which has in the active site some amino acids like tyrosine, arginine, serine, threonine, aspartic acid (Tadhg, D.B., McMurry, J., 2005; Cox, M. *et al.*, 2005). Some enzymes involved in Krebs cycle occur on some intermediary products resulting from the conversion of carbon chains and of some amino acids to further decomposition: i.e. - malate dehydrogenase attacks the oxaloacetate resulted from the conversion of aspartate and asparagine, the succinate dehydrogenase attacks the fumarate derived from tyrosine, phenylalanine and asparatate (McNurry, J., Begley, T.P., 2005, Storey, K.B., 2004) and the  $\alpha$ -cetoglutarat is a precursor in the biosynthesis of other amino acids (so-called glutamate family, represented by proline, glutamine, arginine and histidine (Grow, N.A.R, Gadd, G.M., 1995, Griffin, D.H., 1996, Owen, O.E., 2002, Brody, T., 1999).

Going on the line of other researches (Manoliu, Al. *et al.*, 2003, 2004, 2007), this study concentrates on the analysis of the influence that some amino acids have on the activity of some dehydrogenase as glucose-6-phosphate dehydrogenase,  $\alpha$ -ketoglutarate-dehydrogenase and malate dehydrogenase from *Monilinia laxa* (Aderh. & Ruhl.) Honey fungus, an ascomycetous fungus responsible for the appearance of brown rot on some stones fruits belonging to the *Prunus* genus.

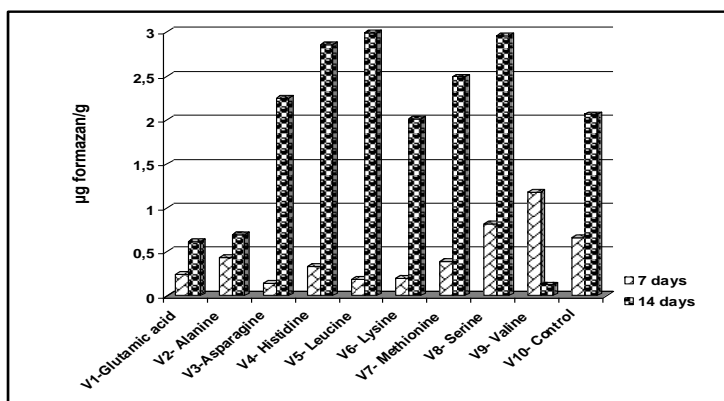
## MATERIAL AND METHOD

The microbial strain used in this study, represented by the *Monilinia laxa* (Aderh.&Ruhl.) Honey fungus has been isolated from the mummified fruits collected from varieties of the *Prunus domestica* from Experimental Orchard for Pomiculture Research Station, Miroslava, Iasi County. The "in vitro" cultivation of the fungus involved the use of acidified streptomycin 2% malt medium (Constantinescu, O., 1974; Malvarez *et al.*, 2001) formula's without agar, distributed in Erlenmeyer flasks, over which were added 0,125 mg each of the amino acids: glutamic acid, alanine, asparagine, histidine, leucine, lysine, methionine, serine, valine. We used a control sample, devoid of amino acids. The ten culture medium were seeded with disk cut-out from a culture of *Monilinia laxa* (Aderh.&Ruhl.) Honey aged 7 days and incubated under alternating light - dark conditions and variable temperature. The experimental measurements performed at 7days and respectively 14 days, were made from the mycelium of the fungus, for each treatment in part three parallel determinations were performed, and the enzymes activity, followed as dynamics, was determined using the Sîsoev and Kasna spectrophotometric method (Cojocaru, D.C., 2009).

## RESULTS AND DISCUSSIONS

The graphical representation of the statistically processed results of the dehydrogenases activity in *Monilinia laxa* (Aderh. & Ruhl.) Honey specie's mycelium shows at a rigorous analysis that the glucose-6-phosphate dehydrogenase, the  $\alpha$ -ketoglutarate-dehydrogenase respectively, malate - dehydrogenase activity was different, being influenced by culture age of mycelia and the type of amino acid that has been added to the culture medium.

The activity of glucose-6-phosphate dehydrogenase is shown graphically in figure 1, where it can be seen that at 7 days after inoculation of the culture, the value of the enzyme activity in control sample was 0.6600  $\mu\text{g}$  formazan/g, while the peak of enzyme activity in the mycelium at this time was detected for V9 variant - 1.1778  $\mu\text{g}$  formazan/g and the minimum point of the enzyme activity was found in V3 (asparagine) - 0.1439  $\mu\text{g}$  formazan/g. Between the two limits of activity, we found in descending order: V8 variant (serine) - 0.8164  $\mu\text{g}$  formazan/g, V2 variant (alanine) - 0.4385  $\mu\text{g}$  formazan/g, variant V7 (methionine) -  $\mu\text{g}$  formazan/g, variant V4 (histidine) - 0.3306  $\mu\text{g}$  formazan/g, V1 (glutamic acid) - 0.2397  $\mu\text{g}$  formazan/g, V6 (lysine) - 0.1941  $\mu\text{g}$  formazan/g. respectively, V5 (leucine) - 0.1890  $\mu\text{g}$  formazan/g.



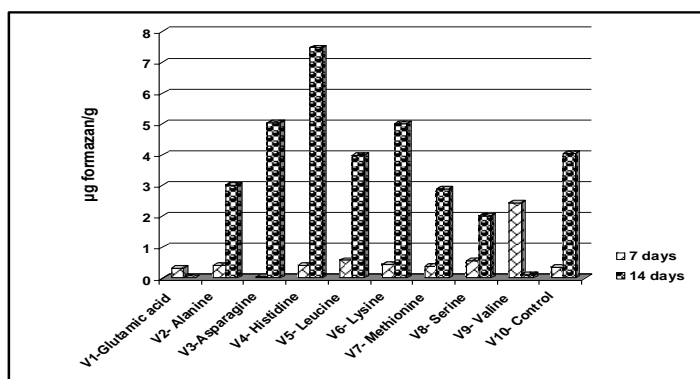
**Fig. 1** - The glucose-6-phosphat- dehydrogenase activity in *Monilinia laxa* (Aderh.&Ruhl.) Honey specie's cultivated on medium with different amino acids

In the parallel series of tests conducted at 14 days, the value of the activity of glucose-6-phosphate dehydrogenase in the mycelium, in the control sample was 2.063  $\mu\text{g}$  formazan/g. Valine inhibited the enzyme activity, which reached the lower limit at this time - 0.1257  $\mu\text{g}$  formazan/g. Reporting to the value that had a control variant, the strongest activity of glucose-6-phosphate dehydrogenase was intensified by leucine - 2.9937  $\mu\text{g}$  formazan/g, followed by serine - 2.9596  $\mu\text{g}$  formazan/g, histidine - 2.8611  $\mu\text{g}$  formazan/g, methionine - 2.4907  $\mu\text{g}$  formazan/g, asparagine - 2.2475  $\mu\text{g}$  formazan/g. As for the test where we administered lysine we observed that it inhibited the activity of glucose-6-phosphate dehydrogenase compared to control value - 2.0150  $\mu\text{g}$  formazan/g,

followed by alanine and glutamic acid (0.6934  $\mu\text{g}$  formazan/g, respectively 0.6135  $\mu\text{g}$  formazan/g).

Critical analyzing the evolution of the glucose-6-phosphate dehydrogenase, it can be seen that it increased in all medium variants, except V9 variant in which the enzyme activity decreased between the two series of tests, ranging from 1.778  $\mu\text{g}$  formazan/g. to 0.1257  $\mu\text{g}$  formazan/g.

Data on the evolution of the  $\alpha$ -ketoglutarate dehydrogenase activity in *Monilinia laxa* (Aderh. & Ruhl.) Honey specie's cultivated on medium enriched with various amino acids are shown in Figure 2. Diagram analysis shows that for the first time measurements of the enzyme activity in the mycelium, the value the control sample was 0.3421  $\mu\text{g}$  formazan/g. The peak of  $\alpha$ -ketoglutarate-dehydrogenase activity at 7 days after inoculation was found in variant V9 - 2.4442  $\mu\text{g}$  formazan/g and the smallest value of this enzyme activity was noted in version V3 - 0.0318  $\mu\text{g}$  formazan/g, at the rest of the medium variants ranged from relatively uniform activity values, as follows: leucine - 0.5723  $\mu\text{g}$  formazan/g, serine - 0.5685, alanine - 0.4187  $\mu\text{g}$  formazan/g, histidine - version V4 - 0.4045  $\mu\text{g}$  formazan/g, methionine - 0.3915  $\mu\text{g}$  formazan/g, glutamic acid - 0.3286  $\mu\text{g}$  formazan/g.



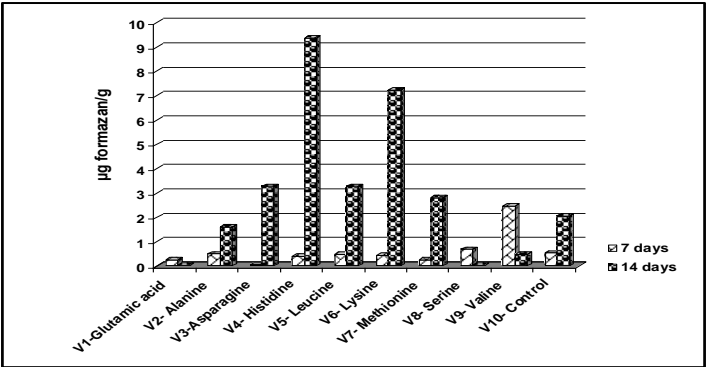
**Fig. 2** - The  $\alpha$ -ketoglutarate dehydrogenase activity in *Monilinia laxa* (Aderh. & Ruhl.) Honey specie's cultivated on the medium with different amino acids

By measuring  $\alpha$ -ketoglutarate-dehydrogenase in *Monilinia laxa* specie's mycelium after 14 days of incubation we noted that the enzyme shown in the control variant, an average activity of 4.0554  $\mu\text{g}$  formazan/g., while histidine, asparagine and lysine have stimulated a greater or lesser extent of their activity (7.4823  $\mu\text{g}$  formazan/g.- V4; 5.0549  $\mu\text{g}$  formazan/g - V3; 5.0074  $\mu\text{g}$  formazan/g. - V6). In this case it is shown a strong inhibitory effect of  $\alpha$ -ketoglutarate-dehydrogenase activity, the most notable effect being detected in glutamic acid case - 0.0256  $\mu\text{g}$  formazan/g. The same inhibitory effect were, in descending order, leucine (3.9912  $\mu\text{g}$  formazan/g), alanine (3.0087  $\mu\text{g}$  formazan/g), methionine (2.8902  $\mu\text{g}$  formazan/g), serine (2.0224  $\mu\text{g}$  formazan/g) and valine (0.1117  $\mu\text{g}$  formazan/g). Studying the dynamics of  $\alpha$ -ketoglutarate-dehydrogenase activity in time, it appears that between the two series of determination the

enzyme activity in the mycelium has escalated to all medium variants, except the V9 variant where it decreased from 2.4442 µg formazan/g to 0.1117 µg formazan/g and variant V1, where it decreased from 0.3286 µg formazan/g to 0.0265 µg formazan/g.

The malate dehydrogenase activity chart from *Monilinia laxa* specie's cultivated on medium supplemented with various amino acids indicates at the control sample at 7 days after inoculation, an endoenzyme activity with a value of 0.5285 µg formazan/g. The minimum point of it's activity was recorded in the medium variant containing asparagine - 0.0467 µg formazan/g and the maximum activity was recorded in the medium variant supplemented with valine - 2.4536 µg formazan/g, a change in its values was ound in the rest of the medium variants supplemented with different amino acids, as follows: serine - 0.6828 µg formazan/g, leucine - 0.4667 µg formazan/g, lysine - 0.4311 µg formazan/g, histidine – 0.3870 µg formazan/g, glutamic acid - 0.2594 µg formazan/g.

In this case also was determined the enzyme activity at 14 days after inoculation. Experimental results have shown, for the control sample, that the malate-dehydrogenase activity in the mycelium of the *Monilinia laxa* fungus what reached for 2.0637 µg formazan/g. The maximal limit of the enzyme activity was recorded in the V4 variant - 9.3863 µg formazan/g and the minimum was noted in V1 variant (glutamic acid) - 0.0246 µg formazan/g. Amplification of the enzyme activity was found in the mycelium when the medium variant is supplemented with lysine (7.2475 µg formazan/g), asparagine (3.2755 µg formazan/g), leucine (3.2718 µg formazan/g), methionine (2.8231 µg formazan/g) and the reduced values at the time, for malate - dehydrogenase activity compared with the control sample, were recorded in mediums supplemented with alanine (1.5922 µg formazan/g), valine (0.4785 µg formazan/g) and serine - 0.0290 µg formazan/g.



**Fig. 3 -** The malate-dehydrogenase activity in *Monilinia laxa* (Aderh.&Ruhl.)Honey specie's cultivated on the medium with different amino acids

The dynamic's analysis of the malate-dehydrogenase activity in the two time intervals show that in all medium variants the enzyme activity in the mycelium increased in time, except V8 variant (serine), whose activity decreased from 0.6828 µg formazan/g. to 0.0290 µg formazan/g and V9 variant (valine) which declined from 2.4536 µg formazan/g to 0.4785 µg formazan/g, V8 (serine) - 0.0290 µg formazan/g to

0.0246 µg formazan/g. and V1 (glutamic acid) from 0.2594 µg formazan/g to 0.0246 µg formazan/g.

## CONCLUSIONS

The amino acids used have had an important influence on the enzymes studied, the activity of the three studied dehydrogenase was stimulated differently, depending on one hand by the type of amino acid that had been added into the culture medium, and on the other hand by the age of the culture.

At 7 days after inoculation, the activity of glucose-6-phosphate dehydrogenase was stimulates eith valine and serine, the  $\alpha$ -ketoglutarate-dehydrogenase activity with valine, methionine, leucine and alanine and malate-dehydrogenase activity with valine and serine.

After 14 days of incubation, the activity of glucose-6-phosphate dehydrogenase was stimulated by serine, methionine, lysine, leucine, histidine, asparagines, the activity of  $\alpha$ -ketoglutarate-dehydrogenase by histidine, lysine and asparagine and the malate-dehydrogenase activity by methionine, lysine, leucine, histidine, alanine.

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# EVALUATION OF THE ANTITOXIC POTENTIAL OF SOME QUERCETOL CONTAINING VEGETAL PRODUCTS

## TESTAREA ACȚIUNII ANTITOXICE A UNOR PRODUSE VEGETALE BOGATE ÎN QUERCETOL

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**Abstract.** Acrylamide, chemical compound with a structure containing two unsaturated centers, represents the result of thermally processed foods rich in amino acids and reducing sugars. By the means of glycidamide, its epoxidic metabolite, acrylamide exerts toxic effects as neurotoxicity, carcinogenicity, embryotoxicity, and reproductive toxicity. The present experiment aims to establish a way of diminishing the toxic effects of acrylamide by the means of a flavone derivative. Quercetol, a flavonol remarkable by its antiradicalic effect, is found in high concentrations in fruits and vegetables as cabbage, parsley, onion, soy, blueberries. This flavone derivative exerts its antiradicalic potential in synergy with glutathione, ascorbic acid (vitamin C) and vitamin E, with which it forms efficient redox systems. The experiment related in this paper analyses the antioxidative potential of quercetol from a phytopreparation obtained from the fruits of *Vaccinium myrtillus*. The evaluation of the antiradicalic activity of quercetol was established by the means of biochemical parameters that give indications upon the oxidative stress. The results are positive, confirming the antioxidant potential of the phytopreparation obtained from *Vaccinium myrtillus*.

**Key words:** acrylamide, quercetol, *Myrtilli fructus*, catalase (CAT)

**Rezumat.** Acrilamida, un compus chimic ce posedă două centre de nesaturare în mica sa structură, reprezintă produsul prelucrării termice a alimentelor bogate în aminoacizi. Prin metabolitul său epoxidic, glicidamida, amida acidului acrilic exercită efecte dintre cele mai toxice: neurotoxicitate, carcinogenicitate, embriotoxicitate și efecte toxice asupra reproducerii. Experimentul prezent încearcă să diminueze efectele toxice ale acrilamidei prin intermediul unui derivat flavonic. Cvercetolul, un flavonol ce se remarcă printr-o puternică acțiune antiradicalară, se găsește în concentrații semnificative în legume și fructe (varză, pătrunjel, ceapă, soia, afine etc). Acest derivat flavonic își manifestă potențialul antiradicalar sinergic cu glutatiunea, acidul ascorbic (vitamina C) și vitamina E cu care formează sisteme redox eficiente. Experimentul relatat în această lucrare monitorizează potențialul antioxidant al cvercetolului dintr-un fitopreparat obținut din fructele de *Vaccinium myrtillus*. Evaluarea care a condus la evidente rezultate pozitive s-a efectuat prin intermediul unor parametri biochimici cu valoare de indicatori ai stresului oxidativ.

**Cuvinte-cheie:** acrilamidă, cvercetol, *Myrtilli fructus*, acid ascorbic (AA), catalază (CAT)

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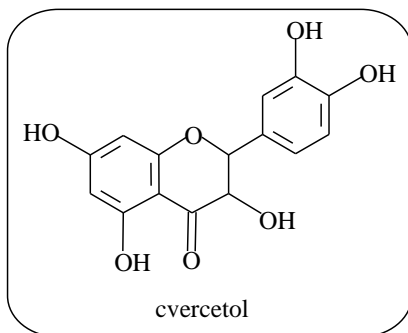
## INTRODUCTION

Acrylamide, compound with well-known multiple uses, is one of the most studied toxic substances at the beginning of the third milenium. Although many of its toxic effects had been known for a long time, acrylamide drew the attention of the medical world after high levels had been found in different food cathegories (Mottram, D. S, Wedzicha, B. L., Dodson, A. T., 2002;).

The present scientific knowledge reveals the fact that acrylamide is the result of thermal processing of foods that contain amino acids and reducing sugars. The main generating source appears to be the Maillard reaction (Chuda, Y. et al., 2003). The researches regarding the toxicological profile of this substance emphasize its neurotoxicity, carcinogenicity, embriotoxicity etc. (Fennel, T. R., et al., 2003; Sumner, S. et al, 2003).

The high incidence of acrylamide in foods correlated with its toxic aggresiveness imposes the necessity of finding ways of reducing its toxicity and of preventing/limiting its formation in thermally processed foods. As acrylamide reveals its toxicity by the means of its epoxidic radical, a direction of research would be the decrease of its toxicity by the activity of vegetal antioxidants. Quercetol is a flavonol (fig. 1), that exerts antiradicalic activity by inhibiting the oxidation of some compounds from the membrane of erythrocytes and thrombocytes and also by inhibiting the synthesis of some pro-inflammatory prostaglandins and leukotrienes. Its antioxidant potential is emphasized by the presence of glutathione, vitamin C and vitamin E, with which it forms redox systems, with important role in oxidative stress. Furthermore, quercetol possesses the property of regenerating the tocopherols oxidated consequently to the attack of reactive oxygen species (ROS).

The source of quercetol is offered by vegetals as onion, parsley, cabbage etc. The concentration of 80 mg/Kg quercetol in the fruits of bilberry (*Myrtilli fructus*) represents an argument for the use of phytopreparations obtained from this vegetal product as antiradicalic weapon in the oxidative stress produced by the epoxidic metabolite of acrylamide.



**Fig. 1** - Structure of quercetol



## MATERIAL AND METHOD

The experimental model (table 1) was conceived so as to emphasize the possible antiradicalic activity of quercetol from the fruits of *Vaccinium myrtillus*. The present experiment is part of a vast research that aims to find ways of reducing the toxicity of some alimentary noxes (mycotoxins, benzopyrenes, acrylamide, nitrites, nitrosamines, pesticides etc.) (Burlacu et al., 2007, Prisacaru C. et al., 2008, Prisacaru C. et al., 2009, Prisacaru C., 2010).

The experiment comprises 4 groups of 5 Wistar rats each, having a mean weight of 195.2 g. The first group (the reference group) was maintained and fed in standard conditions. The second group represents the control group for the acrylamide intoxication and offers information regarding the amplexness of the oxidative stress provoked by the ingestion of an oral soutuion of acrylamide, in doses of 20 µg/Kg bw. The animals of the third group received, along with the acrylamide dose, an hydroalcoholic extract of *Myrtilli fructus* (XV drops per day). The biochemical results obtained from this group of animals test the antioxidant activity of quercetol and other active principles with antiradicalic effect from *Vaccinium myrtillus*. Due to the fact that the antioxidant effect of quercetol is increased by the presence of ascorbic acid along with which it forms an efficient redox system, the role of this redox system has been evaluated by the means of ascorbic acid intake. In this direction, the animals of the fourth group received, along with the protection of bilberry extract, XV drops of ascorbic acid, 5% aqueous solution.

The experiment was unfolded on a period of 6 weeks. In the end, blood samples were collected in order to evaluate the biochemical parameters relevant for the oxidative stress: catalase (CAT), superoxid dismutase (SOD), gluathione peroxidase (G-Px) and free sulfhydryl groups.

Table 1

Experimental model				
Groups	ACR [µg/Kg bw]	<i>Myrtilli fructus</i> (Hydroalc. sol. 3,5%)	<i>Myrtilli fructus</i> (Hydroalc. sol. 3,5%) + AA	Biochemical parameters
Reference group	-	-	-	CAT, SOD, G-Px, -SH
Control group	20	-	-	
Experimental group 1	20	XV guttes	-	
Experimental group 2	20	-	XV guttes	

Legend: ACR = acrylamide; AA= ascorbic acid (5% aqueous solution); CAT = catalase; SOD = superoxide dismutase; G-Px = glutathione peroxidase; -SH = free sulfhydryl groups.

## RESULTS AND DISCUSSIONS

The evolution of catalase (table 2) emphasizes a marked decrease of its activity for the animals of the control group, that may be the consequence of its consumption by the neutralisation of the epoxidic radical of acrylamide. The value for the activity of this enzyme is 380.09 U/L compared to 475.79 U/L, the

value for the reference group. Regarding the evolution of catalase for the groups protected with hydroalcoholic extracts of *Myrtilli fructus* there can be noticed an improvement of the enzyme activity, improvement that becomes more significant for the group that was additionally given the ascorbic acid.

Table 2

The evolution of catalase			
CATALASE (U/L)			
	minimum	Mean	MAXIMUM
Reference group	389.50	475.79	490.50
Control group	339.70	380.09	431.00
Experimental group 1	399.50	419.00	451.10
Experimental group 2	385.00	432.12	495.15

The variation of superoxid dismutase (table 3) follows a similar evolution to that of catalase, with which it forms a redox system. Therefore, the value of SOD decreases from 444.34 U/L (value obtained for the reference group) to 368.66 U/L (value characteristic to the acrylamide intoxicated group). The improvement of the SOD activity takes place in groups treated with hydroalcoholic extract of *Vaccinium myrtillus*. The additional intake of ascorbic acid reveals the positive role of this valuable antioxidant that increases the activity of SOD to a value (445.6 U/L) that goes beyond the value of the reference group (444.34 U/L).

Table 3

The evolution of superoxide dismutase			
SUPEROXIDE DISMUTASE (U/L)			
	minimum	Mean	MAXIMUM
Reference group	338.00	444.34	480.12
Control group	300.10	368.66	400.20
Experimental group 1	400.40	438.30	469.00
Experimental group 2	311.00	445.60	491.00

The third biochemical parameter, glutathione peroxidase (table 4) varies almost identically to catalase, revealing increases and decreases corresponding to the same groups. Therefore, the value of the enzyme increases with 16 U/L for the group exposed to the acrylamide subacute intoxication (the control group) compared to the reference group. As in the case of catalase, the activity of G-Px improves for the groups protected with hydroalcoholic extract of *Myrtilli fructus*, mainly for the experimental group 2 that takes benefit of additional ascorbic acid protection.

Table 4

The evolution of glutathione peroxidase			
GLUTATHIONE PEROXIDASE (U/L)			
	minimum	Mean	MAXIMUM
Reference group	55.20	86.96	88.19
Control group	66.30	70.22	79.50
Experimental group 1	75.50	77.70	89.50
Experimental group 2	75.12	82.20	86.00

The quantification of free sulfhydryl groups (table 5) led to results that confirm the existence of a certain antiradicalic potential of quercetol from *Vaccinium myrtillus*. The most convincing value belongs to experimental group 1, and not to experimental group 2, as happened in the case of the first three oxidative stress parameters.

Table 5

The concentration of free sulfhydryl groups			
FREE SULFHYDRYL GROUPS (μmol/mL)			
	minimum	Mean	MAXIMUM
Reference group	322.00	441.60	461.00
Control group	299.50	303.16	315.00
Experimental group 1	317.00	408.16	488.00
Experimental group 2	303.00	387.66	412.00

## CONCLUSIONS

1. The evolution of the four oxidative stress parameters confirms the antiradicalic effect of quercetol and other active principles from *Vaccinium myrtillus*;

2. The variation of catalase, superoxid dismutase and glutathione peroxidase emphasize the fact that the most significant antioxidant potential belongs to the quercetol-exogen ascorbic acid association;

3. The quantification of free sulfhydryl groups leads to results that sustain that the most efficient antioxidant potential is hold by the phytopreparate from *Myrtilli fructus*.

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# DEVELOPMENT OF *RHODOTORULA* YEAST STRAIN UNDER THE INFLUENCE OF POLYPHENOLIC COMPOUNDS IN THE PRESENCE OF COPPER IONS

## DEZVOLTAREA TULPINEI DE DROJDIE *RHODOTORULA* SUB INFLUENȚA COMPUȘILOR POLIFENOLICI ȘI A IONILOR DE CUPRU

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**Abstract.** *The paper presents the results of a study on the influence of polyphenolic compounds in combination with free metal ions on the growth, development and biosynthesis of specific pigments by Rhodotorula spp. yeast strain. For this purpose, the aqueous extract obtained from Vitis vinifera (Merlot) was characterized from the point of view of the total and individual phenolic content. We added in the aqueous extract different concentrations of copper ions, the solution obtained was used for preparation of culture medium for Rhodotorula yeast in a fermentative process. Under these circumstances, we monitored the effect of polyphenolic aqueous extracts on the amount of wet biomass and the biosynthesis of carotenoid pigments. Thus, it was noticed that the same metal concentration in the extract might have a stimulating effect on the amount of wet biomass while an inhibitory effect was registered on the carotenoid pigments biosynthesis.*

**Key words:** *Vitis vinifera* seeds, *Rhodotorula* spp., polyphenols, carotenoid pigments, copper ions

**Rezumat.** *În lucrare sunt prezentate rezultatele unui studiu privind influența compușilor polifenolici în asociere cu ioni metalici liberi, asupra creșterii, dezvoltării și biosintezei de pigmenți specifici a unor tulpini de drojdie Rhodotorula sp. În acest scop s-au preparat extracte apoase din semințe de Vitis vinifera, (soiul Merlot), care au fost caracterizate din punct de vedere al conținutului total și individual de polifenoli. Aceste soluții apoase în care s-au introdus diferite concentrații de ioni de cupru, au fost folosite pentru prepararea mediului de cultură necesar cultivării tulpinii de drojdie Rhodotorula sp. În aceste condiții s-a urmărit efectul extractelor apoase polifenolice și a ionilor de cupru asupra cantității de biomasă umedă și asupra biosintezei de β-caroten. Astfel, s-a observat că aceeași concentrație a metalului în extract poate avea un efect de stimulare asupra randamentului în biomasa umedă și un efect de inhibare asupra biosintezei pigmenților carotenoizi*

**Cuvinte cheie:** *semințe de Vitis vinifera, Rhodotorula sp., polifenoli, pigmenți carotenoizi, ioni de cupru.*

## INTRODUCTION

Polyphenolic compounds are some of the most common classes of secondary metabolites present in plants, generally known and appreciated because of

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strong antioxidant properties that prevent free radical formation (Kong J. et al., 2003). In recent years, natural antioxidants have aroused particular interest because of potential applications in industry as food and pharmaceuticals additives and because of multiple beneficial effects in treating and preventing various diseases (Bleve M. et al., 2008; Caridi D. et al., 2007).

Due to the character of their biological activity, natural polyphenols are compounds essential to stimulating plant growth and development as well as of some species of microorganisms. The ability to stimulate or inhibit the development of plants and microorganisms is closely correlated with the concentrations of polyphenolic compounds applied. Thus, in some cases, the presence of these compounds in low concentrations may have beneficial effects on the development of microorganisms; in cases when concentrations are higher, there is a phenomenon of inhibition (Popa V.I. et al., 2007).

Another important property of these compounds is the ability to complex with heavy metals. On the other hand, free metal ions are the most important chemicals used in the metabolism of microorganisms like microelements (Bartacek J. et al., 2008).

In addition, yeasts are well known for their potential to remove heavy metal cations from aqueous solutions. Recently, it was reported that yeasts of the genus *Rhodotorula* spp. are resistant to heavy metals and can play an important role in their mineral cycle (Li Z. et al., 2006). Their cell wall is composed of mannan, chitin, traces of glucans and glucoproteins. The destruction of this wall by alkali treatment leads to a considerable decrease in the adsorption of heavy metals, suggesting that the yeast cell wall is responsible for biosorption of metal ions.

By using hot water extraction of plant materials the inorganic salts, oligosaccharides, sugars and polyphenols are removed (P. Chow et al., 2008), and extracts can be successfully used as a carbon source in fermentation processes. To this end, we tested aqueous extracts of *Vitis vinifera* seed in combination with  $\text{Cu}^{2+}$  ions in different concentrations in the cultivation of a strain of yeast *Rhodotorula* sp. The effect of these extracts and ions copper on wet biomass yield, the consumption of polyphenolic compounds in the extract and retaining existing copper ions in the culture medium were followed.

## MATERIAL AND METHOD

The extraction of polyphenolic compounds was performed using 20 g of dry material and 125 mL distilled water. Successive extractions were performed in the same conditions (70°C, 45min) until a colorless extract was obtained. The resulting solution was filtered and brought to 500 mL in a calibrated flask. In order to identify the polyphenolic compounds we used as high performance liquid chromatography analytical method. Before to the HPLC analysis the extract obtained was concentrated and subjected to purification steps carried out by liquid-liquid extraction with ethyl acetate. Chromatographic analysis was performed on a HPLC Dionex UltiMate 3000 system equipped with a UV-VIS PDA detector. Separation was achieved on a Dionex Acclaim 120, C18 RP (4.6x150 mm, particle size 5  $\mu\text{m}$ ) column and the temperature was maintained at 30 °C $\pm$ 1. The flow rate was 0.5 mL/min. The mobile phase used was 1% acetic acid in water (A) versus 1% acetic acid in methanol (B) for a total running time

of 30 min, and the gradient changed as follows: solvent B started at 10% and increased immediately to 40% in 30 min. The determination of total polyphenols, tannins, flavonoids, flavonols and anthocyanins was also achieved in the concentrated extract (Hainal A.R. et al., 2010a).

For cultivation of yeast strain and carotenoid pigment extraction and analysis were used procedures described in a previous paper (Hainal A.R. et al., 2010b).

## RESULTS AND DISCUSSIONS

In table 1 the total concentrations of polyphenolic compounds, tannins, flavonols, flavonoids and anthocyanins expressed in mg/100 g dry plant material are shown.

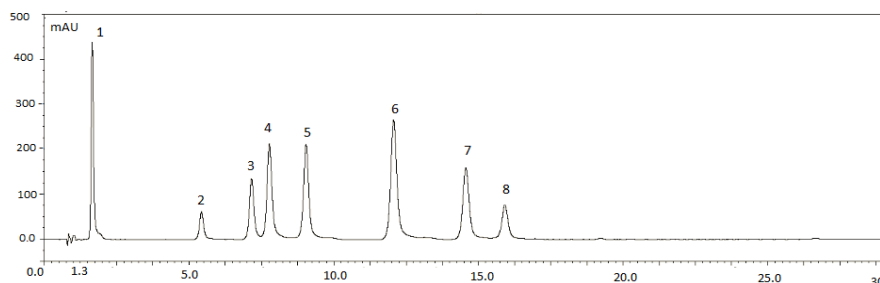
Table 1

**Total amount of phenols, tannins, flavonoids, flavonols and anthocyanins for concentrated extracts**

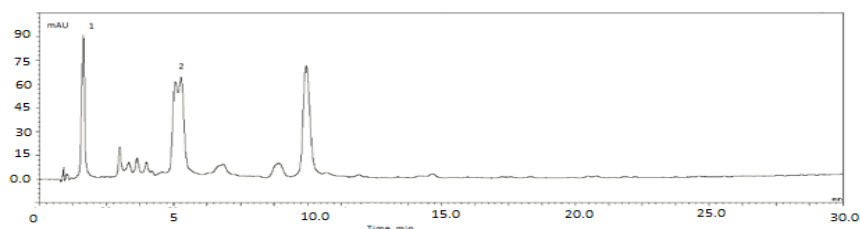
Aqueous extracts:	Total phenols mg /100g GAE	Taninns mg /100g GAE	Flavonoids mg /100g RE	Flavonols mg /100g RE	Anthocyanins (mg/100g RE)
<i>Vitis vinifera</i> seeds	506.25	198.38	27.73	7.11	18.52

The identification and quantification of polyphenols existing in *Vitis vinifera* seed extract was done according to the calibration straight lines obtained for a series of standard polyphenols. Chromatographic profile of standards used is that of fig.1 and the chromatogram recorded for the plant extract is represented in fig.2.

The main compounds identified in the extract obtained from *Vitis vinifera* seeds were gallic acid (6.12 mg/100g plant material) and catechin (44.36 mg/100g plant material). We can also see the presence of another major element to  $T_r = 9.8$  which according to literature (Maier T.et al., 2009, Montealegre et al., 2009) can be attributed to epicatechine.



**Fig. 1** - Typical chromatogram at 280 nm obtained for polyphenol standards. Identified compounds of peaks 1–8 are gallic acid, catechin, vanillic acid, caffeic acid, syringic acid, p-coumaric acid, ferulic acid and sinapic acid respectively



**Fig. 2** - HPLC profile of *Vitis vinifera* seeds aqueous extract; Identified compounds 1-gallic acid; 2-catechine

In fig. 3 we can see changes in the amount of wet biomass for fermentation performed in an aqueous extract of *Vitis vinifera* seed. These extracts have a total of 259.14 mg /100g GAE polyphenols. In these solutions, we added a solution of copper ions in concentration of 10, 25, 50 and 100 mg/L. It appears that the best yield in the wet biomass is recorded when we add in the medium 10 mg/L copper ions, which is the optimum condition for cultivation of yeast *Rhodotorula spp.*

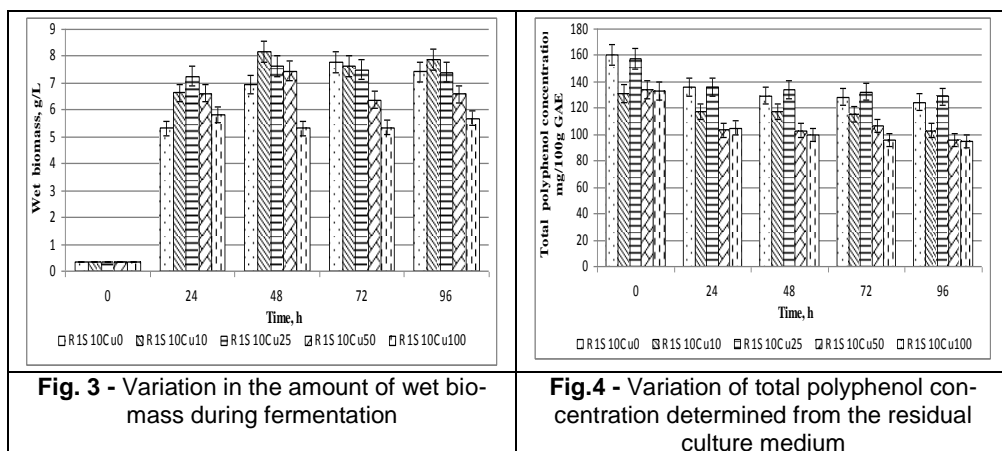


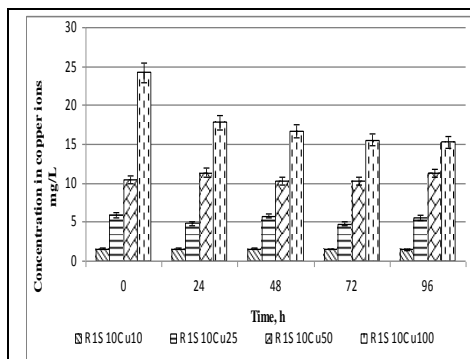
Fig. 4 shows that the concentration in total polyphenols is lower than that measured before the addition of copper ions. It also shows that with increasing concentration of copper ions added in the extract, the concentration of polyphenolic compounds decreases; this confirms literature data that say that the polyphenols complex with copper ions (Hainal A.R., 2009).

However, the lowest concentrations in total polyphenols during fermentation processes are identified for the experiment in which we obtained the maximum amount of wet biomass. This leads to the conclusion that the yeast degrades polyphenols and uses them as carbon source.

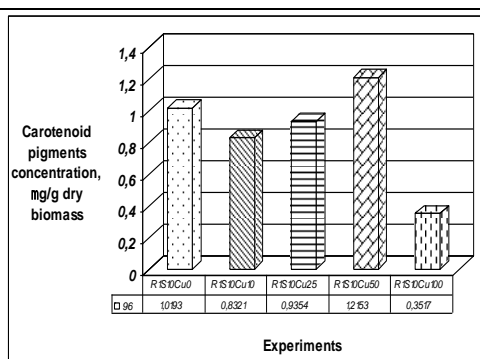
At the same time, fig. 5 shows that, at baseline there was a low concentration of copper ions in comparison to the one introduced in the environment. Their



concentration decreased until the end of the process, which proves that biomass can retain free copper ions in the environment.



**Fig. 5** - Variation of concentration in copper ion determined from the residual culture medium



**Fig. 6** - Variation of carotenoid pigments concentration extracted from the biomass resulting at the end of the fermentation processes

In fig. 6 we can observe the variation of carotenoid pigments concentration biosynthesized by yeast strain *Rhodotorula spp.* Thus, it appears that a maximum of pigments extracted at the end of fermentation is carried out in the presence of 50 mg/L copper ions added, an experiment in which we obtained a small quantity of wet biomass. This can be taken into account when intend to obtain a maximum of carotenoid pigments.

## CONCLUSIONS

1. Aqueous extract of *Vitis vinifera* seeds contain high concentrations of catechins and gallic acid along with other unidentified polyphenolic compounds.
2. The best conditions for obtaining a maximum yield in wet biomass are those when a total polyphenol concentration of 258.95 mg GAE/100g has been used with an addition of 10 mg/L copper ions.
3. To assure conditions for biosynthesis of carotenoid pigments, it is recommended a culture medium containing 258.95 mg GAE/100g total polyphenols to which was added 50 mg / L copper ions
4. Polyphenolic compounds existing in the culture medium were used as carbon source by yeasts.

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# THE PRODUCTION INCREASE FOR TOMATOES IN FIELD CROPS UNDER THE INFLUENCE OF TREATMENTS WITH GROWTH STIMULATORS

## CREȘTEREA PRODUCȚIEI LA TOMATE ÎN CULTURĂ DE CÂMP SUB INFLUENȚA TRATAMENTELOR CU STIMULATORI DE CREȘTERE

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**Abstract.** *The work is part of a three-year study on the influence of treatments with growth promoters on tomatoes in various stages of development. This part presents data on the effect of treatments applied on tomato production in field crops. We used two growth promoters, conditioned as potassium and dimethylamine salts, in two dilutions, with and without added solution of zinc acetate. Three treatments were applied and followed the general development and production - average yield per plant (g) and average production in tones per hectare. Treatments applied to tomatoes in field culture led to higher output compared to control sprinkled with distilled water and compared with the variant treated with zinc acetate solution 5 ppm. The variant with the highest production this year was the one treated with the stimulator BCO 4 K - 20 ppm followed by BCO 4 K + -20 ppm Zn, with production increases of 41.6 respectively 38.9 t/ha.*

**Key words:** tomato, production, growth stimulators, phenoxyacetic.

**Rezumat.** *Lucrarea face parte dintr-un studiu pe trei ani privind influența unor tratamente cu stimulatori de creștere asupra tomatelor în diferite stadii de dezvoltare. În această parte se prezintă datele privind efectul tratamentelor aplicate asupra producției la tomate în cultura de câmp. Au fost utilizați doi stimulatori de creștere, condiționați ca săruri de potasiu și de dimetilamină, în două diluții, cu și fără adaos de soluție de acetat de zinc. Au fost aplicate trei tratamente și s-a urmărit dezvoltarea generală a plantelor și producția medie pe plantă (g) și producția medie în tone/hectar. Tratamentele aplicate la tomate în cultura de câmp au condus la producții mai mari comparativ cu martorul stropit cu apă distilată, dar și comparativ cu varianta tratată cu soluție de acetat de zinc 5 ppm. Varianta cu cea mai mare producție a fost anul acesta cea tratată cu primul stimulator BCO 4 K – 20 ppm urmată de BCO 4 K+Zn –20 ppm, cu sporuri de 41.6, respectiv 38.9 t/ha.*

**Cuvinte cheie:** tomate, producție, stimulatori de creștere, fenoxiacetic.

## INTRODUCTION

Sulphonamides represent an important class of chemical compounds characterized by an herbicide or growth regulator and auxinic effect auxinic and by the lack of toxicity. The sulphonamides' main feature is represented by the fact that introducing the sulphonamidyic group into an aromatic or heterocyclic ring, their toxicity is profoundly decreased. We chose as support for the sulphonamidyic group chloro-derivatives of the phenoxyacetic acids because they

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have reduced toxicity, are biodegradable and don't have cumulative properties in the organism or side effects. Seeds' germination and plantlets development in a shorter period of time is very important in their future development and in order to obtain production increases (Finck A., 1982; Garcia R.L., Hanway J.J., 1976).

As an alternative to chemical fertilizers in agriculture, growth stimulators are more and more used. Synthesizing and experimenting new chemical structures from the sulphonamides' class, used as innovative growth regulating substances, represents the preoccupation of many researchers in this field (Bireescu L. et. al., 1999; Mansaur F.A. et. al., 1994; Oniscu C. et al., 2005)

## MATERIAL AND METHOD

The tested compounds, 4-chloro, 2-sulphonamidic phenoxyacetic acid (BCO 4) and 2- chloro, 4-sulphonamidic phenoxyacetic acid (BCO 2), were previously conditioned as potassium and dimethylamine salts. Preliminary tests were performed in order to select an optimal dilution interval that induces the growth stimulating effect, avoiding the concentration threshold from which the herbicide effect of these compounds start to manifest. As a result, we chose two dilutions – 20 ppm and 25 ppm, for the seeds treatments as well as for the foliar applications for the more developed stages of the plants (Trofin Alina, 2003).

For the tomato plants cultivated in field, three treatments were applied and we observed in the mean time their general development. Variants were randomly placed, in three repetitions for each treated variant, with five plants for each repetition. In order to avoid the interferences between different variants, they were separated by a row of buffer plants, which were not treated or measured (Trofin Alina, 2003). The considered variants were the following (table 1).

Table 1

**Variants used for the foliar treatments**

Variant	Treatment solution	Variant	Treatment solution
m <sub>apa</sub>	Control boiled water	V <sub>8</sub>	BCO 4 DMA+Zn –25 ppm
m <sub>Zn</sub>	Control zinc salt	V <sub>9</sub>	BCO 2 K – 20 ppm
V <sub>1</sub>	BCO 4 K – 20 ppm	V <sub>10</sub>	BCO 2 K – 25 ppm
V <sub>2</sub>	BCO 4 K – 25 ppm	V <sub>11</sub>	BCO 2 K+Zn –20 ppm
V <sub>2</sub>	BCO 4 K+Zn –20 ppm	V <sub>12</sub>	BCO 2 K+Zn –25 ppm
V <sub>4</sub>	BCO 4 K+Zn –25 ppm	V <sub>13</sub>	BCO 2 DMA – 20 ppm
V <sub>5</sub>	BCO 4 DMA – 20 ppm	V <sub>14</sub>	BCO 2 DMA – 25 ppm
V <sub>6</sub>	BCO 4 DMA – 25 ppm	V <sub>15</sub>	BCO 2 DMA+Zn –20 ppm
V <sub>7</sub>	BCO 4 DMA+Zn –20 ppm	V <sub>16</sub>	BCO 2 DMA+Zn –25 ppm

The control variants were treated with boiled and cooled water, and the others with the selected dilutions for the tested compound; the first foliar treatment was applied at 15 days from the plantlets' sowing, the second one, after the next 15 days, and the third one after one more month, with 15 ml of growth stimulator solution for each plant and each application.

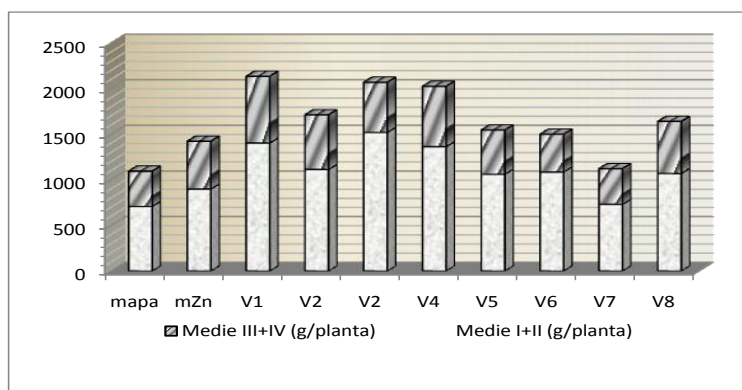
Irrigation was assured daily during the dry periods, and between, related to the required water necessities of the used tomato cultivar.

## RESULTS AND DISCUSSIONS

In what regards the general development of the plants, we noticed a bigger number of flowers, respectively bonded fruits on all four permitted floors for each plant for the variants treated with BCO 4, with a slightly bigger number for the variants where zinc salt was added. Even if the second growth stimulator obtained smaller valued in what regards the number of bonded fruits, they were anyway superior to the considered controls. From the two used dilutions, the 20 ppm one gave better results, for the variants without zinc salt added compared to the variants treated with the 25 ppm dilution, as well as compared to controls. The BCO 2 growth stimulator lead to more uniform plants in what regards height and even slightly taller for most of the variants.

The observations regarding production were made separately for the first two floors, then for floors 3 and 4, measuring the average production on a plant (g) and the average production in tones/hectare. Finally we combined the results for the observations on the total production of the four floors for each treated variant (table 2).

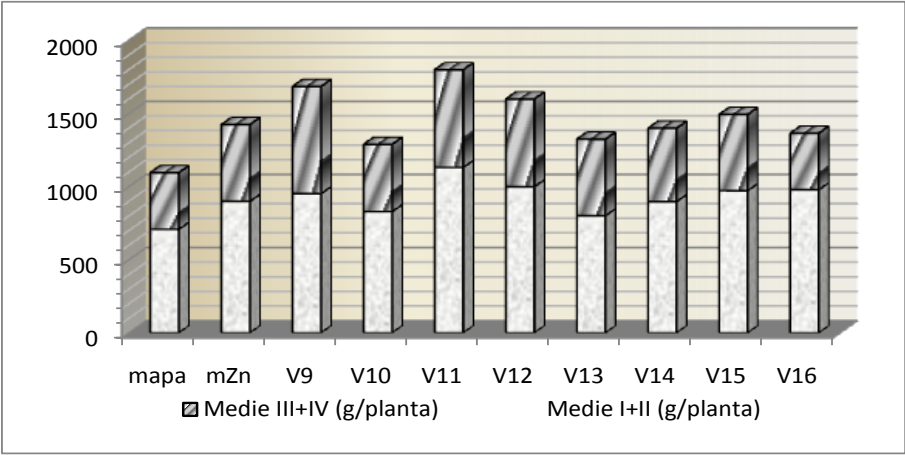
For the 1<sup>st</sup> and 2<sup>nd</sup> floor we obtained the biggest differences between controls and treated variants. The data regarding the production of the 3<sup>rd</sup> and 4<sup>th</sup> floor registered smaller differences compared to controls, but all treated variants had better results than both control variants. Some plants from some variants' repetitions suffered a viral attack, they did not properly develop and as consequence, the productions of all four floors diminished for those specific repetitions (figure 1).



**Fig. 1** - Average production on a plant for the variants treated with BCO 4

The average production on a plant registered as well bigger values for the treated variants, different for the two growth stimulators: BCO 4 gave again better results, for both dilutions, with or without zinc salt added, compared to BCO 2, but the second growth stimulator also lead to superior results compared to control

variants (figure 2). The potassium salt determined bigger production yields than the dimethylamine one, for all four floors of the plants.



**Fig. 2** - Average production on a plant for the variants treated with BCO 2

We calculated in the end the total production yield for tomatoes in field culture in tones/ha, as average value for three repetitions, considering a surface cultivated with 40 000 plants/ha.

*Table 2*  
**Total production for tomatoes in field culture related to the applied treatment - tones/ha (40 000 plants / ha)**

Variant	Total production (t/ha)			
	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	Average
m <sub>apa</sub>	42.84	43.04	45.4	43.76
m <sub>Zn</sub>	53.96	61.16	55.6	56.907
V <sub>1</sub>	82.8	91.28	82	85.36
V <sub>2</sub>	68.24	68.36	68.8	68.466
V <sub>3</sub>	76.16	87.36	84.68	82.733
V <sub>4</sub>	77.28	84.84	80.76	80.96
V <sub>5</sub>	61.84	62.72	60.92	61.827
V <sub>6</sub>	53.12	62.04	64.84	60.0
V <sub>7</sub>	50.84	60.08	23.68	44.867
V <sub>8</sub>	59.04	67.04	70.64	65.573
V <sub>9</sub>	63.72	72.8	65.44	67.32
V <sub>10</sub>	58.36	30.56	65.6	51.506
V <sub>11</sub>	67.76	77.24	70.72	71.906
V <sub>12</sub>	60.96	69.48	61.2	63.88
V <sub>13</sub>	28.76	60.48	69.52	52.92
V <sub>14</sub>	51.88	58	57.8	55.893
V <sub>15</sub>	61.48	63.2	54.28	59.654
V <sub>16</sub>	57.16	51.2	55.24	59.907

We observed significant production increases for the treated variants compared to controls, but even so, the variants did not overcome the cultivar's production capacity, of 70 – 90 t/ha. The climate conditions registered in the experimental field were not very favorable; the extended drought periods were followed by extremely abundant rainfalls.

Most of the fruits presented a scared inferior half, and for a part of them, this part rot.

Even so, considering all conditions, the treated variants overcame the production of the control variant sprinkled with water and excepting five variants, the production of the control variant treated with zinc acetate.

The influence of the different considered factors was appreciated by statistic calculus, using the randomized blocks method with limit difference. We obtained the following results (table 3):

*Table 3*

**The influence of the applied treatment on total production for tomatoes in field culture (40 000 plants/ha)**

Variant	Production	% comp. control	Differences	Significance
BCO 4 K – 20 ppm	85.36	194.98	41.6	xxx
BCO 4 K+Zn –20 ppm	82.73	188.81	38.9	xxx
BCO 4 K+Zn –25 ppm	80.96	184.93	37.2	xxx
BCO 2 K+Zn –20 ppm	71.9	164.16	28.1	xxx
BCO 4 K – 25 ppm	68.46	156.39	24.7	xx
BCO 2 K – 20 ppm	67.3	153.65	23.5	xx
BCO 4 DMA+Zn –25 ppm	65.57	149.77	21.8	xx
BCO 2 K+Zn –25 ppm	63.88	145.89	20.1	xx
BCO 4 DMA – 20 ppm	61.83	141.10	18.0	x
BCO 4 DMA – 25 ppm	60.0	136.99	16.2	x
BCO 2 DMA+Zn –20 ppm	59.65	136.30	15.9	x
Control zinc acetate 5 ppm	56.91	129.91	13.1	
BCO 2 DMA – 25 ppm	55.89	127.63	12.1	
BCO 2 DMA+Zn –25 ppm	54.5	124.43	10.7	
BCO 2 DMA – 20 ppm	52.92	120.78	9.1	
BCO 2 K – 25 ppm	51.5	117.58	7.7	
BCO 4 DMA+Zn –20 ppm	44.87	102.51	1.1	
Control water	43.76	100.00	0.0	Control
DL 5% : 14.5 t/ha DL 1% : 19.5 t/ha DL 0.1% : 25.7 t/ha				

## CONCLUSIONS

1. The growth stimulators applied to tomatoes in field culture lead to bigger production yields compared to control variant sprinkled with water but also compared to control variant treated with zinc acetate 5 ppm;

2. Between the two considered growth stimulators, the best results were obtained using BCO 4, followed by BCO 2;

3. Generally speaking, the 20 ppm dilution determined bigger production yields than the 25 ppm dilution;

4. The added zinc salt solution 5 ppm increased production for most of the variants where it was combined with the growth stimulator, and the control variant treated only with this solution had production yields bigger than five treated variants and the control variant sprinkled with water;

5. The treatment combinations with very significant results, according to the statistic calculus, were: BCO 4 K 20 ppm; BCO 4 K 20 ppm + Zn acetate; BCO 4 K 25 ppm + Zn acetate and BCO 2 K 20 ppm + Zn acetate.

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# STUDIES CONCERNING THE INFLUENCE OF TRACE ELEMENTS ON THE DYNAMICS OF SOME BIOCHEMISTRY MARKERS ACTIVITY OF OXIDATIVE STRESS AT *MONILINIA LAXA* (ADERH.& RUHL.) HONEY PARASITE ON PLUM TREES

## STUDII PRIVIND INFLUENȚA OLIGOELEMENTELOR ASUPRA DINAMICII ACTIVITĂȚII UNOR MARKERI BIOCHIMICI AI STRESULUI OXIDATIV LA *MONILINIA LAXA* (ADERH. & RUHL.) HONEY PARAZITĂ PE PRUN

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**Abstract.** Because some microorganisms like fungi owe their pathogenicity, aggressivity and virulence to their rich enzyme equipment, we have to monitor their biological activity by analyzing some biochemical markers like oxidoreductases. This paper synthesizes some experimental results concerning the influence that some oligoelements like B, Cu, Mn, Mo, Zn, Fe and a mixture between them, have on the time activity of catalase and peroxidase at *Monilinia laxa* parasite on different types of plum tree species. „In vitro” culture of the fungus was made on Leonian medium and the experimental determinations involved some samples from the fungus mycelium and the liquid used for the culture, at intervals of 7, respective 14 days from the inoculation. The evaluation of catalase activity was made using the method of Sinha and the peroxidase activity was determined by Moller's method with an o-dianisidine. The experimental data analysis indicated that the variation of the two oxidoreductases is correlated directly with the age of the culture and that there are some substantial differences between the types of oligoelements used in the culture medium.

**Key words:** *Monilinia laxa*, trace elements, catalase, peroxidase, *Prunus domestica*

**Rezumat.** Dat fiind faptul că unele microorganisme de genul fungilor își datorează atât patogenicitatea cât și agresivitatea și virulența unui bogat echipament enzimatic, se impune pentru monitorizarea activității lor biologice studiul unor markeri biochimici de genul oxidoreductazelor. Lucrarea de față sistematizează o serie de rezultate experimentale privind influența exercitată de oligoelemente de tipul B, Cu, Mn, Mo, Zn, Fe, dar și a unei mixturi din acestea asupra activității în timp a catalazei și peroxidazei la specia *Monilinia laxa* parazită pe diferite soiuri de prun. Cultivarea „in vitro” a ciupercii s-a făcut pe mediul Leonian, iar determinările experimentale s-au realizat atât din miceliul ciupercii cât și din lichidul de cultură, la 7, respectiv, 14 zile de la însămânțare. Evaluarea activității catalazei s-a făcut utilizându-se metoda Sinha, iar cea a peroxidazei prin metoda Moller cu o-dianisidină. Analiza datelor experimentale a relevat faptul că, variația activității celor două oxidoreductaze este direct corelată cu vârsta culturii și că, există diferențe substanțiale în funcție de tipul oligoelementului cu care a fost suplimentat mediul de cultură.

**Cuvinte cheie:** *Monilinia laxa*, oligoelemente, catalază, peroxidază, *Prunus domestica*

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## INTRODUCTION

One of the most significant effects that prokaryotes have on the living environment is their ability to play a crucial role in processing and recycling the essential chemical elements, in the total biomass of microbial cells in the biosphere, their metabolic diversity and persistence in all habitats constitutes the argument for this idea. In recent years there has been an increasing realization of the importance of the role that micronutrients play in biological systems. Needed in small quantities, the trace elements are used by filamentous fungi for growth and development and their physiology. The modern classification of the minerals of life, classifies the vast majority in trace elements (Fraústo da Silva and J.J.R. and Williams R.J.P, 2001, Gârban Z., 2005, Nikolaevich Baskin, V., 2006), others authors considering that only Fe is an oligoelement, and the rest are micronutrients (Şoldea C. and Mocanu, M. 2011) and other studies fits in addition Fe, Cu and Zn in the group of essential trace elements, and the rest, B, I, F, Se, Si, As, Mn, Mo, Co, Cr, V, Ni and Cd in the essential of the ultratrace elements group (Reddy H., 2007).

The data from the literature awards of the nutrients the modulators role (Cojocaru D.C., 2007), these having an inductive or inhibitory action in different chemical reactions catalyzed by a variety of enzymes. Although they are known to play an important role in the production of secondary metabolites including antibiotics and mycotoxins, and acting as growth factors - Cu, Zn, Mn or inducer of the conidiogenesis, as element of the mycelium pigmentation - Zn, Cu, as elements coupled with the protein- transporting ATP-ase (Saitoh Y. *et al.*, 2010), concentrated in the vacuolar juice -  $\text{Fe}^{2+}$ ,  $\text{Zn}^{2+}$  (Gow N.A.R. and Gadd G.M., 1996), the trace elements get into the enzymatic context depending on the needs of the fungal cell, performing different roles: some trace elements such as Cu and Fe achieves a catalytic function, their presence in the enzymes composition stimulating their functioning. They act as a union factors between active enzyme and the substrate (metal ions), and in several enzymes acts as a powerful electronic attraction center, leading to the important oxido reduction reactions (Zn, Cu, Mn, Se and Fe) (Halliwell, B. and Gutteridge, J.M.C., 2007). Although some micronutrients are less important than others in the development of metabolism and growth of fungal cell, they must exist in a certain proportion to act synergistically. There are several essential nutrients with mineral origin which are taking part in antioxidant processes with the enzymes, delaying or completely inhibiting the oxidation of the substrate and acting at all different levels of the oxidative sequence. Possessing the transduction systems and the mechanisms to adapt to oxidative stress (Tanaka C. and Izumitsu K., 2010) materialized in an endogenous antioxidant system, the fungi releases an exoenzyme in the extracellular space to minimize the negative impact of the reactive oxygen species.

In this context, the objective of the present work, going on the line of studies that have followed the influence of trace elements on the the oxidoreductase or other environmental factors on the catalase and peroxidase activity in different fungal species (Manoliu Al. *et al.*, 2009, 2010) follows to quantify the activity of biochemical parameters in *Monilinia laxa* species grown on the medium supplemented with various micronutrients.

## MATERIAL AND METHOD

The inoculum source have constituted a sporodochia from mummified fruit harvested from different varieties of *Prunus domestica* from Experimental Orchard Pomiculture Station of Mirolaslava, Iasi county. For "in vitro" cultivation of the *M. laxa* fungus was used the Leonian medium, distributed in Erlenmeyer flask, over which we added the following trace elements in the following quantities: B -10 mg, Cu - 100 mg, Mn - 20 mg, Mo - 20 mg, Fe -20 mg, Zn - 200 mg (Constantinescu, O., 1974) as  $\text{H}_3\text{BO}_3$ ,  $\text{CuSO}_4 \times \text{H}_2\text{O}$ ,  $\text{MnCl}_2 \times 4\text{H}_2\text{O}$ ,  $\text{Na}_2\text{MoO}_4 \times 2\text{H}_2\text{O}$ ,  $\text{FeCl}_3 \times 6\text{H}_2\text{O}$ ,  $\text{ZnSO}_4 \times 7\text{H}_2\text{O}$ . Trace elements were added one by one, separately, and in one variant we added all. We used a control sample, without micronutrients. The media were seeded with disks cut-out from an 7 days old culture of *M. laxa* and incubated at 28°C. The experiment was conducted in two intervals, respectively 7 days and 14 days after inoculation of the culture, the catalase and the peroxidase activity was determined both from the fungus mycelium and from culture liquid. The catalase activity was assayed by the method Sinha and the peroxidase by Moller method (Artenie VI., 2008).

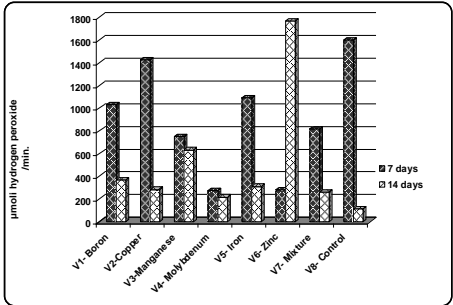
## RESULTS AND DISCUSSIONS

The first conclusion from the statistical analysis and represented graphically in figures 1 and 3 of the catalase activity in the *M. laxa* species cultivated on medium supplemented with different trace elements, indicates that the enzyme activity in the mycelium was different from that in liquid culture.

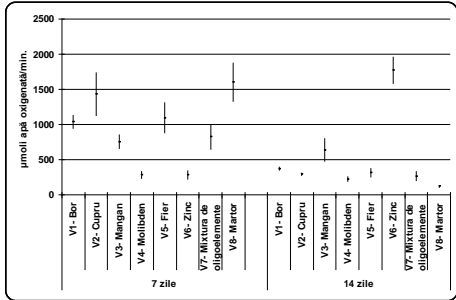
The catalase activity in the mycelium, shows in figure 1 that the control sample had the highest value in 7 days - 1599.206  $\mu\text{mol}$  hydrogen peroxide/min., and the minimum point of the activity was recorded in the variant with Mo - 273.7148  $\mu\text{mol}$  hydrogen peroxide/min. Between them, in descending order, the following values of the endocelulare catalase are: variant V2 - 1427.606  $\mu\text{mol}$  hydrogen peroxide/min, variant V5 - 1090.383  $\mu\text{mol}$  hydrogen peroxide/min, variant V1 - 1030.233  $\mu\text{mol}$  hydrogen peroxide/min, variant V7 - 817.2983  $\mu\text{mol}$  hydrogen peroxide/min, variant V3 - 748.5597  $\mu\text{mol}$  hydrogen peroxide/min and the V6 version - 278, 1847  $\mu\text{mol}$  hydrogen peroxide/min.

At 14 days the catalase activity in the mycelium was stimulated to all medium variants with trace elements and the control sample recorded a minimum of the activity: 112.6078  $\mu\text{mol}$  hydrogen peroxide/min. A strong induction at this time had on the catalase the zinc - 1766.281  $\mu\text{mol}$  hydrogen peroxide/min, followed in descending order by V3 - 630.6306  $\mu\text{mol}$  hydrogen peroxide/min, variant V1 - 366.8229  $\mu\text{mol}$  hydrogen peroxide/min, variant V5 - 308.7956  $\mu\text{mol}$  hydrogen peroxide/min, variant V2 - 282.4119  $\mu\text{mol}$  hydrogen peroxide/min, variant V7 (the trace elements mixture) - 258.2396  $\mu\text{mol}$  hydrogen peroxide/min., respectively, variant V4 - 216.9855  $\mu\text{mol}$  hydrogen peroxide/min. The analysis of the enzyme activity in mycelium indicates various reductions in the catalase activity in for all variants excepting variant V6 (Zn), in which the aging culture had induced a strong amplification of the enzyme activity – from 278.1874  $\mu\text{mol}$  hydrogen peroxide/min. to 1766, 282  $\mu\text{mol}$  hydrogen peroxide/min. Depending on the mean values and standard deviation for all the samples we calculated the

upper and the lower limits of the confidence intervals based on the critical value  $t(\alpha, n-1)$ , given by  $\alpha = 0.05$  and  $n-1$  degrees of freedom (fig. 2, 4, 6, 8).

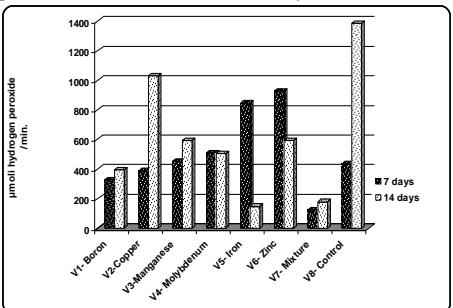


**Fig. 1** - The influence of the trace elements on the catalase activity in the mycelium of the *Monilinia laxa*

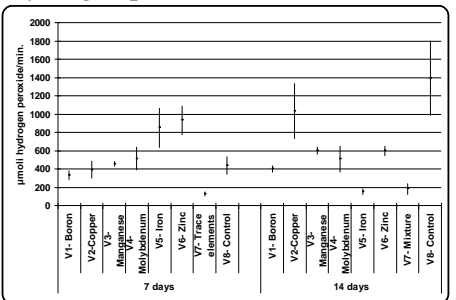


**Fig. 2** - The confidence intervals of the catalase activity in the mycelium of the *Monilinia laxa*

In culture liquid, the control sample from 7 days had a value of the catalase activity of 434.5048 µmol hydrogen peroxide/min. The strongest induced effect on the enzyme at this time had zinc - 927.2237 µmol hydrogen peroxide/min, followed by Fe - 845.7711 µmol hydrogen peroxide/min, and more modest amplifications to Mo and Mn - 508.8757 µmol hydrogen peroxide/min, respectively, 451.9774 µmol hydrogen peroxide/min. A significant inhibitory effect on the catalase activity at 7 days, in culture liquid, had the trace element mixture – 123.829 µmol hydrogen peroxide/min. and from this mixture the elements with a moderate inhibitory effect was Cu - 387.0968 µmol hydrogen peroxide/min, followed by B 326.5306 µmol hydrogen peroxide/min.



**Fig. 3** - The influence of the trace elements on the catalase activity in the culture liquid of the *Monilinia laxa*

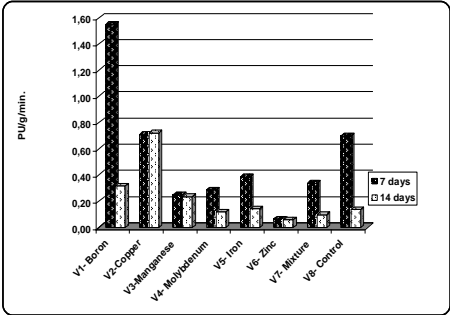


**Fig. 4** - The confidence intervals of the catalase activity in culture liquid in the *Monilinia laxa*

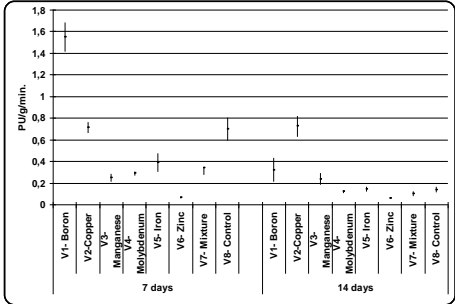
With the aging of culture, the extracellular catalase activity decreased in all medium variants, the most significantly in the case of the iron and the mixture of the trace elements - 146.6395 µmol hydrogen peroxide/min, respectively, 178.9096 µmol hydrogen peroxide/min. Other medium variants had relatively uniform values, excepting the copper - 1031.301 µmol hydrogen peroxide/min.

The data on the influence of the various trace elements on the peroxidase activity in the mycelium, after 7 days of incubation in *M. laxa* are shown graphically in figure 5. It may be noted that boron had a stimulating effect on endoenzyme - 1.5500 PU/g /min.

while a strong inhibitory effect was obtained with zinc -0.0630 PU/g /min, reported for peroxidase activity value in control control - 0.6990 PU/g /min.

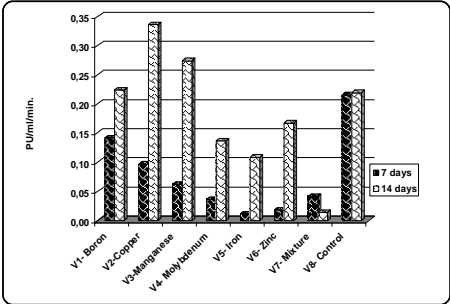


**Fig. 5** - The influence of the trace elements on the peroxidase activity in mycelium of the *Monilia laxa*

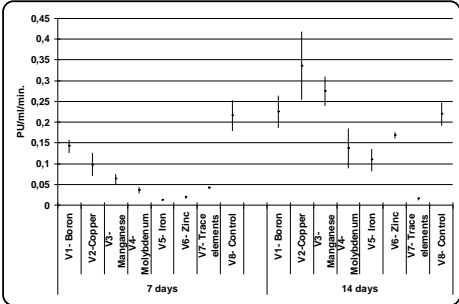


**Fig. 6** - The confidence intervals of the peroxidase activity in mycelium of the *Monilia laxa*

At 14 days after seeding the culture medium, in the mycelium, the peroxidase value for the control sample was 0.1379 PU/g/min. Zinc inhibited at this time the peroxidase activity - 0.0599 PU / g / min. The same thing happened in the medium variants with the mixture of trace elements and molybdenum -0.1990 PU/g/min respectively, 0.0973 PU/g/min. An enhancement of the activity was induced in variant containing copper - 0.7215 PU/g/min and the boron - 0.3178 PU/g /min.



**Fig. 7** - The influence of the trace elements on the peroxidase activity in culture liquid of the *Monilia laxa*



**Fig. 8** - The confidence intervals of the peroxidase activity in culture liquid of the *Monilia laxa*

So, for the case of the peroxidase also we calculated and plotted graphically the values in both mycelium and culture fluid, with the limits of the confidence intervals for each treatment option in part (fig. 6, 8). The eliberations of the peroxidase in the extracellular space for the first intervals of tests was inhibited in all medium variants with the trace elements, compared with the control sample (0.2156 PU/ml/min) the highest in variants containing zinc and iron-0.0180 PU/ml/min and respectively, 0.0117 PU/ml/min.

In a secondary series of tests, after 14 days, in both culture liquid and control sample, the peroxidase had a value of the activity of - 0.2195 PU / ml / min. The cumulative effect of the trace elements in the mixture has found expression in the strong inhibitory effect on the extracellular peroxidase - 0.0141

PU/ ml / min, while the variant containing copper stimulated its activity up to a peak of 0.3356 PU/ ml / min, followed by that of manganese variant - 0.2742 PU / ml / min and boron - 0.2242 PU / ml / min.

## CONCLUSIONS

In young mycelia, at 7 days, all trace elements inhibited the catalase activity and for the liquid culture the exoenzyme activity was stimulated by manganese, molybdenum, iron and zinc. At 14 days after seeding the culture medium, the intracellular catalase activity was stimulated by boron, copper, manganese, molybdenum, iron, zinc and trace elements mixture and the extracellular catalase was inhibited at this time by all trace elements, including their mixture.

After 7 days of incubation, the peroxidase activity was stimulated by boron in the mycelium and for the culture fluid it was inhibited by all trace elements and their mixture and at 14 days after sowing, in the mycelium, the peroxidase activity was stimulated by boron, copper, manganese and iron, while in liquid culture, was stimulated, this time, by boron, copper and manganese.

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# VIRTUAL SUPPORT FOR REAL LIFE LET'S GO, APLANET, ISPY PROJECTS

## SUPPORT VIRTUAL PENTRU VIAȚA REALĂ PROIECTELE LET'S GO, APLANET, ISPY

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**Abstract.** *The three projects presented within this article develop on the idea of user virtual support. It is highly recommended that both students and teachers are presented with such resources which enhance efficiency, relevance and achievement. However, despite the vast quantity of online materials, users often find themselves at a loss: there are too many, too varied materials and too little time for selection. Directly addressing this situation, the three projects focus on online material selection, development of tutor guidance, online courses for direct beneficiaries with user support and international collaboration opportunities. Before actually being supportive, virtual support needs to be clearly structured and labeled so that target beneficiaries can easily access relevant material directly. Although direct transfer to real life use necessarily includes adaptation of the material, the products of the above mentioned projects will facilitate selection of online material and will thus support use of relevant material appropriate the context of implementation.*

**Key words:** online resources, training, skill development

**Rezumat.** *Proiectele prezentate în articolul de față sunt centrate pe ideea de dezvoltare a suportului virtual. Bazele de date online dezvoltate de aceste proiecte oferă atât profesorilor cât și elevilor un suport de lucru relevant cu scopul de a le eficientiza activitatea. În fața marii varietăți de materiale online utilizatorii se află în situația dificilă de a le selecta pe cele potrivite activității lor. Proiectele mai sus amintite se adresează direct acestei situații și urmează să implementeze activități de selectare a materialelor online, dezvoltare de ghiduri pentru utilizatori (profesori și elevi), și deschidere de oportunități de colaborare internațională. Pentru a facilita accesul beneficiarilor la aceste materiale bazele de date trebuie să fie clar structurate și catalogate oferind în același timp posibilitatea de adaptare a resurselor la contextele specifice ale beneficiarilor.*

**Cuvinte cheie:** resurse online, sesiuni de formare, dezvoltare de abilitati

## INTRODUCTION

With all the latest development in relation to online teaching and learning materials few of us teachers can undertake the position of a well

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informed, competent user of online resources and educational technologies. Even though materials exist in an overwhelming amount we find ourselves in the position of not being able to decide whether or not we need online resources, which ones we need and best suit our needs and how to smoothly integrate them in our classes. When it comes to the learner, the situation tends to be even more dramatic: to be able to select a proper set of online materials they need to have a very well structured approach to discriminate among the immense variety of online offers.

We all know that online materials are meant to make our work easier, both for educators and learners. But does it always turn out to be just as easy as that?

When we discuss the facility with which we approach online resources and their selection we need to bear in mind at least a few more other aspects such as: appropriateness, efficiency and accessibility. When we consider all these aspects and try to assess a large amount of material the task turns out not to be as easy as it seemed in the beginning.

It is within this context that the three projects, funded by the European Commission, are set. LET'S GO (LLP-LdV-TOI-2009-IT-0912), APLANET (511460-LLP-1-2010-1-TR-KA2-KA2MP) and ISPY (511558-LLP-1-2010-1-UK-KA2-KA2MP) all deal with online materials user support in more or less complementary manners.

Let's Go underpins the necessity of educators being trained to select online materials for their classes and develops online courses in this direction.

The main target group of the Aplanet project (Autonomous "Personal Learning Networks" for language teachers) is made of language teachers that want to improve their professional development and hence the performances of their pupils by accessing a wide range of resources, teaching techniques and advice available from other colleagues on the World Wide Web. There is a technique that can be used by any individual that wants to engage in learning online and this is called a Personal Learning Network (or PLN in short). The Aplanet project aims at enabling a high number of teachers in using PLNs effectively by designing a set of instructions for developing a PLN, by familiarizing potential beneficiaries with current concepts for using a PLN and by giving examples of resources that can be used for the creation of a PLN. In this article, we wish to explore how support is being offered for teachers that want to create and maintain a PLN, how effective can support be when it is ensured only online and sometimes by experts the trained teachers have never met. We will analyse the main tools and strategies designed within the Aplanet project for recruiting and retaining teachers and in the conclusion we will present the tools and strategies that have proven to be most effective in attracting teachers and the ones to which the target group has responded well.

Within the context of developing mother tongue and two other languages alongside other goals set out under the E & T work programme 2010, language and intercultural competencies are key skills for personal, social and economic effectiveness and fulfillment within the European context



and citizenship. Improving education and training, the quality of the workforce and promoting language learning are key areas addressed by ISPY project.

## **MATERIAL AND METHOD**

In order to respond to the needs outlined above, the Let's Go project developed four online training courses on the following topics:

1. Introduction to e-learning
2. Research and evaluation of e-learning based language training products
3. Development of e-learning based language learning sources
4. Effective use of e-learning based language learning sources

The project partnership also developed a database of e-learning based products for language teaching and learning, a database of e-learning experiences carried out by language teachers and a collection of tools and sources related to e-learning

The first steps taken by the Aplanet project partnership are in the direction of bringing together a high number of teachers interested in piloting the Aplanet methodology. This is a very essential stage as, once the Aplanet methodology for creating PLNs will be finalized, it will need to be validated by those who will have to use it – the foreign language teachers. The project partnership, through promotion in social networking sites, has managed to find 140 foreign language teachers willing to volunteer as participants. All these teachers were recruited online which proves that, even if a high number of teachers are present in social networks and on websites for professional development, they still feel the need that they would benefit from training in the area of designing a PLN. The social networks most frequently used for recruiting teachers were Twitter and Facebook. The institutions managing the Aplanet project are educational institutions with a wide range of contacts among foreign language teachers. The 140 teachers initially recruited have been directed to a Facebook group that was created when the project received the EU-funding for development. On this initial group news were posted regarding the project goals and initial steps. This was a challenging time in the life of the project as the project partnership could not offer much to the teachers interested since the project products have not been developed yet. The next step to involve the teachers was to let them know that the first project of the meeting is being organized and to give them the opportunity to attend an online seminar (webinar) within this meeting. The webinar was organized as follows: every teacher had a webcam and a chat window opened in which they could type-in questions for the project partners. The project partners were all in one room, using one computer and one web camera for introducing themselves to the teachers. After a member of the partnership introduced herself or himself, they moved on to their own computers where they answered, in the chat window, questions coming from the teachers. In this webinar the teachers that decided to participate (around 30 teachers, on a weekend day) were presented the project goals by the project coordinator and explained what their main role will be.

The second interaction with the teachers was to announce them that a Facebook page was created for replacing the Facebook group - as it allows posting more information. The Facebook page has now gathered more than 200 supporters. The Aplanet project has a Ning as well. The Ning is – to some extent – the equivalent of a project website – that in addition to the traditional content of a

website – allows collaboration between registered users of the website. The Aplanet partnership advertised the Ning to the teachers recruited via Facebook and on the project Ning: <http://aplanet-project.org/> there is now a lively community of teachers already sharing a lot of information and starting discussions even if the resources from the Aplanet project and the methodology will be finalized at a later stage. The number of the Ning users is greater than the number of the Facebook page and of the Facebook group initially used. Most of the users interested in the project have continued to participate in all the subsequent channels of communication used.

ISPY project focuses on the following aspects:

- Reinforcing the acquisition of competence in languages to improve intercultural dialogue in Europe
- Reinforcing language competencies relevant to the workplace in order to improve the integration of individuals in enterprise and enhance European competitiveness
- Developing and promoting methodologies to motivate language learners and to enhance their capacity for language learning, in particular, through information and communication technologies.

## **RESULTS AND DISCUSSIONS**

Work on Let's Go project started from the presumption that there are three core competencies necessary for language teachers / trainers who are willing to exploit the e-learning potentials :

- Knowing how to choose products within the available identifying those that best meet their educational needs.
- Knowing how to use and enhance the products available either as an alternative or as integration of traditional methodologies.
- Knowing how to create educational and training products that exploit the potential of new technologies.

To further develop on these ideas the partnership prepared an action plan focusing on development of online user support, assessment and improvement of materials. Activities included:

- Involvement of 5 school and 20 teachers per partner
- Involvement of 3 training institutions and 10 trainers per partner
- Collection of 5 school letters of intent per partner
- Collection of 3 training institution letters of intent per partner
- Sending of the School Presentation Forms and of the Training Institutions Presentation Forms
- Creation of the project web site
- Technical check and debug of the LeTS On Line courses.
- Check of the contents of the LeTS On Line courses
- Pilot course to prepare the partners for the delivery of the course for trainers
- Project web site
- Technical Improvement of the Lets On Line courses

- Improvement of the contents and of the translations of the Lets On Line courses
- Preparation of partners for the delivery of courses and for distance tutoring

The main objectives of the LeTS GO project is to enable language trainers and teachers to: choose quality language teaching products identifying those that best meet specific educational needs, use the products available either as an alternative or as integration of traditional methodologies, create educational and training products that exploit the potential of new technologies.

The project partners in APLANET found out that the online recruiting channels (Twitter and Facebook) can be very efficient if those who launch an invitation are credible and well-known in the online environment. A crucial step in recruiting online and in maintaining the teachers interest in the project is to give regular updates regarding the project development and to send the clear message that the volunteers are not forgotten. The webinar was the most effective tool in retaining the attention of the participants as they met the project team more closely and reviewed the project goals and their roles as volunteers. A very effective tool in retaining the attention of the participants is the creation of the project Ning. The project's Ning was initially advertised on the Facebook page and then teachers were invited to register on the Ning and share discussions, questions and expectations related to PLNs. In the true spirit of collaborative learning encouraged by PLNs, the teacher enrolled on the Ning already started sharing resources and interesting links. This is the first step in creating a PLN and the partnership has noted as very important the fact that the teachers involved are doing this naturally.

The ISPY platform makes use of a real context for developing a European dimension to learning, multilingualism, interaction, cooperation and collaborative working, learning language strategies, and experiencing different cultures via interactive social facilities. The platform is aimed at upper secondary learners and learners in vocational education and training who are also the primary test users alongside teachers and trainers. It makes use of a new methodology for teaching and learning languages and, therefore, pedagogical guidelines are included to support initial and teacher training (staff and educators).

## **CONCLUSIONS**

Knowledge of the foreign languages is a key element for a good employability. New Technologies can make the language learning process more user friendly and enjoyable. At the same time New Technologies have changed training methodologies, introducing elements of innovation that have redrawn the role of teachers and trainers.

In recruiting and retaining participants in a project online, the main risk is that the participants lose interest, and, not being compelled by an extrinsic

obligation to continue, they are very likely to give up. The partnerships in the three projects managed to keep the teachers' interest through several communication channels. The main feature of these communication channels was the fact that they are open. Every participant has the opportunity to contribute and to say something, with discrete moderation from the entire partnership. It is very likely that many of the teachers would have given up if they had not been allowed to communicate but only receive information and instructions. Collaboration is thus one of the key features one must take into consideration when designing a recruiting process online. Another key element that has resulted in maintaining interest through online presence of the project partnership and presentation of updates. The permanent presence of the project members and their contributions to the discussions has assured teachers that the project is not inactive and that their contributions are being taken into consideration by the project partnership.

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# INTERGENERATIONAL LEARNING MyStory, BILFAM & ENIL

## ÎNVĂȚARE INTERGENERAȚIONALĂ PROIECTELE MyStory, BILFAM și ENIL

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**Abstract.** *Because social dynamics have lately been restructured we no longer have the time and the opportunities we once had to transfer the experience of one generation up to another. Establishing collaboration patterns among various age groups is not only a form of socialisation. Beyond that, intergenerational learning is a very practical way of developing on transferred information and thus equip beneficiaries with new skills and abilities. MyStory project (511641-LLP-1-2010-1-RO-KA3-KA3MP) plans to collect a series of life stories engaging seniors and young people who are very good computer operators. Materials produced will be freely available online. BILFAM(511515-LLP-1-2010-1-IT-KA2-KA2MP) is a transfer of innovation project involving parents in children's language teaching and in reflection activities on the margin of this topic. Online support will also be available. ENIL (510890-LLP-1-2010-1-FR-GRUNDTVIGGNW) focuses on involving parents and grandparents in volunteering activities in schools to present children with direct learning experiences within their families.*

**Key words:** intergenerational learning, stories, volunteering

**Rezumat.** *Societatea actuală evidențiază lipsa oportunităților de colaborare intergenerațională pe fondul schimbării dinamicii relațiilor sociale. Stabilirea acestui tip de colaborare între diferite categorii de vârstă nu trebuie văzută doar ca o formă de socializare. Colaborarea intergenerațională presupune și o modalitate de procesare a materialului și a informației transferate de la o generație la alta precum și o oportunitate de dezvoltare a grupului țintă prin formarea de noi deprinderi și abilități. Proiectul MyStory are în vedere colectarea unui set de povești de viață implicând grupuri de seniori și de tineri, foarte buni operatori de computer și material online. BILFAM este un proiect transfer de inovație în cadrul căruia părinții și copii vor fi implicați activ în modalități non-formale de învățare a limbilor străine. În cadrul proiectului ENIL părinții și bunicii vor fi implicați în activități de voluntariat la nivelul școlilor pentru a oferi copiilor experiențe directe de studiu cu ajutorul membrilor familiei.*

**Cuvinte cheie:** învățare intergenerațională, povești, voluntariat.

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## INTRODUCTION

This article will present three different approaches towards intergenerational learning (IGL). The approaches are developed by three European projects, funded by the European Commission, that encourage IGL in three different ways. The ENIL project promotes IGL by supporting practitioners in the field, the BilFam project aims at enhancing foreign language learning by enabling parents to teach their children a foreign language and the MyStory project aims at involving grass-root target groups in IGL by involving young people and senior citizens in a mutually beneficial learning partnership taking place in the wider community, not only within the family.

## MATERIAL AND METHOD

MyStory project focuses on collecting basic input, seniors' stories, processing this input to be available online in several languages. The project also looks into directions these materials could be made use of in the future by other beneficiaries.

The project team bases story collection on an internally developed tool – the DSK (Digital Story Telling Kit). The Kit has been developed under the supervision of an expert with input from field research and field literature. The Kit contextualizes storytelling and story-collecting presenting future story collectors with basic tips for their work. Methodology is described and clearly presented in gradual steps so that those who will do the field work (collecting stories from seniors) do not need to have prior special studies in this domain.

Another way of working on quality assurance is to organize trainings for the staff working on the project activities. Training are delivered in a blended format for adults working with the young story collectors. The training focuses on content, methodology and collaboration skills. Trainings are also developed and implemented for those delivering the IT trainings to seniors. The project team wishes to engage a centralized yet flexible approach to all these activities.

There will be four rounds of story collecting. Representatives of the project team accompany the story collectors to offer support and ensure a smooth implementation of the interview. The stories and complementary materials collected from the seniors will then be processed and transferred into electronic format. Materials will be uploaded on the project platform under the proper content category and linked to various other relevant online input. These connections can provide extra information on the events described in the stories and thus create a context to frame the stories.

The ENIL (European Network for Intergenerational Learning) project aims at creating a network of professionals in the field of sustaining intergenerational learning (IGL). The main goal of the project is to set up a network that will offer these professionals the possibility to share good practices, opportunities for training and certification, strategies for influencing decision makers. The network will also offer a series of instruments to its target groups: a research report on volunteering in relation to IGL, a glossary of the most frequent 200 terms connected with IGL, a library of resources and a series of events for IGL practitioners.

The IGL glossary contains terms such as: "Literacy/ Numeracy/Skills for Life", "Active Citizenship" which are easily translatable in all European languages but also terms such as "school grand parents", "Service learning", "job shadowing" are difficult to translate since they do not reflect a reality in all the European countries.

The BilFam project aims at encouraging foreign language learning at a young age. The main drive behind the project is to use a learning methodology that enables parents with little or no knowledge in the foreign language to be mentors in their children's learning and even learn together with them. The BilFam project uses the Hocus&Lotus learning and teaching model and the narrative format created by Professor Traute Taeschner of the University of Rome 'La Sapienza'.

## **RESULTS AND DISCUSSIONS**

The two primary beneficiaries in MyStory project are senior citizens and very young people. These categories include very skilled ICT users and those socially marginalized partly because of the great emphasis put on their ICT interest or competence. The partnership has developed a strategy directed towards activating these two categories creatively, so as to support and educate one another. Thus, the partnership intends to valorize and enhance the potential of both groups in teaching and helping the others in mutually rewarding ways.

Collaboration between the two beneficiary groups discovers new opportunities to enhance and extend both young people's computer skills and senior citizens' life experiences. Through their volunteering activities young people have the opportunity to offer their support to senior citizens and help them learn how to access the Internet, how find new information that may be of interest to them and how to upload their life stories online. On the other hand, senior citizens can share their stories with the younger generation raising their awareness – not only on the historical events that can be easily traced back in history books – but, more than that, on real and personalised life stories to illustrate history and offer much more complex shades of real life and shared socio-historical meaning.

This gradually progresses into a continuous loop cycle that is intended to engage active, conscious learning on the part of both beneficiaries spanning both generations. However, transfer of skills and information extends beyond the two direct groups of beneficiaries into wider circles of social interaction throughout societal space.

The research report on IGL and volunteering aims at providing a general framework for action for practitioners working in the field. Very popular in the western part of Europe and in many countries institutionalized and acknowledged as a practice for enhancing learning, less used in Eastern Europe, IGL has many forms and this makes it hard for experts to define it and to label certain activities as being IGL or not. The research report shall present a series of learning situations which can be considered IGL best practices. They will be collected from 20 European countries and this means that both countries with a certain tradition in IGL but also countries with less experience will be represented. This instrument is meant to assist IGL practitioners with examples of activities, methods for overcoming obstacles such as reluctant learners and with the possibility to contact the professionals that are developing the activities presented in the case studies. The research report will be available on the project website in November 2011, for free for all those interested.

The glossary that will also be available on the project website contains 200 terms relevant for the field of IGL, together with their definition in English. The glossary is translated in over 15 languages (the languages of the ENIL partnership) for enabling practitioners all over the EU to standardise the terminology they use and to better understand materials and activities from other countries. The project partnership has tried to standardise the terminology and to find translation equivalents for all the project languages. Being a field so differently developed throughout Europe, a lot of the terms used in some countries in relation to IGL do not have an equivalent in all languages.

## CONCLUSIONS

Use of latest technology can enhance social integration if used to trigger communication and collaboration at international and intergenerational level;

Integrating family in school activities derives in higher school performance and a more open communication channel school-students-family;

Stories, games and cartoons, the attributes of childhood, are a magic tool family can use to link to school activities, especially those related to foreign language learning;

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# OPTIMIZING THE FORMATION OF FUTURE SCIENCE TEACHERS FOR ACTIVATING THE STUDENTS DURING LESSONS

## OPTIMIZAREA FORMĂRII VIITORILOR PROFESORI DE ȘTIINȚE ÎN VEDEREA ACTIVIZĂRII ELEVILOR ÎN LECȚII

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**Abstract.** *In the modern school, an important role of the teacher consists in the organization of didactical activity in such way to determine the students to participate actively to their own formation, as subjects of learning. By organizing diversified learning situations with respect to the didactical methodology used, and differentiated in accordance with the different learning styles of the students, the teacher creates conditions needed for the activation of students within the lesson. Taking into consideration the importance of formation of future science teachers, in accordance with the exigencies of present education, we have carried out an empirical research, based on the questionnaire and interview methods. We consider that the formation of future science teachers for activating the students during lessons can be optimize by stimulating the practican students' creativity, and by encouraging the cooperation among the practican students who are using a diversified methodological register within the lesson and the other students.*

**Key words:** future science teachers, activating the students, lessons

**Rezumat.** *În școala modernă, un rol important ce-i revine profesorului constă în organizarea activității didactice în așa fel încât elevii să participe activ la propria formare, ca subiecți ai învățării. Prin organizarea unor situații de învățare diversificate în ceea ce privește metodologia didactică utilizată și diferențiate în funcție de diferitele stilurile de învățare ale elevilor, profesorul creează condițiile necesare activizării elevilor în cadrul lecției. Având în vedere importanța formării viitorilor profesori de Științe conform exigențelor învățământului actual, am realizat o cercetare empirică, bazată pe metoda chestionarului și interviului. Considerăm că formarea viitorilor profesori de Științe în vederea activizării elevilor în lecții poate fi optimizată prin stimularea creativității studenților practicanți și prin încurajarea cooperării dintre studenții practicanți care utilizează un registru metodologic diversificat în cadrul lecției și ceilalți studenți.*

**Cuvinte cheie:** viitori profesori de Științe, activizarea elevilor, lecții

## INTRODUCTION

The quality of didactic activity in the modern school is given by its capacity to multiply by itself the formative effects on the students and to avoid those situations in which the learning become a process of memorizing the answers given to some questions which are not of themselves (Albulescu I., 2008). Having in view that not any type of learning is efficient for the formation of students personality, at present, is

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considered that the role of teacher does not limit to the transmission of some “ready made” knowledges, which the students to receive passively, but consists in organizing the learning in such way that the students have to participate actively, by their own effort, to their acquiring (Petruța, G. P., 2008). Is considered that the student is active at lesson if make an effort of personal reflection, if undertake a mintal action of searching, investigating and rediscovering of truthes, of elaborating new knowledge (I. Cerghit, 2006). Thus, for the active student, the teaching-learning lesson becomes “an adventure of getting knowledge” (Oprea C. L., 2009).

Activation of students is an action of education and instruction, of developing of their personality by methodical stimulation and guidance of their activity. It refer to the stimulation of thinking, intelligence and other psychic functions of the students, as well as to the creation of a motivation for learning and action (Dicționar de pedagogie, 1979). Activation of students is a condition of school successful outcome, of obtaining maximum performances by the students, constantly accompanied by instructive-educative effects with positive role in developing all the components of their personality. This is carried aut by: a) stimulation and cultivation of the students interest for knowledge; b) valorization of the students intelligence and other psychic functions, by the effort that they made; c) formation and practicing of students ability to acquire knowledges; d) formation and practicing of students abilities to autonomously orientate in practical problems/situations; e) cultivation of investigative spirit, personal searches, and of the epystemic attitude, by training the students in organizing, conducting, carrying out and evaluating school and out of school didactic activities (Ionescu M., Radu I., 2004).

For coming up to these exigences of the modern education, is necessary that, within the pedagogical practice, the future teachers of Sciences organize the didactic activity in such way to stimulate the students to documentate themselves, to discover new knowledge, to investigate, to solve different problem-situations, to propose personal solutions, which they have to sustain with arguments, or to elaborate personal paperworks. In order to optimize the initial formation of the teachers of Sciences, we were aiming at evaluating the level of formation of practicant students in respect of determining the active participation of students within the lessons, during the pedagogical practice carried out by them in gymnasium. The objectives of this research were the following:

- establishing the modalities used by students for activating the school children during the lessons;
- establishing the level of school children activation within the lessons given by the students.

## **MATERIAL AND METHOD**

In order to know the mode in which the students from the Faculty of Sciences, within the University of Pitesti, have stimulated the active participation of school children within the lessons, an empirical research was carried out, based on the questionnaire and interview methods. The questionnaire, elaborated for the students, included questions concerning the modalities of activating the school children used by the students for verifying their knowledges, for arousing the interest for the lesson, for communicating new knowledges and

for their fixation and systematization. Also, it included a question concerning the personal contribution with respect to the application of some methods or creation of some learning tools aiming at the activation of school children. The structured interview was elaborated for the mentor teachers. It comprised questions concerning the school children categories solicited within the lessons and the level of their activation, during the two lessons given by the student sat gymnasium. Both the questionnaire and interview were applied within the colloquium of pedagogic practice, at the end of first semester.

The starting hypothesis was the following: the stimulation of students to use within the lessons a diversified and differentiated methodological register, helping to solicitate all the school children categories, as well as encouraging the students to create original didactic tools, contributes to the formation of the future teachers of Sciences according to the requirement of activating the school children at lessons.

The population sample included in our research was formed from 81 students in the third year of study, in the academic year 2010 – 2011, and five mentor teachers. From the questioned students, 11 were from the study program in Biology, 21 students from the study program in Ecology and environment protection, 10 students from the study program in Horticulture, 25 students from the study program in Environmental engineering, four students from the study program in Chemistry, four students from the study program in Physical engineering, and six students from the study program in Nursing, respectively.

## **RESULTS AND DISCUSSIONS**

By analysing the students answers we found that all the lessons given by them were lessons of communicating/acquiring new knowledges.

With respect to the forms of activity used during the probe lessons, it was found that 37.03% from the students have used exclusively the frontal activity. The same percentage (37.03%) of students, combined the frontal activity with individual activity. A smaller percentage (18.51%) of students, combined the frontal activity with that carried out in groups. The students who combined during the lesson the frontal activity with that carried out in groups and individually, formed the smallest percentage (7.40%). Within the final lessons, 43.20% from the students combined the frontal activity with individual activity, 30.86% from the students combined the frontal activity with that carried out in groups, while 25.92% from the students combined the frontal activity with that carried out in groups and individually.

For the activation of school children at lessons, the students have used various didactic methods (table 1), enabling the stimulation of thinking, language, intelligence, memory, and the other psychic functions.

For stimulating different learning styles of school children, the students have used certain didactic methods, which were combined during the lesson. In order to stimulate the school children with a visual learning, the students have used observation, demonstration, model devices, work with the manual, didactic game, graphical organizer. For the school children with an auditory learning style, the students have used conversation, explanation, narration, problem solving, learning by discovery, and for the school children with a practical learning style, the students have used laboratory practical work, work with the manual, exercise, and the five minutes essay. In the case of probe lesson, the answers to the questions from the questionnaire and interview revealed that 71.60% from the students have

combined the models which stimulate the visual learning style with those which stimulate the auditory learning style.

Table 1

**The didactic methods used by the students within the lessons**

<b>Lesson's stage</b>	<b>Didactic methods</b>	<b>Probe lesson Students (%)</b>	<b>Final lesson Students (%)</b>
verifying the knowledges	conversation	65.43	37.03
	conversation and demonstration carried out by the school children	28.39	41.97
	didactic game "who knows the answer?"	6.17	14.81
	graphical organizer	0.00	6.17
sensitizing, awakening the school children interest	narration	3.70	1.23
	conversation	88.88	80.24
	problem solving	2.46	3.70
	didactic game (rebus)	4.93	14.81
communicating / acquiring new contents	observation, demonstration, explanation, conversation	40.74	22.22
	observation, conversation, learning by discovery, explanation	3.70	18.51
	observation, conversation, problem solving, explanation	2.46	4.93
	conversation, observation, model devices, explanation	24.69	14.81
	explanation, demonstration, conversation, work with the manual	23.45	27.16
	explanation, demonstration, conversation, laboratory practical work	4.93	12.34
fixation of knowledges	conversation	27.16	18.51
	conversation and demonstration carried out by the school children	12.34	16.04
	conversation and exercise	37.03	35.80
	conversation and narration	23.45	4.93
	didactic game (rebus)	1.23	13.58
	graphical organizer	0.00	6.17
	five minutes essay	0.00	4.93

A smaller percentage of students (28.39%), combined the methods which stimulate the visual learning style with those which stimulate the auditory and practical learning styles. The analysis of the answers of students referring to the final lesson revealed that the percentage of students who have combined methods which stimulates the visual learning style with those which stimulate the auditory learning style decreased to 60.49%. Concerning the percentage of students who have combined the methods which stimulates the visual learning style with those which stimulates the auditory and practical learning styles, an increase to 39.50% from the students was found.

Another aspect that we have in view by applying the questionnaire refers to elaboration by the students of some didactic tools, which are intended to solicitate

the participation of school children during the lesson. Within the probe lessons, 11.11% from the students elaborated working records for the school children individual activity, with the aim of verifying their knowledges, and 25.92% from the students, with the aim of evaluating their knowledges. A small percentage of students (9.87%) have elaborated working records for the school children activity within groups, aiming at the fixation and systematization of knowledges. A high percentage of students (55.55%) have presented images or curiosities extracted from the Internet sites. In order to apply the didactic game in different moments of the lesson, 6.17% from the students have elaborated a rebus. Within the final lessons, the percentage of students who have elaborated working records for the individual activity of the school children aiming at verifying their knowledges decreased to 4.93%, but this resulted in the increase to 38.27% of the percentage of students who have elaborated working records for the individual activity of school children aiming at verifying their knowledges. Some students (30.86%) have elaborated working records for the school children activity within groups, aiming at the fixation and systematization of knowledges. The percentage of students who have used in the final lessons images or curiosities found on the Internet sites maintained at a similar value (53.08%) with that mentioned for the probe lessons. A higher percentage of students (28.39%) have elaborated a rebus, and a small percentage (3.70%) have identified interdisciplinary conexions and realized a schedule of a graphical organizer, which was intended to be completed with help from the school children.

Following the discussions with the mentor teachers, there have been identified the categories of school children who were solicitated during the lessons by the students (table 2).

*Table 2*

**Categories of school children who participated actively within the lessons  
given by the students**

Categories of school children	Probe lesson students (%)	Final lesson students (%)
Very well trained school children	6.17	0.00
Very well, and well trained school children	20.98	3.70
Very well, well, and poor trained school children	16.04	7.40
Very well, well, and very poor trained school children	9.87	20.98
Very well, well, poor, and very poor trained school children	46.91	67.90

*Table 3*

**Level of school children activation within the lessons**

Type of lesson	Activation of school children		
	to a small extent students (%)	to some extent students (%)	to a great extent students (%)
Probe lesson	6.17	46.91	46.91
Final lesson	0.00	32.09	67.90

Taking into consideration the categories of school children activated during lessons, the mentor teachers have pointed out the level of school children activation, realized by the students during the lessons given by them (table 3).

## CONCLUSIONS

1. The students have used in lessons the following modalities for activation of school children: a) they have combined different forms of activity with the school children; b) they have used various didactic methods, including active and interactive methods; they have combined the didactical methods, considering the necessity of activating the school children with different learning styles; c) they have used working records for the individual and within groups activity; d) they have created original didactic tools (rebus, graphical organizer) for gaining the interest of school children and for motivating them for learning.

2. Comparing the answers of students with those from the mentor teachers, can be identified the following types of students, with respect to their formation in order to activate the school children within the lessons: 1) students satisfactory trained – who have used properly the modalities of activation the school children during the lessons, but have solicited only a category of school children; 2) students well trained – who have used properly the modalities of activation the school children, engaging during the lessons more categories of school children; 3) students very well trained – who have used properly the modalities of activating the school children in lessons, stimulating the participation of all categories of school children.

3. For optimizing the initial formation of the future teachers of Sciences, with respect to the activation of school children at lessons, we consider that should be stimulated the creativity of practicum students and encouraged the cooperation between the students who are successful in soliciting the participation of all categories of school children, using a diversified and differentiated methodological register, and the other students.

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# EXAMPLES OF GOOD PRACTICES OF A NATIONAL TRAINER IN THE FIELD OF IN-SERVICE TRAINING OF TEACHERS FROM SECONDARY EDUCATION

## EXEMPLE DE BUNE PRACTICI ALE UNUI FORMATOR NAȚIONAL ÎN DOMENIUL FORMĂRII CONTINUE A CADRELOR DIDACTICE DIN ÎNVĂȚĂMÂNTUL PREUNIVERSITAR

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**Abstract.** *This paper presents the author's living experiences as a national trainer. There are presented not only some examples of good practices in the field of in-service training, but also some difficulties encountered within the in-service training programmes. I presented examples of curricular design focused on the competences, of strategies for in-service training, and examples of the evaluation methodology as well. The in-service training process of teachers from secondary education should be modernized according to the development standards of a postmodern society.*

**Key words:** teachers training; curricular design; competences; paradigms of professionalization;

**Rezumat.** *Comunicarea prezintă experiența acumulată de autor ca formator național. Sunt prezentate nu numai câteva exemple ca bune practici în domeniul de formare continuă, precum și unele dificultăți întâmpinate în cadrul programelor de formare continuă. Am prezentat, de asemenea, exemple de proiectare de tip curricular axat pe formare de competențe, strategii de formare continuă și exemple de metode de evaluare. Procesul de formare continuă a cadrelor didactice de la nivel preuniversitar ar trebui să fie modernizat în conformitate cu standardele de dezvoltare ale unei societăți postmoderne.*

**Cuvinte cheie:** formare continuă; proiectare de tip curricular; competențe; paradigma profesionalizării;

### INTRODUCTION

The authors of the Report to the Club of Rome, entitled *No Limits to Learning. Bridging the Human Gap*, argued that the human gap, including the one between societies is based on the fact that one does not learn how much and how he/she should need. Thus, instead of anachronistic types of learning (of maintenance and by shock), the unprecedented dynamism of the present historical time implies the innovating learning (which has as main features: the anticipative and participative characters)

*The Report to UNESCO of the International Commission for Education in the 21st Century* mentioned that the main pillars of the education in the new millennium would be related to learning to know, learning to be, learning to act and learning to live together with the others.

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## MATERIAL AND METHOD

### I. Key competences in professionalizing the training of teachers from secondary education

#### I.1. Teacher training process focused on competences

De Ketele defined in 1996 the competence as an ordinate totality of abilities that are practised to some contents in a certain category of situations to solve the problems limited to that situational area (*apud* Roegiers, 2001). This definition emphasizes the three constituent parts of a competence: content, ability and situation.

Learning is “at the same time a divergent process, at the level of capacities and convergent at the level of competences” (Roegiers, 2001). The interdependence between capacity and content will lead to the formulation of a specific objective (Roegiers, 2001).

**Competence** = (abilities X content) X  
situations = specific objective X situations

The definition of the competences can also be realized in a metaphorical manner (transfer of knowledge or stimulation of the subject's resources at a given time) (Perrenoud Ph., 2002, *In* Dolz J., Ollagnier E., Éd.),. The metaphor of stimulation underlines the subject's activity, which implies “a *totality of complex mental operations*, connected to some situations, rather *transforming the knowledge*” (Perrenoud Ph., 2002). The metaphor of stimulation suggests “the orchestration, the coordination of multiple and heterogeneous resources” of the subject, a permanent recombination of these resources (Perrenoud Ph., 2002). “Mobilization has nothing magic, it is an effort of the spirit” (Perrenoud Ph., 2002)

## RESULTS AND DISCUSSIONS

### I.2. Paradigms of professionalization

We live in an extremely complex and dynamic world accompanied by the negative consequences of the current crisis which manifests worldwide. That is why forming professionals for all the fields of society represents an important direction from the perspective of turning human to good account. “A society is not prepared to pay the correct price of professionalization unless the tasks to achieve seem very important for a job. It is not enough for the professionalization to be pledge for the quality and efficiency of education. It is not relevant to favour the professionalization of the teacher unless increasing attention is paid to training new generations” (Perrenoud, 1993,). We would also add a social status that the society should recognize! This is how one can explain the superior results of certain modern educational systems.

The professional teacher can turn to good account his competences in any situation, is able to adapt, is efficient and has a superior expertise (M. Altet, in L. Paquay & al., 1998). He is, first of all, “a professional in articulating the teaching-learning process into situation, a professional of the interaction of shared significations.” (M. Altet, In L. Paquay & al., 1998)

Specialists in the field identified six paradigms of training the professional-teacher (L. Paquay, M.-C. Wagner, In L. Paquay & al., 1998):

- a) an “educated teacher”;



It refers to mastering the scientific subject as well as elements specific of specialty didactics. In our country, the conception of the one who knows his scientific subject as a guarantee of developing an efficient activity as a teacher has remained as dominant.

b) a “technician”;

The module-training programmes often had in view training competences organized in a pre-established order, through a mechanical approach. A solution might be the organization in integrated modules (De Ketele, 1990 *apud* L. Paquay, M.-C. Wagner, in L. Paquay & al., 1998).

c) a “craftsman - expert”;

The teacher should excel in the art of assembling, structuring different elements in a coherent educational project, as a real tactician of everyday life.

d) a “reflexive expert”;

This is mostly an analyst of the educational situations regarded in their singularity and a reflexive decision factor. The authors of the quoted volume mention at a certain time the development of the professional intelligence (L. Paquay, M.-C. Wagner, in L. Paquay & al., 1998). It is within this area that we define our efforts to develop the metacognitive competence both for students and teachers.

e) a “social actor”;

Nowadays teachers are more and more imposed to involved themselves into group or institutional projects. In our country there have also appeared the opportunities to access European funds. This component is neglected in initial training and in-service training cannot achieve a pragmatic approach within this field.

f) a “person”

This appeal is focused on personalized training. The man is a project “thrown” into the world, in a state of “creation”, of permanent training all along his life. The individuality of the human being has increasingly imposed the paradigm of a **personalized training**.

The personalized training radically changes the role of the trainer who becomes an organizer, an entertainer, facilitator of varied experiences of training and education.

The quoted authors consider that each of these paradigms develops a certain face of the profession, that this does not refer to contradictory approach but rather to complementation (L. Paquay, M.-C. Wagner, in L. Paquay & al., 1998).

### **I.3. Key competences of a professional teacher**

The efforts of the specialists have tried to catch the specific competences of an individual in general (EU, 2006), of the graduate of a school period (Canada 2001, France, 2005) as well as those which lead to training a professional teacher.

Phillippe Perrenoud synthesized 10 basic competences of a teacher, each of them having other specific ones (1996): to organize learning situations; to administrate the learning progress; to conceive and evolve the differentiating devices; to involve the students in learning and working process; to work in a

team; to participate in the school administration; to inform and involve parents; to integrate ICT; to cope with the tasks and the ethical dilemmas of the profession; to administrate one's in-service training process .

Lately there have been preoccupations in this line in Romanian literature as well. Among these, there should be mentioned the research developed by a group from the University of Pitesti within a research project (Ezechil L., 2009). The authors distinguished six general competences, each of them having a number of specific competences: methodological competences, communication and relation competences, for the students' evaluation, psychosocial competences, technological competences and competences of career management.

## **II. Curriculum projection focused on competences of in-service training programme of teachers in secondary education**

In-service training programmes in which I was involved were projected in a systemic, curriculum view, underlining the interdependence between competences/objectives, the scientific content, training strategies and methods and instruments of evaluation. Here are some examples from the programmes of in-service training.

*Table 1*

<b>Interdisciplinary school curriculum</b>			
<b>CS</b>	<b>Topic / Contents Development</b>	<b>Type of activity</b>	<b>Duration</b>
<b>4. From theory to practice. Projecting and simulating some interdisciplinary didactic approach</b>			
I 8	<b>4.2. Projecting and simulating some interdisciplinary didactic approach</b>	Interactive discourse Power Point	<b>15 min.</b>
I 6, 8 III 3	Organizing work groups in order to approach the work topic. Enouncing and explaining the work topic <b>Work task</b> : Simulate an activity with an interdisciplinary character Solution of the work task and presentation of the results of the activities <b>Debate</b> : Examples of good practices and generalizing the positive experience	Practical activity Work group  Formative evaluation	50 min.  20 min

## **III. Modernizing strategies of developing stages of in-service training of teachers of secondary education**

One important element in the efficiency of developing in-service training stages is represented by the catching moment. The modalities are extremely varied and represent the trainer's personality as well as the particularities of the members of the training group. Here are suggested only a few elements which can be realized at the beginning of an in-service training stage.

### **Techniques of introduction and self-knowledge**

- Technique of introducing oneself in pairs;
- What stresses you at your job?
- What could make you relax?

- Defining the present moment with only one word;
- Diagram of coat of arms.

The efforts of the researchers and experts had in view perfecting the teaching-learning strategies, by turning to good account the acquisitions of psychopedagogical research and other fields. The end of these preoccupations has in view the realization of an efficient teaching-learning activity.

1. One orientation is represented by the re-evaluation of “traditional methods” mostly criticized because of the students’ passive character during the teaching-learning process.

2. Using active-participative strategies.

3. Unprecedented emphasis of the heuristic character of didactical strategies

4. Predominant use of active, applicable methods

5. Integrating ICT in the in-service training activity

6. Developing critical thinking (CT)

#### **IV. Methods and instruments of evaluating the efficiency of developing stages of in-service training for teachers in secondary education**

From the curricular (systemic) perspective, evaluation is the component which shows us the efficiency of the teaching-learning process. Evaluation is also a function of the educational system, interdependent with the other two: teaching and learning. The key to the approach is represented by emphasizing the relation between curriculum and evaluation, but it is also centred on competences (M. Stanciu, 2003).

The trainer has to develop his didactical activity by thinking systemically (“to see the forest”) and to act on the spot, according to the existing variables of the place and space where the training process takes place. This means that, starting from the objectives had in view, he will have to select those relevant content elements (avoiding informational overloading), choose those training strategies which will emphasize the educational values of the training process, the forms and ways of organization. Through the methods and instruments of evaluation, the trainers must have a realistic image concerning the efficiency of in-service training process.

We insist upon the fact that evaluation must be present throughout all the didactical approach, within each sequence of this training effort. What does formative evaluation really mean? It is this effort to assure a continuous feed-back in each training sequence.

At the end of the training stage there will be a summative evaluation, with use of complementary methods and instruments. The participants in the training process usually present their individual/group projects (having discussions about them); instruments of evaluating the activity developed by the trainer are applied; suggestions to continue lifelong learning are given. The evaluation commission makes general appreciations regarding the participation in the training stage and the participants receive qualifications.

## CONCLUSIONS

1. From the perspective of connecting the educational and training system to the mutations of informational society, we have suggested *the paradigm of personalized training*, which turns to a better account the resources that society puts to our disposal, as well as each individual's potential.

2. It tends to represent a *new educational ecology*, which has in view the development of competences of holistic approach of the phenomena and of informational processing.

3. An unsolved problem of the training Romanian system is *mentoring* young teachers until their confirmed examination in his/her post.

4. *The media means can be organically integrated in in-service training* of teachers in secondary education (there are module offers of *online* in-service training; initiation in integrating in the activities of creating educational platforms; realizing activities of group and individual frontal training; the development of the activity of distant learning, evaluation with media instruments).

5. A greater turning into account in the evolution and career of teachers from secondary and high education of in-service training portfolio

6. Experimental research in initial and in-service training should be intensified in the decisional process. Here must be reminded the efforts of the research group of Craiova, coordinated by Elena Joita.

7. There is no monitoring system of the impact of in-service training programmes over the change of teachers' habitus.

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# THE EFFICIENCY OF THE INFORMATION DISSEMINATION IN AGRICULTURE AREA THROUGH THE PUBLIC RELATIONS (PR) EVENTS

## EFICIENȚA MEDIATIZĂRII INFORMAȚIILOR ÎN DOMENIUL AGRICOL PRIN EVENIMENTE PR

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**Abstract.** *In a changing society where information technologies plays an important role in transmitting news, most times about virtual, events "live" complement a specific type of public access. Usually it is the public who needs a concrete impact, direct meetings. It is for those who invest in agricultural machinery, plant or animal biological material or those who wish to acquire new technologies. This paper aims to highlight the importance and effect of direct events such as "Indagra" to coverage of useful information in the shortest time among those involved that need improvement and efficiency. The purpose of this study is to demonstrate if the events of public relations (PR) may contribute to the transmission of news, if they are effective through the direct impact to the specific audience. The results show that agricultural producers and investors are more receptive to such forms of promotion, implement more easier the technological news because they can test and learn directly about them, are credible.*

**Key words:** promotion, public relation, events, agricultural technologies, efficiency

**Rezumat.** *Într-o societate în continuă schimbare, în care tehnologiile informaționale joacă un rol important în transmiterea noutăților, de cele mai multe ori pe cale virtuală, evenimentele „live” vin să completeze cu succes accesarea unui anumit tip de public. De obicei este publicul care are nevoie de impact concret, de întâlniri directe. Este cazul celor care investesc în utilaje agricole, material biologic vegetal sau animal sau al celor care doresc să achiziționeze noi tehnologii. Lucrarea de față își propune să evidențieze importanța și efectul evenimentelor directe de tipul „Indagra” în scopul mediatizării informației utile în cel mai scurt timp, în rândul celor implicați, care au nevoie de progres și eficiență. Scopul studiului este de a demonstra dacă evenimentele de relații publice pot contribui la transmiterea noutăților, dacă sunt eficiente prin impactul direct la publicul specific. Rezultatele arată că producătorii și investitorii agricoli sunt mai receptivi la astfel de forme de promovare, implementează mai ușor noutățile pentru că pot testa și învăța direct despre acestea, sunt credibile.*

**Cuvinte cheie:** promovare, relații publice, evenimente, tehnologii agricole, eficiență economică

## INTRODUCTION

Public attention is a topic of great competition for many organizations that need to be defined by his eyes. Promote products, services, ideas, or holistic

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organization is through the direct involvement of the public, calling a special tool for Public Relations (PR) and Marketing: **organizing events**

“An event is a news generator” (Balaban D., Abrudan M., Farcas P, 2008), improves image of the organization and transmit very useful information by the most direct and accessible manner to the consumers and to the end users. All this is much of the essence of Public Relations Marketing, that organizations tend to use with confidence this time, being more reliable and cheaper.

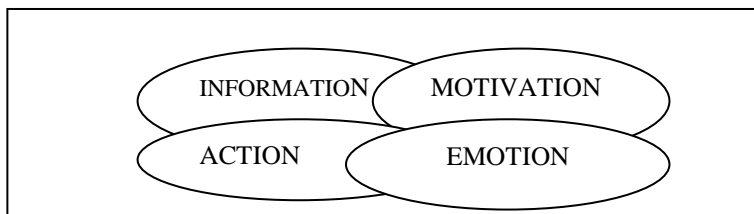
## MATERIAL AND METHOD

The methodology used in achieving scientific article includes both documentary study of specific literature, observation and analysis, and qualitative research based on structured interviews applied to a number of representatives of the event investigated.

## RESULTS AND DISCUSSIONS

Starting from what it should include a public event and the methods of evaluation of its success, as recommended by the specific theory, we have investigated one of the events representative of the Romanian agriculture. We wanted to highlight the importance of quality public relations services in the desired success of events, based on my theory-practice correlation.

The aim of a public event represent, most often, *a mix of interests* of the target group and based on *a mix of communication* for the public to obtain its maximum effect, as can be seen from figure 1 (adapted from Stephan Schafer -Mehdi, 2008).



**Fig.1. – Combining the four targets of communication within an event**

*The information* must be correlated with those already known to the target group and the public for not to repeat, but to capture. *Emotions* can be stirred up may vary to extremes: rejection and exuberance, with a deep and prolonged effect compared to pure information, to the point. *An honest discussion* with the target audience can lead, given the emotions aroused, to *long-term incentives*. As already motivated and excited, if the group will clearly find out what are *the objectives* for which the event takes place, will know exactly what to do for the organization.

The events help organizations to precisely target the audience through open presentations, usually verbal, through creativity ideas to the fore and through the credibility of those who contribute to their achievement. Organising events, as a PR tool, is included in the current trend crossing from advertising-oriented marketing to a marketing-oriented Public Relations (Ries Al.&L., 2005). Managers of organizations are beginning to recognize the power of public relations strategies to build brands. A

clever company can be positioned during an event on a specific audience and can remain in its mind because of the multitude of means of communication that has impact.

The success of a PR event can be evaluated according to the purpose for which it was organized and the methods can be used are: *Return on Experience, Enlargement, Emotion and Engagement* (ROE), in contrast to being the quantitative: *Return on Investment* (ROI). It can be search the important parameters: if the event has produced *motivation*, or *effects of short / long term*? If the event had *some meaning for participants*, desired by the organizers.

On top of the events organized for the Romanian agricultural sector are mainly *the events of presentation*, which we will deal in this article and we will evaluate one of them based on ROE. We illustrate with a ranking of the leading European agricultural exhibitions that editors "FARM" (<http://www.revista-ferma.ro>) and the magazine "Agro-Business" (<http://www.agro-business.ro/tag/exhibitions>) is done as:

1. „EuroTier”, Hanovra - The most important agricultural fair in Europe;
2. „Săptămâna Verde”, Berlin - International Exhibition for Food Industry, Agriculture and Horticulture;
3. „VIV Europ” Turcia, Rusia – exhibition of farm animals;
4. „VINVEST”, Timișoara - International Wine Shop;
5. „AGRARIA”, Cluj-Napoca - International Fair for Agriculture, Food and Packaging Industry, the flagship for the Transilvania area;
6. „AGROMALIM”, Arad – International Agricultural Exhibition organized by the Chamber of Commerce, Industry and Agriculture;
7. „Intervitis, Interfructa”, Stuttgart - a top international event focused on technologies related to wine, fruit and fruit juices and distilled;
8. “Ecoagris”, Iași - organic and traditional products fair;
9. „INDAGRA”, București – International exhibition of equipment and products for agriculture, livestock and food

We chose to study INDAGRA event of great importance during the 15 years for the Romanian market, which attracted not by this, but by the fact that he had a resounding failure in 2010. By applying ROE, we conducted a structured interview intended for some representatives of the companies participating in the exhibition with various tools, technologies or products, and we know which were the main strengths and weaknesses of the event. We first present the objectives, the purpose and the target audience to be able to match them with the results obtained and to draw the necessary conclusions.

In November 2010 took place in Bucharest the XV international exhibition dedicated to equipment and products for agriculture, livestock and food industry, INDAGRA. There were two sections INDAGRA INDAGRA FOOD and INDAGRA FARM. *The objective of the event* was attracting a larger number of participating companies and visitors than in 2009 and the degree of internationalization to be higher.

The purpose of the event was the development of Romanian business environment in the agricultural sector by creating new partnerships, launching new brands in the field, to inform the representatives of Romanian companies and investors about the novelties in the field in order to improve the agricultural activity, attracting public attention who visited the fair regarding on the importance of organic food and natural.

**The public event:** the event was and is dedicated to employers and senior decision makers, technical departments and specialized units of the agro-food students.

Following the structured interview made for this event, we could evaluate it:

### **1. Negative aspects:**

- attended few companies importing agricultural machinery;
- was a complete lack of meat processors
- It was noted that the effectiveness of fair and interest of participants have been lower in recent years that because the organization period of the event have changed repeatedly and also the structure of the event.
- representatives of companies said they had been visited by a very small number of specialists, and the benefits obtained were almost zero.
- some participants noted that the demarcation between Indagra Farm and Indagra Food was not beneficial for many visitors. They have not seen the two distinct exhibitions sale and they were confusing;
- some exhibitors considered that INDAGRA is no for the specialists, ie for their customers, *the event you must not miss it*
- other exhibitors noted that INDAGRA are not any good pictures. Worse, you could say that it has a negative image of "stealing" due to: the people at Romexpo, the prices, the logistical obstacles
- the organization was seen as undesirable and tariffs also.

### **2. Positive aspects:**

- ❖ many contracts were signed between representatives of companies attending trade visitors and managers.
- ❖ It is want a clearer delineation of the agricultural food industry, the two majors specializations be namend: INDALIM or ALIMENTA and INDAGRA FARM;
- ❖ s-a coștientizat faptul că târgul ar trebui organizat mai rar, din doi în doi ani, pentru a crea cerere de informații mai mare și public mai numeros; rata apariției de noutăți în domeniul mașinilor, utilajelor și tehnicilor alimentare este de 2-3 ani.
- ❖ it was realized that the fair would be held less frequently, at every two years to create demand for more information and the wider public; rate of emergence of innovations in machinery, food machinery and techniques is 2-3 years.
- ❖ the organization of 2 in 2 years would allow a fair INDAGRA better coordination with other international fairs in Eastern Europe.
- ❖ is intended knowledge of customers' wishes to better understand what are the optimal solutions.



- ❖ is found that the number of specialists who visited the stands of specialized equipment has led to increased activity after the fair;
- ❖ the participation of a large numbers of customers from Moldova Republic was observed, demonstrating that this is a very important area for agricultural business.
- ❖ trainings held have been very popular to customers to understand how the use of equipment and technology
- ❖ It was noted a very large audience for each demonstration performed live
- ❖ some companies have also offered demonstrations in the customer production departments, which is very important to finally convince them of the equipment quality of equipments and for long term cooperation in the field.
- ❖ some participants with various exhibits recognized that INDAGRA help them to promote their business image, over the time of fair;
- ❖ It suggests improving the promotion event to be known and to enrich it with exhibitors and visitors.

The statistical figures that INDAGRA event has achieved its main objectives, as can be seen from the following situation:

*Table 1*

**The evolution of the event parameters INDAGRA**

<b>Parameters/ Years</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
<b>No. Participating Companies</b>	579	491	585
- romanians	307	304	351
- foreign	272	187	234
<b>Degree of internationalization</b>	47%	41%	40%
<b>No. of participating foreign countries</b>	23	20	23
<b>No. of visitors</b>	39.000	30.000	42.000

So we can talk about success in terms of objectives: in 2010 was attended by 19.5% more than 2009 participating companies, the number of foreign participants was compared with that of 2008, although in percentage terms decreased the degree of internationalization. The number of visitors increased by 40% in 2010 compared to 2009.

## **CONCLUSIONS**

While that number, seems a successful event, ROE analysis based on qualitative instruments such as structured interviews and content analysis of press articles, shows that the situation is different.

The purpose of the event was not reached, only a proportion of 25-30%. There have been too few contracts with firms that have participated in the fair INDAGRA. Some of the key players on the Romanian market (processors) were absent. Many participants said they were dissatisfied with its organization and structure always different, somewhat puzzled. Also noteworthy was the frustration of all the organizational period. The purpose of the event was not reached, only a proportion of

25-30%. There have been too few contracts with firms that have participated in the fair INDAGRA. Some of the key players on the Romanian market (processors) were absent. Many participants said they were dissatisfied with its organization and structure always different, somewhat puzzled. Also noteworthy was the frustration of all the organizational period

The interest for INDAGRA of potential business partners were perceived as increasingly less because of low quality of previous editions and because of the repeatability of the event in a year. Those who have highlighted this issue went on the idea that technological progress and new ideas appear, on average, within 2 years, so often manage INADGRA means low surprise public interest.

Among the pluses of the event we can indicate the bigger number of participants in comparison with previous fairs; some participants experienced a greater workload. The businessmen have realized the importance of partners from Moldova Republic and the potential of Moldova market; they understand that trainings and presentations "live" are essential for customer confidence.

As constructive proposals on the organization of the events INDAGRA future, it specifically to make them every two years at a fixed structure with a well-defined and consistent structure, and better promotion of the event.

The excess for the agricultural and economic Romanian life by the event of Public Relations Marketing as INDAGRA type are very important especially in these times of economic crisis in which businesses are struggling to survive and to gain new partners. For this reason, it has to be taken into account all the shortcomings noted by participants in the interview and the PR specialists. The purpose is to create exceptional future events, whereby the image of producers, processors and Romanian businessmen to be a great, beneficial, favorable business development, to create a quality brand.

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# BUSINESS MODEL DIMENSIONS AND THEIR IMPACT ON COMPANY

## DIMENSIUNILE MODELULUI DE AFACERE ȘI IMPACTUL LOR ASUPRA FIRMEI

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**Abstract.** *The business model explains how to create economic value. Any business model indicated key resources and core competences. Company fails to obtain necessary resources and powers only if it has enough appeal and credibility (reputation). The business success is reflected in increase the market value of the company. We propose a modality of analysis of the business model based on the identification of the distinctive competencies which, in our conception, may facilitate the optimization of the processes of creation of the economic value.*

**Key words:** business model, core competences, economic value, reputation.

**Rezumat.** *Modelul de afacere explică modul de creare a valorii economice. Orice model de afacere indică resursele și competențele cheie ale afacerii. Firma reușește să procure resursele și competențele necesare numai dacă prezintă suficientă atractivitate și credibilitate (reputație). Succesul afacerii se concretizează în creșterea valorii de piață a firmei. Propunem o modalitate de analiză a modelului de afacere fondată pe identificarea competențelor distinctive, care, în concepția noastră, poate facilita optimizarea proceselor de creare a valorii economice.*

**Cuvinte cheie:** model de afacere, competențe cheie, valoare economică, reputație.

## INTRODUCTION

One of the integrative paradigms in management may be considered the idea of business model. In foreign specialized literature, the concept of *business model* has met lately an intense debate. The most recent and relevant aspects of these debates appear in the works of Gentor and Duplaa (Gentor D., Duplaa C., 2009) or in Lequex and Saadun (Lequex J.-L., Saadun M., 2008).

The purpose of the paper is to present my own „model“ of the business model.

A business model refers to the system of essential and sustainable factors which configure the distinctive competencies and the competitive advantages of the business, determining thus the strategic positioning, the financial performances and the market value. Indisputable, the business model is the materialization of a theory or a philosophy of the business (Drucker P., 2007). According to Drucker, the business philosophy consists of a series of

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„presumptions“ on which the organisation of business – the firm is built and run. These presumptions shape the reactions of the organisation, determine its decisions on what it should do and what it shouldn't do and explains what does it mean for the organisation significant results. The presumptions that outline the business philosophy aim at the environment of the organisation, its mission and its key competencies necessary in order to achieve the organisational mission.

## **MATERIAL AND METHOD**

The role or the function of the business model consists in selecting and securing on long term the network with material, financial, informational, knowledge and work flows through which the economic value will be extracted. More precisely, the business model shows on which offer, processes and infrastructure, finances, way of relating to the market and human competencies will count the firm on in order to create the economic value. The business strategy is the tool (mean) of implementing a determined business model. Here we consider appropriate the following shadings: the strategy must be understood as a systematic process and oriented by organizational changes through which a well-defined business model is translated into practice and, consequently, is transformed into a functional chain of economic value creation; the more complex the business model, the more numerous the strategic alternatives it may open, so that to a business model is usually associated not a single strategy, but a family of strategies. In this way, we can discuss the following successive causality:

Business philosophy → Business model → Business strategies

The work hypotheses that we considered in order to underlie this model are as follows:

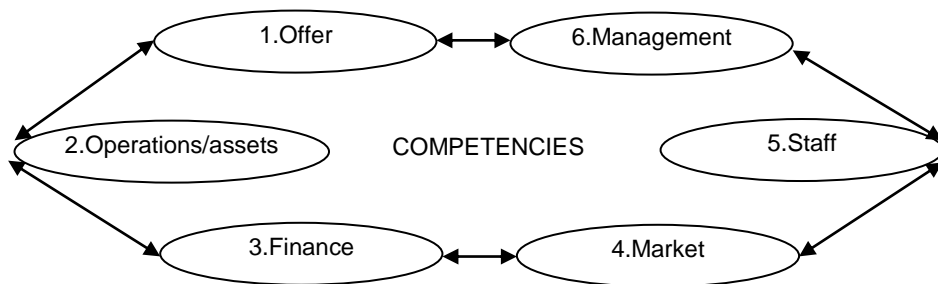
- 1) The main mission of a business consists in creating the economic value.
- 2) To create economic value means to offer, by means of the market, something for which the clients are willing to pay.
- 3) The economic value is generated by exploiting some resources furnished by the business environment that represent, at the same time, the market for the products/services realised within the business.
- 4) The environment provides the firm with the necessary resources and accepts its products only if the firm has a sufficient degree of attractiveness and credibility.
- 5) The most reliable index of the business success is the increase of its market value.

## **RESULTS AND DISCUSSIONS**

The business model, being a complex intellectual construction, may know not one, but several levels of integration. Thus, in our opinion, may be distinguished the following plans of approaching the business model: 1) The simple business model (basic), 2) The expanded business model, 3) The complete business model.

*The simple business model (basic)* may be described as that fundamental combination of the business aspects, which produces the distinctive competencies and the competitive advantages. We consider that these fundamental aspects are the following: the offer; the basic operations and assets; the staff management; the financial management; the market management and, finally, the overall management infrastructure. The distinctive competencies of the business result from the way in which these aspects interact (fig. 1). Therefore, the business model

indicates the source of the competencies. Subsequently, through the valorization of the competencies are created and consolidated the competitive advantages, and their exploitation determines, as a consequence, the strategic positioning, the financial performances and the market value of the firm.



**Fig. 1 - The simple business model (basic) (Own elaboration)**

Each of the six fundamental aspects of the business may be decomposed in a reduced number (we opted for four) of background problems, that set out, practically, the structuring and functioning of the company. Explaining these aspects, as well as the problems that configure it, is crucial to understand the way in which the business will develop and the money will be earned (Phillips J., Phillips Pulliam P., 2007).

Further, we propose the following basis for identifying the fundamental aspects: 1) *The offer* is defined by the answers to the following questions: What specific benefits the products/services of the firm provide to the customers and what differentiate these from the products/services of the competition?; Who are the customers and which of their needs are satisfied?; What is the ratio quality (functionality)/price?; How is it realised the adaptation of the offer (product innovation) according to the market dynamics? 2) *The operations and basic assets*: Which are the real processes that produce the economic value?; Which are the essential technologies and work processes?; What activities will the firm realise in the interior and what activities will outsource?; Which assets the firm must necessarily possess and what assets may be rented, acquired by franchise, lease or concession etc.? 3) *Financial management*: What minimum ratio between the economic profitability and the minimum average weighted cost of the capital is desired?; What minimum ratio will be maintained between the variable expenses and the fixed expenses?; What is the minimum total capital necessary for the normal functioning of the business?; What regularity, consistency and structure will the financial flows have (the entry ones – payment collecting, as well as the exit ones – payments)?; 4) *Market management*: How do the markets find out about the firm's offer?; How do the firm's products reach the consumers?; How does the firm inform itself about the market's evolution?; What pairs product/market?; 5) *Staff management*: What competencies and professional expertise are essential for the business success?; Which is the ideal human profile for the business?; What

minimum effective staff are necessary?; How will the staff be motivated?; 6) *General management infrastructure*: How will the activity be divided into distinct tasks and what integration mechanisms will be used for their coordination?; How will the decisions be taken and the activities planned?; How will the operations and the people be controlled?; What configuration of the internal and external communication system is necessary in order to furnish/disseminate vital information?

Closer examination of these dimensions leads to the conclusion that these are not only technical matters, but represent magisterial options of the managers/entrepreneurs regarding the conception, organisation and functioning of the business, options that point out their business philosophy. We suggest that the configuration effort of the business model must begin with a very precise explanation of the offer. This because the offer is that fundamental aspect of the business model which summarizes the economic value that the business intends to provide the customers with. „Proposal of economic value for the customer“ (Ridderstrale J., Nordstrom K., 2007), as the offer was named by the authors of the inspired *Karaoke Capitalism*, constitutes the core of the business, representing, at the same time, the starting point in the selection and adaptation of all the elements of the business system.

*The extended business model* is based on the idea that the impact of the competencies on the strategic position, the financial performances and the market value of the business is interceded by the reputation that the firm enjoys. The reputation (as well as the image) reflects the system of perceptions and impressions which different external and internal audiences have about the firm. Only that, unlike the image, which is the result of communications (marketing, financial, social, internal), the reputation is the consequence of the actual experiences and of the direct contact which the audiences have had with the firm (Davis A., 2008).

Thus, if the strategic position, the financial performances and the market value are internal dimensions of the business, the simple business model represents the synthesis of the internal aspects. The relation between the „interior“ and the „exterior“ is arbitrated by reputation – the totality of the representations and evaluations of the firm formed by various actors on the inside and outside. In order to generate results, a „business device“ must be „well seen“ by the public, in the broadest meaning of the term. The reason is quite simple – both resources and the positive effects of the business (sales, earnings, profits, etc.) are extracted from the firm’s environment. A business with a good reputation will get a little bit of each, while one with a fragile reputation – will not. If the business is attractive and reliable for different segments of the public (clients, shareholders/investors, employees, suppliers, partners, community, etc.), they will buy its products and will provide the necessary resources. The strategic position, the financial performances and the market value of the firm represents „the mirror image“ of the business model, image projected through reputation.

*The complete business model* details all the elements that interfere between the simple business model (basic) and the market value of the firm:

- 1) The simple business model, representing the generic way of supply, combination, use and management of the business resources in order to create economic value.
- 2) The essential competencies (key) are those dimensions of the business model that have a major importance in assuring the continuity and consistency of the processes of generating economic value.
- 3) The competitive advantages constitute effects of the key competencies in which the firm excels, manifesting itself as a support of the business efficiency.
- 4) The reputation may be understood as the way in which the competitive advantages are perceived and appreciated by the socio-economic environment of the firm.
- 5) The strategic positioning is the place regained or assigned to the firm in its „ecosystem“ as a result of exploiting the competitive advantages. The interface between the competitive advantages and strategic positioning is the reputation of the firm.
- 6) The financial performances and business' risks represent „the return effects“ generated by the quality and the amplitude/extent of the strategic positioning. The risks reflect the volatility of the financial performances.
- 7) The market value of the business reflects the overall assessment, both quantitative (financial) and qualitative of the business force, being, in this manner, the synthetic expression of the success and attractiveness of the firm for different segments of the internal and external public.

The completely business model suggests that any business has four defining elements: 1) The definition of the economic value which the firm intends to provide the customers with; 2) The key competencies which, constituting the support for the internal efficiency, produce economic value; 3) The reputation, which preserves, consolidates, amplifies and refines the economic value generated by competencies, through the external recognition of the internal efficiency, as a result of satisfying the expectations formulated by different groups interested from the business environment. The reputation acts as a „relay-transmitter“, converting the competencies in business value; 4) The market value of the business, being the final overall effect of the way of origination, structure and functioning of the business model.

## CONCLUSIONS

1. The mission of a business model is to highlight the strategic capital of the firm, as a source of the created economic value. In a business, may be involved and exploited the following three types of capital: *the technical capital*, *the financial capital* and *the intellectual capital* (the reputation itself may be regarded as an element of the intellectual capital).

2. The business represents a mix consisting of elements of the three types of strategic capital. But in any business there may be identified a dominant type of

strategic capital, which will determine the practical way to extract the economic value.

3. We consider that the business models may be classified according to the dominant strategic capital:

- Business models based on the technical capital in which the economic value is produced especially with the help of the technical resources and competencies.
- Business models based on the financial capital, that generate economic value, using, mainly, financial resources and competencies.
- Business models based on the intellectual capital, which extract the economic value by valorifying the intangible resources and the intellectual competencies.

4. Within each class of the business models the dominant strategic capital will determine the key-competencies of the business, the kind of reputation that the firm will benefit of and, finally, the structure of the market value of the firm.

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# MECHANISMS AND INSTRUMENTS OF FINANCIAL SUPPORT FOR THE AGRICULTURE OF GALAȚI COUNTY

## MECANISME ȘI INSTRUMENTE DE SPRIJIN FINANCIAR ÎN AGRICULTURA JUDEȚULUI GALAȚI

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**Abstract.** *The paper aims to provide an input in analyzing the economic efficiency of farms and the effects of payment schemes on their performance. The study also aims to analyze the changes that have occurred in the European agricultural space by implementing the payment system, knowing that the new Member States which apply the single area payment scheme (including Romania), have the possibility of applying this simplified system beyond 2013. The financial assistance granted to farmers in the form of the single payment scheme following both the historical model and the regionalized one is based, more or less, on a past reference period (currently set between 2000 and 2002). Very important for the agricultural development of Galati county is also the economic-financial support to farmers, which will be achieved through mechanisms and instruments, in accordance with the law. So far, the economic and financial support for crops production has been granted to certified seeds, fertilizers, pesticides, according to OUG. 65/2006. Because the current measures of the agricultural development policy involve Romania directly the authors will present a summary of the key reforms proposed and the options that Romania has in applying these agricultural policies.*

**Key words:** mechanisms, financing instruments, finance, agricultural policy

**Rezumat.** *Lucrarea își propune să aducă un aport în analiza eficienței economice a exploatațiilor agricole și a efectelor schemelor de plăți asupra performanțelor acestora. De asemenea, studiul vizează analiza modificărilor produse în timp în spațiul agricol european prin implementarea sistemului de plăți, cunoscând faptul că, pentru noile state membre ale U.E., care aplică schema de plată unică pe suprafață (inclusiv România), se întrevade posibilitatea de a aplica acest sistem simplificat și după anul 2013. Ajutorul financiar acordat fermierilor sub forma schemei de plată unică, atât sub forma modelul istoric, cât și cel regionalizat, se bazează într-o măsură mai mare sau mai mică pe o perioadă de referință trecută (în prezent stabilită a fi cuprinsă între 2000 și 2002). O importanță deosebită asupra dezvoltării agriculturii județului Galați o are și sprijinul economico-financiar acordat fermierilor, care se va realiza prin mecanisme și instrumente specifice, în concordanță cu legislația în vigoare. Până în prezent, sprijinul economico-financiar în producția vegetală a fost acordat pentru semințe certificate, îngrășăminte chimice, pesticide, conform OUG nr. 65/2006. Întrucât măsurile actuale de politică de dezvoltare a agriculturii implică direct și România, autorii vor prezenta o sinteză a principalelor reforme propuse, precum și opțiunile pe care le are România în aplicarea acestora.*

**Cuvinte cheie:** mecanisme, instrumente financiare, finanțe, politici agricole

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## **MATERIAL AND METHOD**

The study involved detailed knowledge of agricultural production processes and of the relations between them and the financial support, for which reason the following actions were taken:

- a thorough documentation on the potential ways and means to finance crop production, achieved by knowing the laws in force;
- direct involvement in financing implementing activities to support the agricultural production;
- systematization of the existing information and data, their analysis and synthesis, and the conclusions on the allocation of financial resources directed to the agricultural production in the county of Galati.

## **RESULTS AND DISCUSSIONS**

The concept of a European model of agriculture was formally defined in 1997 in a period of new challenges for the European agriculture, mainly related to: the European Union expansion towards Central and Eastern European countries, the growing international competition, domestic financial constraints.

The European agricultural model includes a set of values shared by EU Member States. From the outset it included the continuation of the CAP reform model started in 1992, their expectations being to achieve further durable solutions, particularly from an economic perspective, but socially acceptable. The decision in 2003 reinforced the principles of reform of the European model of agriculture, and the approval of the financial framework for 2007-2013 has provided resources (Chiran A. et al., 2008; PNDR 2007-2013).

Briefly, the model assumes a sustainable agriculture economically, environmentally and socially, having at its core the concept of multi-functionality. In most European countries, family farms are a key element in achieving the objectives of the model, even if there are differences between Member States in terms of production systems, farm size and natural conditions, as well as the cost of production.

In Romania there are a total of about 4 million farms of different sizes which employ about 2 million people, or 30% of the working population of Romania. Although these figures are deeply disproportionate from the European average (only 5.6% of the active population is working in agriculture in the EU-27) it is not a concern in itself. Problems arise, however, when trying to disseminate the structure of these farms and their economic sustainability. The data are alarming, to say the least: of the 4 million households, 2.5 million have less than 1 hectare, and only about 900,000 have the minimum degree of economic profitability (1 ESU). However, of all 900,000 profitable farms, about two thirds produce for personal consumption only. A simple calculation shows that, out of the 4 million Romanian households, only 312,000 (or 8%) are economically viable and connected to the market (especially large agro-industrial farms) while the remaining 92% are mostly subsistence households. The lack of consistent data on the economic dimension of small and medium-sized farms significantly prevent political support decisions.

Despite the methodological limitations imposed by a certain delay in taking over the instruments of analysis of the farm (RICA, structural surveys), the general picture of the orientation of Romanian production farms, reveals a somewhat predictable feature of small size farms: a combination of growing crops and farm animals, known as "traditional polyculture" specific to peasant holdings. If, to this picture, we add some rural Eurobarometer results, obtained in Romania in 2002 and 2005, which highlight some *worrying attitudes of rural residents (present farmers) in connection with entrepreneurial spirit and intention of moving from traditional agriculture (semi-subsistence), to pass to a modern agriculture, to a trade agriculture*, then we can conclude that for these segments, "implementing" the measures must be based on counseling and training, especially for the category of farms that have a potential for exceeding the subsistence level.

**Financing the Romanian agricultural farm** is aimed, at this stage, at the formation of the "commercial sector", with viable European farms (holdings). For this purpose it is necessary to promote an adequate system for financing production and investment in agriculture (Filip G., Onofrei M., 2001; Reg.CE nr.1782/2003). To finance farms, two categories of sources are used:

- **own sources** (*net profit and depreciation fund for corporate farms, gross margin for family farms producing for the market*);
- **additional sources, which come from:** *the state budget (subsidies), external financial assistance grants, the external credit inflows, bank loans, other domestic sources (credit cooperatives, moneylenders, friends and relatives, term delivery sales, bank certificates of deposit, leasing etc).*

The main instruments of support, implementation and consolidation of the Common Agricultural Policy are: *prices, subsidies, production quotas and customs protection*.

Romania had the freedom to decide on the following aspects of the funding modalities:

- *the choice of direct payments scheme;*
- *choosing to supplement the direct payment with national severance pay;*
- *the possibility of transferring funds from the budget for rural development in the agriculture budget.*

**The choice of the payment scheme** has been achieved respecting the rules imposed by the CAP for all new EU member countries. Of all the new Member States, eight chose as funding mechanism the single area payment scheme (Single Area Payment Scheme - SAPS) as an interim solution for a period of three years, with the possibility of extension - twice, no more than one year each - with approval of the European Commission, after which the standard direct payment scheme or the single farm payment scheme (Single Payment Scheme - SPS) is to be adopted.

**The amount of support from the Community budget for new Member States** for direct payments could not exceed the limits of the allocated direct payments, i.e.: 25% of the direct payments in the first year after joining, 30% in the second year, 35% in the third year, 40% in its fourth year and 10% each year until it reaches the full 100 % (Chiran A. et al., 2008; Bîzu C.L., Chiran A., 2010):

The financial package for Romania, from the Community budget, allocated to implement the CAP for the period 2007-2013, exceeds 4 billion Euros, with the following destinations:

- the financial support for the proposed direct payments amounted to €881 million to sustain products or sectors that have established quotas, reference surfaces or national ceilings and does not require national co-financing from the national budget;

- the sum of €732 million was proposed for market measures, without national co-financing;

- the amount of €2,242 billion, part of the package designed to support the rural development policy, which Romania will have to contribute to by co-financing with the sum of approximately €606 million.

It appears that the Galati County farms under 50 ha area (individual farms), run into 26,307, accounting for 31.3% of the agricultural area, with an average area of 3.87 ha. The 140 family associations holding 7.21% of the agricultural area have an average surface of 180.8 ha and the 48 agricultural companies with legal personality detain 17.99% of the area.

On the other hand, the 101 companies own an average area of 1514.30 hectares, 43.50% of the county's agricultural area.

Table 1

**Growth in direct payments per area (% compared to previous years)**

Sizeholding	Area (ha)			Amounts awarded (thousand RON)		
	2008/2007	2009/2008	2009/2007	2008/2007	2009/2008	2009/2007
<50ha	1,46	2,16	3,66	39,20	42,37	98,18
50-1000ha	18,03	-26,61	-13,37	61,93	2,28	65,62
1000-2000ha	49,18	21,19	80,79	104,67	68,88	245,66
2000-3000ha	105,49	123,66	359,60	181,92	211,69	778,73
3000-4000ha	1,76	9,65	11,58	39,61	52,81	113,34
4000-5000ha	2,91	13,01	16,29	41,18	57,49	122,34
5000-6000ha	-49,47	2,35	-48,29	-30,68	42,63	-1,13
6000-7000ha	0,00	122,39	122,39	0,00	209,92	209,91
<b>SUM</b>	<b>15,63</b>	<b>1,90</b>	<b>17,82</b>	<b>58,63</b>	<b>42,00</b>	<b>125,26</b>

As shown by the data presented in table 1, there is an increase of the areas that required payments by 15.63% in 2008 compared to 2007, by 1.90% in 2009 compared to 2008. Also, in terms of growth rate of disbursements under direct payments there is an increase of 58.63% in 2008 compared to 2007 and of 42% in 2009 compared to 2008. The increase appears both as an effect of expanding the areas for which payment was claimed by 17.82% in 2009 compared to 2007 as well as an effect of the amount of compensation per hectare, which increased from €85 in 2007 to €110 in 2009.

Regarding the amounts granted to Galati county for market measures, the data presented in figure 1 reveal that in 2007-2009 the highest amounts (873,438.10

RON) were given for the vineyards restructuring/reconversion program, in accordance with Disposition no 211/2007 of the Minister of Agriculture and Rural Development, followed by the assignment of 106,701.78 RON for organizing producer groups in accordance with Government Decision no. 1078-2008 (figure 1).

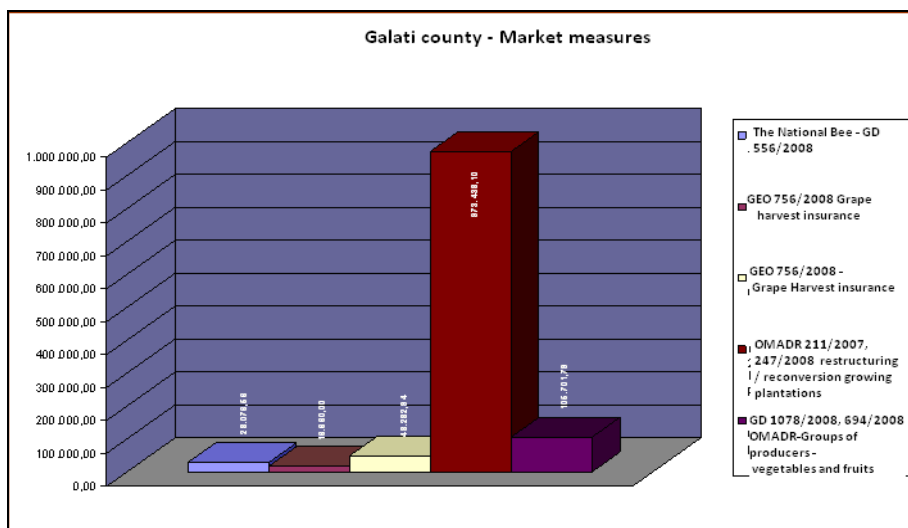


Fig.1-Paymentsformarket measures

The new CAP reform must take into account the peculiarities of the new Member States, where agriculture plays an important role in the national economy. It must also provide a realistic support for agriculture, to allow the new members to overcome structural problems and to achieve the convergence objective, by increasing their level of development and added value in agriculture, in order to bridge the efficiency and competitiveness gap between the older and the newer members.

Romania sustains the need to discuss the agricultural budget for the post 2013 period, after which the objectives and measures within the CAP will be discussed again.

The structure of the new budget for agriculture should create equal conditions of competition on the EU internal market and give the agricultural, administrative and economic structures in Romania the opportunity to develop and capitalize the country's potential. For the next period the idea should be publicly promoted that agriculture must be regarded as a common possession and sustained as such, because it can meet the increasing demands of European consumers by supplying wholesome, safe and quality products. In this respect, direct payments should be maintained after 2016 (the year that Romania will reach the 100% level), and the mechanism for constructing the budget should take into account the new CAP objectives (PAC, 2010).

For the 2014 – 2019 period, in view of achieving the complex process of *sustainable development of agriculture and the countryside*, Romania supports a rural development policy that meets the real needs of rural regions and contributes further to combat climate change.

Measures specified in the I<sup>st</sup> pillar of the Common Agricultural Policy in Romania constitute an important tool for ensuring food security and farmers' income, but also as a payment for the provision of public services through respecting environmental cross-compliance requirements.

Regarding the introduction of the principle of co-financing measures for the I<sup>st</sup> pillar of the CAP, Romania considers that it would exert a significant pressure on national budgets, and reinforces the differences between developed countries and less developed ones.

## CONCLUSIONS

1. Implementation of the Common Agricultural Policy in Romania, in general, and in the county of Galati in particular, is supported by significant financial resources allocated from the Community budget and the national budget. Compared with 2000-2006, the first year after becoming a member Galati county received support for agriculture up to 3.0 times higher, and in 2009 4.4 times higher. Therefore, the support per 1 ha of farmed land (or plowable land) and the average per farm increased accordingly.

2. Although the agriculture of Galati county is ranked, in many respects, above the average level of development of this sector in Romania, farmers are facing financial problems for the development of productive activities and investments, due, on the one hand, to the very faint support offered by the financial institutions, and on the other hand, to the delay in the payment of subsidies, respectively to their much smaller size compared to the old European Union member countries.

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# COSMOPOLITAN MANAGER – REALITY OR UTOPIA

## MANAGERUL COSMOPOLIT – REALITATE SAU UTOPIE?

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**Abstract.** *Being caught between their own cultural dominants and the need to achieve competencies for the accommodation in a multicultural environment, the Romanian manager may be confused. How can they overcome their own cultural predispositions, which intercultural competencies should acquire in order to handle themselves in the new economic context which increasingly involves inter- and multi-culturality and which would be the ways to form it, are questions that we intend to answer in this article, starting from the analysis of the cosmopolitan manager model proposed by Moran and Harris and taking into account, in the same time, on the elements of cultural specificity that may constitute in imprints or barriers against change.*

**Key words:** cosmopolitan manager, multiculturalism, culturally specific, intercultural skills, intercultural training

**Rezumat.** *Aflat între propriile dominante culturale și necesitatea dobândirii competențelor pentru acomodarea într-un mediu multicultural, managerul român poate fi derutat. Cum își poate depăși propriile predispoziții culturale, care ar fi competențele interculturale pe care ar trebui să le achiziționeze pentru a se descurca în noul context economic ce implică tot mai des inter- și multiculturalitatea și care ar fi căile de formare a acestora sunt întrebări la care ne propunem să răspundem în acest articol, pornind de la analiza modelului de manager cosmopolit propus de Moran și Harris și ținând cont, în același timp, de elementele de specificitate culturală care se pot constitui în imprinturi sau bariere în calea schimbării.*

**Cuvinte cheie:** manager cosmopolit, multiculturalitate, specific cultural, competențe interculturale, formare interculturală

## INTRODUCTION

The need to overcome the national boundaries, against internationalization and globalization, is a challenge for all organizations, institutions, professional groups, individuals and, particularly, for managers. Hence, their need of cultural adaptation. It is known that the individual is marked by their own culture (Hofstede, 1996). The same thing happens with Romanian managers, who, like any other managers from another culture, are more or less *the prisoners of their own cultural programming*. Overcoming this *mental programming* depends on the manager's capacity to involve in their own training, for being able to adapt to any new cultural environment that they deal with. This training should have as the starting point the manager's cultural "given", the identification of elements that function as accelerators or perturbants along new cultural acquisitions and, as

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reference system, it must take patterns such as the cosmopolitan manager. This theoretical model, very attractive through the idea of synergy, reveals a rather utopian than pragmatic approach because it does not propose a way of understanding the cultural differences, of analysing the culture in its depth. However, it provides an aiming point for what a manager should be, seen as a key actor of change and progress within the company, which is why we focus on them in our study, being interested in the possibility of adapting the Romanian manager to the multicultural business environment, by integrating the above mentioned precepts. Are the cultural models, the axiological structures of this manager, useful for their cosmopolitan becoming or do they constitute barriers in acquiring the necessary competencies?

## MATERIAL AND METHOD

The authors Ph. Harris and R. Moran, through a new approach, a humanist one that joins to the intercultural approaches, identify an area of the cosmopolitan manager's forming, able to adapt to any new cultural environment they come in contact in, as a citizen of the global company (Dupriez, Simons, 2000; Zait, 2002). This cosmopolitan manager opposes to the old world vision, according to which the manager is "the prisoner of their own boundaries" (Dupriez, Simons, 2000). They are a citizen of the world, open to various facets of the political, social, commercial and intellectual life, without national prejudices, free from any geographical attachment (ibid.). The position they fill in requires a new role, the one to participate in investigation of norms and cultural practices on a planetary scale.

The idea of cosmopolitanism, of the cosmopolitan manager model, is supported by ten precepts raised by Ph. Harris and R. Moran in their book "Managing Cultural Differences" (ibid., p. 55-57): *cosmopolitanism* (the open and creative attitude that leads the manager to adapt their behaviour to new situations without feeling their identity threatened), *intercultural communication* (aware of the sensitive interpretation differences that may occur from one culture to another, they make efforts to learn and understand the languages and codes applied in the regions where they develop their activity), *cultural sensitivity* (the capacity to integrate at behaviour level the characteristics of each new culture which they deals with), *acculturation* (the capacity to adapt to a specific culture), *cultural particularism* (the capacity to identify their own cultural predispositions and do not require them to his collaborators with different cultural references), *intercultural effectiveness* (the capacity to acknowledge the impact of cultural specificity upon the personnel management), *global overflights* (considering the effects of markets' globalization on local economies), *cultural synergy* (the capacity to build, across differences, a common project based on cooperation, embracing differences by choosing what is good in each group or in each individual), *professional culture* (the capacity to adapt the cultural norms to the specific working methods of a given location), *world culture* (considering the mutual influences between cultures and the capacity to adapt the transnational strategies to local needs).

The article is based on the comparative analysis of data provided by the cosmopolitan manager model (Moran and Harris) with those that refer to the Romanian manager's profile, gathered through interviews with 19 managers from Iasi, Bacau and Timisoara.

The objectives of the study were the following:

- analysis of the compatibility level of a Romanian manager profile with "cosmopolitanism", as it was defined by Harris and Moran;



- outlining specific attitudes and behaviors in the Romanian management;
- analysis of professional dominants of the Romanian manager.

The sample was a random one, established following our request sent by e-mail, to the small and medium private companies. The original database, elaborated after gathering information from the National Pages, Yellow Pages, newspapers, magazines etc., included 219 addresses. Note that we specified in the sent out request that the study addresses to middle managers. The rate responses and their regional distribution were as follows:

*Table 1*

**Calculation of the Responses Rate**

<b>Location</b>	<b>No. of sent out collaboration requests</b>	<b>No. of respondents with collaboration accept</b>	<b>Responses Rate</b>	<b>No. of respondents who really collaborate</b>
Iasi	69	8	11.59%	8
Bacau	70	4	5.71%	4
Timisoara	80	8	10.00%	7
Total	219	20	9.13%	19

Synthetically, the research methodology can be described as follows:

- Mix approach (qualitative-quantitative)
- Methods and techniques for collecting and processing data: structured interview, qualitative analysis (comparative-interpretive), quantitative analysis (statistical analysis).

In order to outline the cultural profile of the Romanian manager through self-evaluation features we used the content analysis (grouping the features according to their semantics area and ordering them according to their occurrence frequency). We then analyzed the correlation between the skills needed to the cosmopolitan manager and the cultural predispositions of the Romanian manager.

To analyze the leadership style regarding taking decisions we used the leadership model developed by Victor Vroom and Arthur Jago (1988), built around a key variable, the participation level, which defines the following styles:

- Autocratic A1 - the manager solves the problem or take decisions alone, using information available at that time;
- Autocratic A2 - the manager obtains additional information from subordinates and takes alone the decision;
- Advisory C1 - the manager will consult individually with key members of the management; takes alone the decisions;
- Advisory C2 - the manager discusses the issue to be solved at a meeting with employees, the decision may reflect or not their influence;

Democratic D – the manager discusses the issue with the employees, identifies solving options, applies the solution presented by the group

## **RESULTS AND DISCUSSIONS**

### **1. The Professional Profile of Respondents in the Sample**

After processing the data, the following socio-professional characteristics of the respondents were noticed:

It is noted that almost three quarters of the interviewed managers have in general an economic or technical education, all have higher education, more than half are aged between 30-39 years and about 60% are male.

Table 2

Characteristics of the Respondents			
Variable		Respondents (number and percent)	
Higher education	economic	7	36.84%
	humanist	3	15.79%
	technical	7	36.84%
	medical	1	5.26%
	juridical	1	5.26%
High school studies	economic	6	31.58%
	humanist	5	26.32%
	technical	8	42.11%
age	<25	1	5.26%
	25-29	2	10.53%
	30-34	6	31.58%
	35-39	4	21.05%
	45-39	3	15.79%
	40-49	2	10.53%
	50-59	1	5.26%
sex	M	11	57.89%
	F	8	42.11%

## 2. Attitudes and Managerial Behaviours

- Dominates the Autocratic Leadership Style A2 (the option in which the manager takes alone the decision, but they require the necessary information from their subordinates - 36.84%) and the Advisory Style C1 (the manager consults with key members of the management; but not necessarily takes into account their suggestions - 31.58%);
- Regarding the leadership style, we notice differences depending on the different professional categories:
  - Higher preference of the technical professionals for the Autocratic Style (57.14%);
  - The Advisory Style is used by the managers with economic education in proportion of 57.14% (these responses may be influenced by their education in the field and actually it may cover the desirability scope);
  - Managers with a humanistic background have the highest percentage in favour of the Advisory Style (66.66%);
- All those interviewed agreed on the importance of high control and organization rules;
- Three quarters of those surveyed believe that planning is important and should be done rigorously;
- Over 60% of the surveyed managers agree with the beneficial role of competition;

- More than a third of managers believe that employees have a negative attitude towards work and over one third are still undecided;
- Only a third of managers believe they can have confidence in employees' ability to perform tasks, while half say that they use tasks delegation;
- Over half of respondents stated that encourages teamwork.

### **3. Self-Evaluated Cultural Characteristics**

According to the study, the following main features (through content analysis of the attributes used into the characterization, in response to the question "Which are in your opinion, the main three features of the Romanian manager?") resulted:

- *Creative and flexible* (attributes: creative, innovative, ingenious, adaptable, inventive, resourceful, flexible, open to new ideas, with flair, diplomat)
- *Ambitious* (attributes: persistent, tenacious, ambitious, with a desire to succeed in career);
- *Authoritarian* (attributes: authoritarian, sense of control, is always right, firmly);
- *Hard Working* (attributes: hard working, very hard working, high capacity for work, work overtime, sometimes conveniently);
- *Low confidence in employees* (attributes: low confidence in employees' ability to solve problems by themselves, attitude according to which employees consider work as something unpleasant);
- *Lack of organization and long-term orientation* (attributes: without a clear vision of future, short-term profit oriented, not visionary, lack of organization, lack of time).

There are some aspects that reflect differences of opinion regarding the manager's characteristics: communicative / uncommunicative, resistant to stress, calm / stressed, delegating tasks / no delegation, fair, serious / unscrupulous.

Comparing the identified cultural features of the Romanian manager with what Harris and Moran indicate, even in an ideal manner, as necessary competencies to deal with new cultural environments, we emphasize that there are prerequisites and possibilities for his integration (features such as creativity, flexibility, ambition, work capacity are cultural prerequisites with positive role), but this approach does not come by itself. It takes concern in this respect, awareness and understanding of the importance of knowledge and acceptance of cultural differences but also of intercultural training, to overcome those traits (authoritarian spirit, un-confidence in others, lack of organization and long-term orientation) that may impede the acquisition of intercultural skills.

The intercultural training of the Romanian manager must meet two planes, the intellectual one, knowledge related, and the affective one.

***How to form these competences?*** In particular, through *learning* and *cultural contact*. This is precisely what is intended by the *dilemma theory*, which supposes learning new behaviours from others, acquisition of new ways of solving problems. Hampden-Turner, the founder of this theory, indicates an approach of combining

the benefits provided by cultural differences, leading to a reconciliation of values, consisting of four phases (Hampden-Turner, Trompenaars, 2004):

1. *Identification of the involved cultural features;*
2. *Positioning the noticed attitude in relation with extreme attitudes;*
3. *Elimination of the compromise solution;*
4. *Developing a value-creating solution taking into account the positive aspects of both extremes.*

Another author, Rosinski (2009), provides in a very practical manner, examples of alternative use of different solutions, found by individuals from different cultures to the same general human problems, solutions learned under the guidance of a coach (this practice works at international level - there are already models of cultural learning, such as *the learning model* proposed by the *Center for Creative Leadership*, or *cultural orientation model* developed by *Training Management Corporation*).

## CONCLUSIONS

1. Following the analysis of the cultural profile of the Romanian manager, it results that they dispose of cultural acquisitions that facilitate the acquisition of intercultural competences (adaptability, creativity, flair, diplomacy, ambition, perseverance) but, at the same time, there are features that can limit this development (authoritarian spirit, confidence in others, lack of organization and long-term vision).

2. To deal with multicultural environments, the Romanian manager needs intercultural training, at cognitive level (knowledge about their own culture and other cultures in contact, awareness of cultural relativism, knowledge of other ways to solve problems) and emotional level (overcome ethnocentrism, stereotypes, partiality, cultural shock).

3. To identify the intercultural training needs, larger studies are required, carefully developed, with direct focus on the axiological structures defined by the cultural learning models.

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# STUDENT'S BEHAVIOUR AS CONSUMER

## COMPORTAMENTUL DE CONSUM AL STUDENȚILOR

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**Abstract.** *The paper presents the mean aspects concerning the student's behaviour when they buy products and services. In this order, we have analyzed the all products and services bought by the students from the Faculty of Economics and Business Administration – specialization Marketing, between 1st and 31st of November 2010. The main objective was to identify the products and services bought by the respondents, the place and the day of buying, types of shops and the distance and the place of the products on the shelf into the shop. The results indicate that, in their choices, the students surveyed are influenced by age, social status and their disposable income. They prefer nearby shops and services firms, they buy especially non-food products and brands and allocate significant sums for transport, communication and food services.*

**Key words:** students, consumer behaviour, products, services

**Rezumat.** *Lucrarea prezintă aspectele principale privind comportamentul de consum al studenților. În vederea identificării modului în care studenții achiziționează diverse produse și servicii de pe piață, am analizat totalitatea cumpărăturilor efectuate de studenții Facultății de Economie și Administrarea Afacerilor – specializarea Marketing, în perioada 1 noiembrie-31 noiembrie 2010. Scopul acestei cercetări a constat din identificarea principalelor produse și servicii achiziționate, locul și zilele efectuării cumpărăturilor, tipul de magazine și distanța parcursă, locul pe raft al produselor, achizițiile făcute de aceștia pe zile din lună și din săptămână. Rezultatele indică faptul că, în alegerile lor, studenții chestionați sunt influențați de vârstă, de statutul social și de veniturile pe care le au la dispoziție. Ei preferă magazinele și firmele de servicii aflate în apropiere, cumpără în special branduri și produse nealimentare și alocă sume importante pentru servicii de transport, comunicații și servicii de alimentație.*

**Cuvinte cheie:** studenți, comportament de consum, produse, servicii

## INTRODUCTION

Currently, the market includes a huge variety of products and services from which buyers can choose what they want to purchase exactly. Their producers, but also distributors are interested in what makes people choose one product or another, one service or another, a particular store or a day of a month or week, to influence the decisions of buyers. In the process of buying, there are many factors that affect choosing a product or another by the consumers. Thus, consumers are influenced in their choice by socio-cultural factors (culture, social class, family, social status), personal ones (age, stage and life cycle, occupation, economic circumstances, lifestyle) and psychological characteristics of each individual (personality and self-image, motivation) (Narayana Rao). K. Monroe and J. Guiltinan (Bonoma T., Zaltman G,

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1978) state that the influence factors in consumption are different, depending on the type of products. Thus, consumers are not willing to make big efforts for convenience goods, because they know exactly what product they are looking for, and choosing stores is based on experience and information they have, predisposition for certain stores having also an important role. "When the shop is the issue, although the producers are aware of sales trends, it is harder to understand how the purchasing decision of the consumer was influenced in that universe, the consumer reacting differently depending on the type of store, the category of products they are buying and, respectively, the communication stimuli (Baciu, 2008). For special goods, the customers are willing to make considerable efforts to buy goods that have certain well-defined characteristics and choosing the store depends on the presence or absence of some certain marks they are looking for, as well as on the vendors' skills in helping the client. Shopping goods are purchased following the visit to several shops, catalogues presentation being important in this case. The researchers sought to understand what consumers want in a shop and they found that low prices, quality, possibility of choosing and services are important. Also, consumers are increasingly interested to save time when they go shopping, time being evaluated in distance and arrangement of goods in departments. They want, in addition, to buy with pleasure (characterized by comfort, cheerfulness, lack of congestion) and to simplify life (no queues at the pay desks, like late hours, clear presentation of products, the presence and kindness of staff). In the literature, a dominant role is taken by impulse buying, the ones they did not put on a list, they did not planned at home, but they purchased directly in stores, under the influence of certain factors, in particular the visibility (packaging and positioning of products on shelves). Studies indicate that approximately 65% of buying decisions are taken directly in supermarkets, and over 50% are unplanned purchases, the percentage varying by good category. In addition, consumers have a natural tendency to concentrate and observe firstly the goods located at the eye level on shelves and, therefore, the arrangement of goods leads to a more easy identification (Business Research Study).

The research aims to analyze the behaviour of students in the process of purchasing goods and services, in order to adequate the merchandising techniques by the managers of trade and services companies from Iasi County.

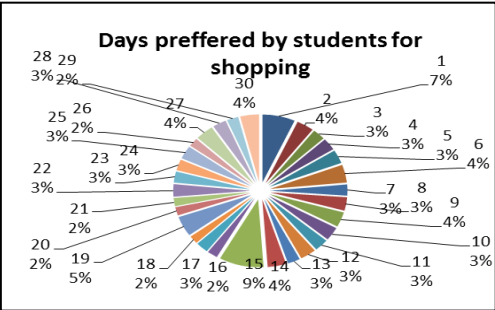
## **MATERIAL AND METHOD**

The objectives of the study were: identifying the reasons behind the students' choice of shops, identifying the day of the week and of the month in which students do their shopping, description of major purchased brands, place of goods on shelves and of the purchased goods by students. The study is based on the analysis of purchases made between 1 to 30 November 2010 by students of the Faculty of Economics and Business Administration, "Alexandru Ioan Cuza" University from Iasi, specializing in Marketing, second year of study. *The research method was the inquiry, the questionnaire* being used as a tool for data collection. Respondents were keeping all receipts and invoices from the above mentioned period, purchases being then registered into a database from Microsoft Excel spreadsheet program. This includes information on: the day of the week and month in which purchases were made, the purchased good / service, the brand, the price, the reason of choosing the good and the place on the shelf (at eye, hand, base level etc.), the

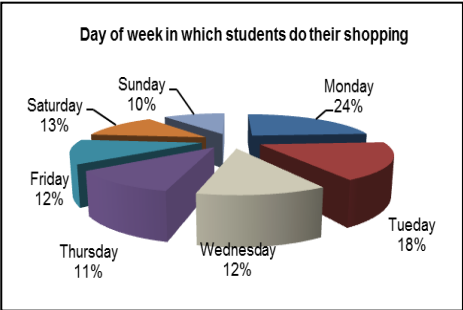
store, the distance to this store, the type store and the reason for choosing it. There was processed information from 32 students (22% from Iasi, 78% from other localities). November was chosen because purchases are not influenced by special events (holidays, vacation etc.). The sample was chosen because of the significant proportion of students in the economic life of Iasi. Data were statistically analyzed using SPSS.

## RESULTS AND DISCUSSIONS

As a result of processing the data using SPSS, it resulted that most of the purchases are made on the 15<sup>th</sup> of the month (9%), and the least - especially in the second part of the month, in says as the 18<sup>th</sup>, the 20<sup>th</sup>, the 26<sup>th</sup> (2%) (figure 1). Also, the participant students in the survey prefer Monday to make necessary purchases (figure 2), behaviour that is influenced in our view, by the moment when parents give them financial allowances (especially in weekends).



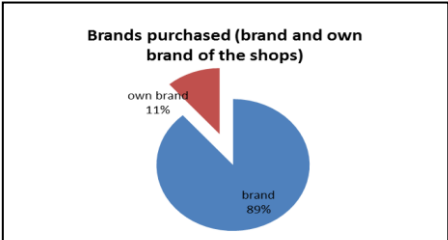
**Fig. 1 - Day of the Month in which Students Do Shopping**



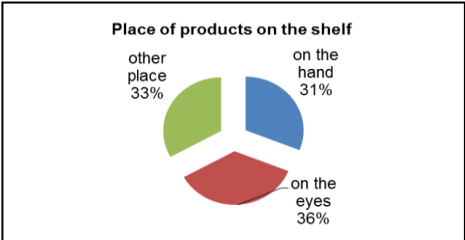
**Fig. 2 - Day of the Week in which Students Do Shopping**

In terms of the acquired marks, it is noticed (figure 3) that the brands are the most sought after, the store's own branded products representing a rate of 11% of the purchase, less than the share of the own brands at national level.

The purchased goods by students are located, especially at the hand level (31% of total) and eyes (36% of all purchases). As shown in figure 4, 33% of all purchases are placed on shelves above or below the gondolas or are services (catering units, public transport services etc.).



**Fig. 3 - Brands Purchased by the Students**

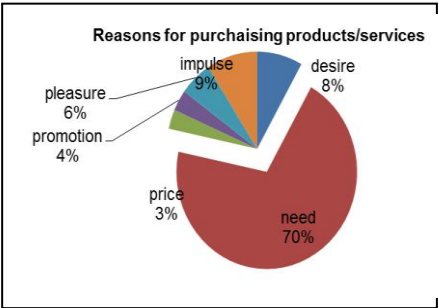


**Fig. 4 - Place on Shelf of the Purchased Goods by Students**

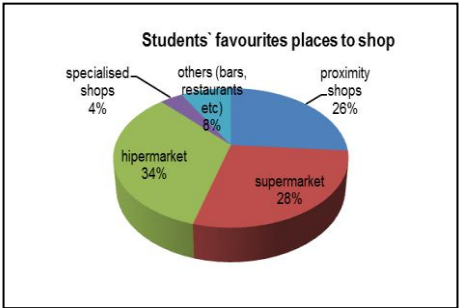
In this case, we noticed that also the students buy more goods under impulse, even if their incomes are lower than those people who have other occupations (especially those who work). Moreover, other studies show that

young people are more drawn by the displayed way of goods on shelves in stores and are more disposed for an impulsive buying behaviour (to Thirmizi, 2009).

The reasons mentioned by students that stay on the basis of purchasing decision making are (figure 5): necessity / need (70% of them), impulse - their attractiveness in a certain time (9%), promotions and prices being the least frequent (4% respectively 3% of total purchases). Most of the purchases are carried out in hypermarkets and supermarkets (34%, respectively 28% of total), followed by convenience stores (26%), public catering units or other types of services and shops. We note here that the purchases were expressed as frequency and not as value, as prices.



**Fig. 5 - Reasons of Purchasing Goods and Services by Students**

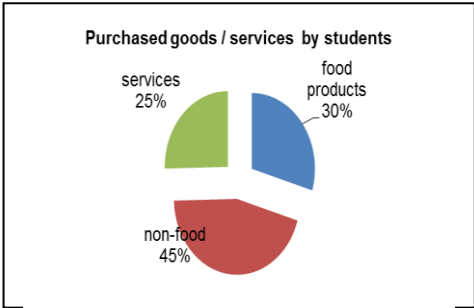


**Fig. 6 - Students Preferred Places in Doing Shopping**

Regarding the reasons of choosing shops, the distance is the reason that prevails (44% of all purchases), followed by diversified supply of goods (23% of shopping) and prices (figure 7).



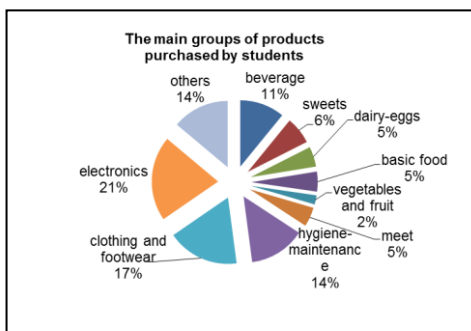
**Fig. 7 - Reasons for Choosing Shops by Students**



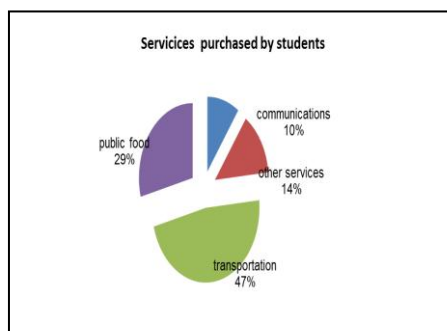
**Fig. 8 - Purchased Goods / Services by Students**

The outcomes show that the students buy in a high proportion, non-food goods (46% of total spend) but also food goods (29% of the amount they spend), while for services they allocate about 25% of the total money (figure 8). We included transport, public catering services and spending on leisure in the category of services.





**Fig. 9 - The Main Good Groups Purchased by Students**



**Fig. 10 - Services Purchased by Students**

In terms of purchased good groups, we notice the following situation (figure 9): A significant amount is allocated by students for electronic products (21% of total), clothing, footwear (17%) and hygiene-maintenance (14%). Foods that are high in proportion are drinks (juice, tea, coffee, alcohol) - 11% of total, confectionary (6% of total), convenience food (we include here bread, rice, salt, flour, sugar) with spending 5% from the total amount, meat and meat-food and dairy products with the same percentage. Vegetables and fruits are purchased at the least, according to this study (only 2% of total). In the other products category we included the bazaar products (cigarettes, bags, etc.), noting that they register an important position in students' purchasing (14% of total).

Data shows that students buy mainly transport services (here were included expenditures with local transport, but also other travels made by students) representing 47% of the total, followed by catering services (29% of the total allocations for services). As expected, students draw an important part of their monthly budget for communications (mobile telephony in particular), other services (hairstylist, tickets to museums, discos, clubs) representing 14% of the expenditure of students to acquire services (figure 10).

## CONCLUSIONS

Following the survey developed among the students at Marketing specialization within the Faculty of Economics and Business Administration - "Alexandru Ioan Cuza" University from Iasi, it has been ascertained that they have a consumer behaviour influenced by the level of income, employment status (the buy brands and lesser the goods made under the own brand of stores) and age.

The income influences the purchases they make, in terms of days of the week and of the month when they go shopping (most purchases are made in the middle of the month, when parents take salaries), but also in the way they perceive the goods as necessary or bought under impulse (for example, a menu in a food service unit is considered a necessity).

Also, the questioned students prefer convenience stores for consumer goods (goods / services they purchase with a high frequency, such as bread, coffee, even copying services), due to proximity to home or place of studies.

Supermarkets and hypermarkets are shops often frequented by students and are preferred for the wide range of products, pricing, special offers and promotions, the majority purchasing from these places. Special stores (pharmacies, textiles and footwear, etc.) occupy also a very important place in choosing goods by students.

Even if prices are an essential criterion for the buying decision of Romanians, the students have different reasons when choosing a store or a good, being influenced in their choice, by age and occupation (they prefer the brands for most of the purchased goods).

The study also indicates that, in terms of good groups, the surveyed students spend a significant proportion of the money they have available to non-food products (electronics, cigarettes, other bazaar-type goods, clothing, and shoes) because, in our opinion the parents are the ones who provide most of the necessary food.

Transport services have an important share in total spending of students, being followed by catering services. Because young people often are concerned about communication with others, we have highlighted these services separately in the study, indicating that the students behave according to their age in this regard.

The study outcomes can be used by the managers of trade and services companies from Iasi, in adapting the merchandising techniques on how behave a significant percentage of their buyers, respective the students.

The study has several limitations, related to the chosen research method and the rather reduced sample, which leads us to affirm that, for being generalized to all students, the results will have to be validated by a broader study, on a sample consisting of students from several faculties and specializations, with a wider representation.

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# BUSINESS MODELS BASED ON INTELLECTUAL CAPITAL

## MODELE DE AFACERE FONDATE PE CAPITALUL INTELECTUAL

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**Abstract.** *In knowledge based economy acquire an increasing importance of business models focused on intellectual capital. To explain the influence of intellectual capital on business competitiveness, we agreed to divide in following three categories: conceptual capital, relational capital and functional capital. A business model based on intellectual capital requires intensive use of one of these categories to create economic value. Identify, in this way, three types of generic business model: „Knowledge master“, „Network orchestrator“ and „Execution master“.*

**Key words:** business model, conceptual capital, relational capital, functional capital.

**Rezumat.** *În economia bazată pe cunoaștere o importanță tot mai mare o dobândesc modelele de afacere axate pe capitalul intelectual. Pentru a putea explica influența capitalului intelectual asupra competitivității afacerilor moderne, am convenit să-l divizăm în următoarele trei categorii: capital conceptual, capital relațional și capital funcțional. Un model de afacere fondat pe capitalul intelectual presupune utilizarea intensivă a uneia din aceste categorii pentru a crea valoare economică. Identificăm, în acest fel, trei tipuri generice de model de afacere: „Maestrul cunoașterii“, „Orchestratorul de rețele“ și „Maestrul execuției“.*

**Cuvinte cheie:** model de afacere, capital conceptual, capital relațional, capital funcțional.

## INTRODUCTION

The business model is a system of constraints, partially assigned deliberately, partly imposed by the environment, which determines the business success. This system of constraints, which sets out the functioning of the business, specifies the way in which the economic value is being created and the firm's incomes realised. The variables of the business model have decisive repercussions and on long-term on the organizational, commercial and financial dimensions of the firm.

Any business is based on a certain „primary“ model. This model may be a tacit or an explicit one, very simple or very complex, descriptive or rigorously formalized. The rise of the knowledge economy implies, among others, a re-settlement in the foundation of the importance of various categories of resources and competencies in order to create the economic value. The contribution of the intangible resources or of the intellectual capital becomes crucial. It is the main reason for which the re-examination of the traditional business models (based on technical and financial resources) acquires a special significance. This is because the economic behaviors of the elements of intellectual capital are significantly

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different in relation to the traditional „production factors“. The understanding and the discovery of the business models based on the intellectual capital represents one of the major challenges of the New Economy.

According to Fustec and Marois, the intellectual capital may be explained by a simple phrase (Fustec A., B. Marois, 2006): it is about all the values owned by the firm, which are not included in the financial and accounting situation, although the markets, especially the financial ones, value it for a long time in a intuitive and empirical manner. The characteristics of the intellectual elements are as follows: 1) The intangible nature (immaterial) or the absence of the physical substance; 2) Indefinite economic lifetime; 3) Uniqueness or, at least, very strong specificity; 4) Uncertainty about the generated results; 5) Difficulty of separation from other assets owned by the company.

Without doubt, the best known model of the intellectual capital that presents its tripartite structure (human capital, relational capital and structural capital) is the one offered by Edvinsson and Malone (Malone M., Edvinsson L., 1999). Even if it benefits from the largest notoriety (this ternary structure has been used also by the Intellect model developed by Europhorum) and acceptance, this model leaves open the problem of the composition of the intellectual capital, existing other suggestive modalities of decomposing and understanding the intangible component of the firm.

The essence of the intellectual capital is knowledge, although this chapter can not be reduced entirely to organizational knowledge. However, we can accept as beginning hypothesis that the elements of the intellectual capital represent distinct forms of knowledge. First of all, each immaterial element implies a particular way of acquisition, preservation and enrichment of knowledge, as well as its transformation in economic value.

## **MATERIAL AND METHOD**

The conversion of knowledge in economic value is not possible without the possession of certain capacities of conception and of operation – the competencies. Thus, a competency refers to the firm's capacity to create economic value differently than other firms. This distinction must be relevant and significant from the consumer's point of view (Zyman S. A. Brott, 2008). Broadly speaking, the competencies represent „tablets“ of knowledge, but this knowledge does not have only a conceptual character (in the widest sense of the term) and can be relational or functional in nature (procedural and organizational).

Secondly, it must be understood that, despite the multiple similarities of the shape, between knowledge and information, there are profound differences. In this way, as Karl Erick Sveiby (Sveiby KE, 2000) points out: a) knowledge is synthetic, facilitating the decision and the action, while the information is plethoric, being excessive, superabundant; b) knowledge is difficult to convey, the information may be transmitted easily and cheaply; c) knowledge has value because it is distinguished by a real practical applicability and the information is deprived of real value because it is not integrated directly in a relation of the type aim-mean. Knowledge always represents a way of achieving well defined goals.

Thirdly, a firm may develop the knowledge in two different ways: buying it or creating it internally, through its own effort. The purchase involves the acquisition of a

person, of a right or of another firm that possesses or incorporates the knowledge in order to extend this knowledge to the whole organization. But the firm cannot be certain of the fact that the purchased elements of knowledge are exactly the necessary ones. Likewise, it is not easy to disseminate this knowledge within the organization. On the other hand, the internal development is possible especially by the means of research – development or of the improvement of the skills and abilities of the staff, process named „organizational learning“. Both ways require, of course, investments. But there isn't, on short term, a direct correlation between the volume of the investments in these areas and the results. The pronounced uncertainty is a fund feature of the investments in creating the knowledge.

Fourthly, it is important the awareness of the fact that where the knowledge is not shared, it cannot be created knowledge because almost the entire knowledge is „stored“ in the minds of the employees. Therefore, in order to share the knowledge and, as a consequence, to develop it, the members of the organization must communicate efficiently. The most difficult task is to provide an internal environment to facilitate the communication. Without doubt, the communication and the knowledge can also emerge only from the organizational behaviors based on the availability to share and divide. At their turn, this type of behaviors cannot manifest without the existence of a strong sense of confidence. Only confidence may streamline the flow of knowledge within the firm, generating an environment based on shared experiences.

Finally, the elements of the intellectual capital, despite their nature – conceptual, relational or functional – may manifest in two essential ways: as explicit knowledge or as tacit knowledge. The distinction between the two categories comes from the fact that, in many situations, we may know more than we may say. The tacit knowledge is personal, highly contextualized and, therefore, difficult to formalize and communicate. That is way this type of knowledge must be distinguished from the explicit knowledge, namely the knowledge that can be formalized, respectively, codified and communicated systematically using some formal languages. Explicit knowledge is that type of knowledge that remains in the firm after all the employees go home at the end of the day. Nonaka and Takeuchi emphasize the importance of the „translation“ of the tacit knowledge in explicit or formal knowledge, this conversion representing, in fact, the essence of the organizational learning processess (Nonaka I., Takeuchi H., 1995).

This synthesis of the main research in the field may constitute a starting point in the approach of configuration a methodology of elaboration of the business models based on the intellectual capital.

## **RESULTS AND DISCUSSIONS**

Further, we propose the following classification scheme of the elements of the intellectual capital, structure which, in our view, meets better our needs of foundation of the business models:

*The conceptual capital* formed of elements of tacit and explicit knowledge which offers us an image of all the things that the firm knows and can do in order to improve from a quantitative and qualitative point of view, the created economic value, defining, at the same time, its potential of learning, storage and transmission of knowledge, development and innovation. This capital includes all the concepts held by the firm, regardless of the nature and characteristics, and also the means of storage, communication, adaptation and their invention, including the portfolio of information and accumulated data. In this category of the intellectual capital, we include the intellectual and practical skills of the

employees, the capacities, experience and their creativity, brands, patents, licences, various rights, databases, informatic systems, formal and informal communication structures, organizational culture, other elements that directly support the learning and the organizational knowledge. The conceptual capital represents, therefore, „the computational intelligence,, of the firm.

*The relational capital* composed of the totality of the relational competencies and abilities of the firm, which determine the quality and the density of its collaborative networks, thus explaining with who the firm intends to do what it knows and can do or who are its partners in the process of creating the economic value. The portfolio of clients, the actioneers/investors, the partners, the suppliers, the ecological capital (in the broadest meaning of this term) and societal, the accessibility of the locations/sites are common elements of the relational capital. Also, the firm's image is part of this category of the intellectual capital. Thus, the relational capital represents „the social intelligence“ of the firm.

*The functional capital* or procedural-organizational, represented by the operational competencies of the firm, shows the way in which the firm acts in order to extract the economic value and is formed of the flows, methods, procedures, rules and the operating system and management of the resources. The systems of organization of the production, quality assurance and cost monitoring, reporting and controlling, organizational structures, decision-making procedures, operational processes, circuits of materials, work and finances, distribution network, management practices of human resources constitute the main elements of the functional capital of the firm. Therefore, this capital is the equivalent of the „pragmatic intelligence“ of the firm.

This classification answers to the question „How does each class of intangibles intervene in the process of generation and supply of the economic value?“, indicating the function of each category of intellectual capital in the global context of the business conducted by the firm. The conceptual capital has the role of „stock“ of knowledge and basic competencies for the firm's business field, but also the role of potential of refreshment of this knowledge. The relational capital has also the function of attracting from the socio-economic environment of the firm the knowledge and the necessary competencies, but the one that lack. The functional capital is responsible of the typical approaches and modalities selected by the firm in the approach of building and maintaining the own device of generation and creation of the economic value.

There are no „pure elements“ of the intellectual capital under the aspect of the clear and neat membership to one of the three categories. All the elements of the intellectual capital display a certain degree of „crossbreeding“. Always any element of intellectual capital is accompanied and completed by at least one element from other category. Unquestionably, any firm that uses intensive intellectual capital in order to create economic value has elements of all three categories. However, it can be identified a certain „intellectual specialization“ or a certain „intellectual profile“ depending on the emphasis on the one of the three forms of the intellectual capital. The equal utilization of all the elements of intellectual capital is, with very few exceptions, economically prohibitive. The

specialization or the intellectual profile specifies the kind of reputation (prestige, fame, appreciation) which the company aspires to. Precisely, the reputation represents the means by which the internal efficiency is projected outside the firm and transformed into present and future economic value. The reputation convinces the environment that the firm is really good.

A business model based on intellectual capital requires the intensive use of the various forms of organizational knowledge, materialized in conceptual, relational and functional competencies, in order to create economic value. We distinguish three generic business models focused on the intellectual capital, structured according to the primary exploitation of one of the categories of competencies mentioned: Masters of knowledge, Network orchestrator and Masters of execution.

*The masters of knowledge* build their business around a solid conceptual capital. They are the most „intellectuals“ of all those who base their business on the intellectual capital. The masters of knowledge produce, develop, accumulate, convey and disseminate concepts. The economic value created by this category of business models has almost entirely an intangible character. The houses of lawyers, consulting firms, professional expertise and projection, universities, the business focused on advanced or disruptive technologies, research institutes etc., but also the owners of the brand portfolios (for example, Unilever) or the specialists in communication are part of this category.

*The networks orchestrators* draw their force from the redoubtable relational capital. They represent true „connecting nodes“ in the „texture“ of the business, bringing together various partners able to contribute efficiently to the achievement of a certain economic project. The network orchestrators find business opportunities, identify the potential participants, select them, bring them together, distribute the tasks and coordinate the so-created network. In other words, they facilitate the cooperation, which, in their absence would be very difficult or extremely inconvenient from the economic point of view. Their competency focuses on building and administering groups of autonomous economic actors, groups more or less temporary, more or less formal in order to conduct some business that require a wide variety of resources and skills. The providers of logistic services (for example DHL) are a good example of orchestrators of some networks consisting of multiple chains of supply-delivery.

*The masters of execution* excel in the virtue of owning a functional capital extremely robust. They know to operate to very high standards of quality and efficiency. But the masters of execution are good also due to the flexibility of the business systems, which allows them to formulate some quick responses and reliable to the changes that interfere in the operating requirements. This type of business models aim at the economic value extracted from the operational expertise. The accuracy and the quality of the execution represent the distinctive advantages of the masters of execution. To equip with such advantages, the masters of execution project and implement structures, systems and internal processes characterized by a higher efficiency. The industrial firms with an exceptional reputation in terms of quality products and service (for example Toyota) undoubtedly practice this type of business model.

A formidable economic force however have the association of the business models based on different types of intellectual capital. The synergies generated by such associations may, in their turn, rise some extremely prolific sources of economic values. But the highest energy may be obtained when all the three models unite their advantages to create economic value.

## CONCLUSIONS

1. In our opinion, the origination of a business model based on the intellectual capital implies running through the following phases: a)defining the economic value to be created; b)identifying the essential necessary competencies to create the desired economic value; c)identifying the elements of intellectual capital which generate the necessary competencies; d)establishing „the specialization“ or „the intellectual profile“ of the business, including: the way of creation/purchase of the elements of the intellectual capital, the way of measurement/evaluation and control of the elements of intellectual capital, the way of stimulation/reward of the intellectual capital; e)identifying the elements of technical and financial capital which complete and support the intellectual capital; f)the correlation of the flows of technical/financial capital with the flows of intellectual capital.

2. We consider that the projection and the functionalization of the business models focused on the intellectual capital represents an approach centered on the objective of focusing all the organizational efforts in order to create and consolidate the materialized knowledge in the three categories of competencies – conceptual, relational and functional.

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# STUDIES CONCERNING RESULTS OF PRODUCTION AND ECONOMIC-FINANCIAL IN THE AGRICULTURE OF GALAȚI COUNTY

## STUDII PRIVIND REZULTATELE DE PRODUCȚIE OBȚINUTE ÎN CULTURA PLANTELOR DE CÂMP DIN JUDEȚUL GALAȚI DUPĂ EXTINDEREA UNIUNII EUROPENE

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**Abstract.** *The process of integration into the European Union allows access to various european funds, targeted to raise the living standards of the rural population in general, but especially for farmers. This process marked a new stage in our country's agriculture. Thus, Romania has to adapt to the European model of agriculture that is based on competitiveness, market orientation, environmental protection, integration of agriculture with forestry and environment etc. In the economy of Galati county, agriculture occupies an important place due to the wide extent of arable agricultural land in general and in particular due to livestock and poultry, the land improvement, the supply with tractors and agricultural machinery. In Galati county agriculture, due to the fact that the arable land represents as much as 82.5% of all agricultural land, the most important crops are oilseed plants and grains. In animal husbandry, the largest flocks we encounter are cattle, pigs, sheep and poultry. An increase of economic efficiency in crop and animal production can be achieved by: obtaining high average yields, improving product quality, developing new storage spaces and ensuring competitive selling prices, promoting new investments in crop and livestock through accessing grants, bank loans and other sources. Attracting funding is an opportunity for farmers to develop and modernize their agricultural activities. Also, competitiveness in agriculture can be achieved through developing multifunctional agricultural holdings oriented towards the competitive market through an association and cooperation of farmers to access grants directed at upgrading and modernizing production and processing the raw materials.*

**Key words:** agriculture, results, opportunities, indicators, finance

**Rezumat.** *Procesul de integrare a României în Uniunea Europeană permite accesarea diferitelor fonduri europene direcționate pentru ridicarea nivelului de viață a populației din mediul rural, în general, dar, mai ales, pentru producătorii agricoli. Acest proces, a marcat o nouă etapă în agricultura țării noastre. Astfel, România trebuie să se adapteze la modelul european de agricultură ce se bazează pe competitivitate, orientarea spre piață, protejarea mediului înconjurător, integrarea agriculturii cu mediul înconjurător și cu silvicultura etc. În economia județului Galați, agricultura ocupă un loc important, datorită ponderii ridicate a terenului agricol, în general și arabil, în special, a efectivelor de animale și păsări, a amenajărilor de îmbunătățiri funciare, a dotării cu tractoare și mașini agricole. În agricultura județului Galați, ca urmare a faptului că terenul arabil ocupă 82,5 % din terenul agricol,*

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*ponderea cea mai mare în structura culturilor o dețin cerealele boabe și plantele oleaginoase. Creșterea eficienței economice în producția vegetală, se poate realiza prin: obținerea unor producții medii ridicate, îmbunătățirea calității produselor, amenajarea a noi spații de depozitare și relizarea unor prețuri de vânzare competitive, promovarea a noi investiții în cultura plantelor, prin accesarea fondurilor nerambursabile, a creditelor bancare și a altor surse. Atragerea finanțărilor de către producătorii agricoli este o oportunitate pentru dezvoltarea activităților agricole și realizarea investițiilor pentru modernizarea fermelor. De asemenea, competitivitatea în agricultură se poate realiza și prin extinderea exploatațiilor agricole cu pluriactivitate, orientate spre piața concurențială, prin asocierea și cooperarea fermierilor în vederea accesării unor fonduri nerambursabile direcționate spre retehnologizarea și modernizarea fermelor de producție, cât și a celor de procesare a materiilor prime de origine agricolă.*

**Cuvinte cheie:** agricultură, rezultate, oportunități, indicatori, finanțe

## **MATERIAL AND METHOD**

The research was conducted for Galati county and targeted the analysis of crop production figures between 2004-2008 (Chiran A. et al., 2007). The analysis involved gathering and selecting information, drawing conclusions by analyzing and processing the primary information that was ordered, classified and introduced in tables or figures and relevant schemes, resulting average values or values of the statistical indicators. The analysis used a system of indicators, of which we mention: the cultivated surface and the structuring of crop types and crops; the average production per hectare; total production; the destination of production etc. The methods used were classical ones, such as: simple division; comparison; analysis of specific markers; the average pace, chain substitution, a.s.o.

## **RESULTS AND DISCUSSIONS**

As a result of negotiations on Chapter 7 - Agriculture between the EU and the Romanian Government, Romania has achieved an overall EU budget allocation related to the CAP, of over 4 billion euros for 2007-2009 (Plăiaș I., 1997). These funds were divided between rural development, market support and direct payments.

This financial support has been allocated since 2007. It is an instrument of market intervention to stabilize the market prices by buying surplus production and storing it in public or private stocks. Refinancing for exported goods is granted only for certain products (milk and dairy products, beef, cereals, fruit and vegetables, sugar products, processed products etc.) or for the difference between the export price and the international price, given that agricultural prices are generally higher in the European Union in comparison with the world market.

The financial support for rural development from the EU budget represents a commitment of €2,424 million for 2007-2009. The required co-financing share of the national budget amounted to 25% (Neagu Comelia, 2007; Zahiu Letiția, 2006).

To stabilize the supply of main plant products, the strategy of sustainable development of agriculture and food for Galati county has set the following measures (Dima Fl.-M. et al., 2008):

- reducing the area planted with cereals by 3% annually;

- increasing the area cultivated with oil seeds by 21% and production by 48%;
- increasing the surfaces cultivated with leguminous plants;
- development of associative structures in the area of supply, sales and services;
- involvement of multi-professional organizations focusing on cereal products, oilseeds, leguminous plants and textiles, in drawing up norms specific to these cultures in accordance with EU law.

The county's agricultural area is 351,597 ha, of which 289,233 ha are arable. The main crops grown in the county are: cereal crops (wheat, rye, barley, oats, maize); technical crops (soybean, sunflower, canola, mustard, sugar beet, tobacco, grown sorghum); pulses grain (beans, peas); potatoes; vegetables (tomatoes, onions, cabbage, peppers, root); melons and fodder plants.

*Table 1*

**The growth rate of cultivated areas (% compared to previous years)**

<b>Specification</b>	<b>2005/2004</b>	<b>2006/2005</b>	<b>2007/2006</b>	<b>2008/2007</b>	<b>2008/2004</b>
<b>Cereal grains-sum</b>	-0.71	-7.07	5.02	-7.82	-10.68
Wheat and rye	-4.30	-32.23	-6.00	28.46	-21.69
Autumn barley and spring barley	50.86	-41.41	67.85	30.08	93.00
Grain maize	-1.34	9.74	6.14	-21.48	-9.76
Grain vegetables	12.35	-19.11	3.88	22.06	15.24
Shelling	227.43	-40.54	11.82	38.62	201.77
Beans	-2.96	-13.96	2.57	19.06	1.95
Oil plants	-6.11	25.28	-18.39	31.53	26.26
Sunflower	-7.49	18.52	-16.28	29.84	19.19
Soy	4.69	72.25	-28.46	40.97	81.87
Plants for other industrial processing	42.14	76.49	-77.07	-74.28	-85.20
Sugar beet	69.71	92.01	-80.33	-86.13	-91.11
Tobacco	-25.57	-10.42	-37.93	-29.17	-70.69
Potatoes	-1.86	-3.98	4.90	-5.21	-6.30
Summer Potatoes	11.19	-1.16	-7.10	-24.05	-22.46
<b>Vegetables- sum</b>	-2.00	-3.14	-2.78	4.97	-3.12
Tomatoes	-4.62	-6.24	-6.05	3.83	-12.77
Dried Onion	-10.91	1.05	8.20	-1.17	-3.74
Cabbage	1.44	2.54	-0.99	8.51	11.75
Peppers	3.63	-5.69	-14.22	5.23	-11.78
Roots	18.95	-0.77	6.19	13.84	42.69
Forage plants-total	4.14	3.36	8.37	-4.68	11.18
Perennials - old and new	0.48	6.74	10.04	-4.87	12.27
Alfalfa	5.13	4.87	11.40	0.25	23.13
Annual hay and green mass	16.33	-4.90	-0.66	-17.40	-9.22
Plants for silage	-24.36	-29.96	-26.74	40.15	-45.61
Fodder roots	-22.77	-12.82	-12.50	-46.22	-68.32

By analyzing the dynamics and structure of the main groups (table 1), we find the following aspects:

- in 2008 compared with 2004, the area planted with cereal grains decreased by 10.68 %, due to the influence of the barley area that increased by 93.0 %;

- area occupied by group of grain leguminous plants increased by 15.24 %, as a result of increasing the surface cultivated with shelling (+ 201.77 %) and beans (+ 1.95 %);

- the subgroup of oil plants had an upward trend, the total cultivated area increased by 26.26 % because of the extension of sunflower areas (+ 19.19 %) and soy beans (+ 81.87 %);

- the area occupied by the technical plants for other industrial processing subgroup followed a downward trend, so that, compared to the reference surface, in 2008 the reduction was 85.20 % as a result of the negative influence of the area occupied by sugar beet, which decreased by 91.11 % and by tobacco, (-70.69 %);

- the decrease of the potato crop was less dramatic (- 6.3 %) and it was due to the obvious reduction of the area occupied by autumn potatoes (- 22.46 %);

- the area planted with vegetables had a slightly downward trend (- 3.12 %), tomato, dried onion and pepper surface reduction having a predominantly negative influence, whereas in the case of sprouts and roots the influence was positive;

- the group of forage plants presented a slightly increasing trend (+ 11.18 %) due to the extension of "old and new perennial plants" and "annual plants for hay and green chop", whereas other forage crops (corn for silage and roots for fodders) had a negative influence by reducing cultivated areas;

- in structure, averaged over the period under review (2004-2008), the first place is taken by the group of grain cereals with 67.4 %, followed by the oilseeds subgroup with 17.5 % and by forage plants with 4.8 %, etc.

- in 2008, grain weight was reduced to 62.7 %; in contrast, the share of oilseeds increased to 20.7 %, and forage plants actually remained at the same level (4.74 %) etc.

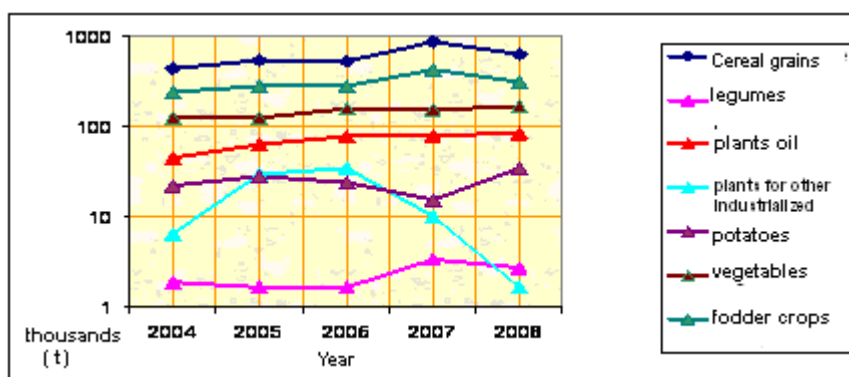


Fig. 1 - Evolution of total production

The data presented in figure 1 show that, between 2004-2008, for some species the total production had an upward trend, while for other species, the trend was downward. Thus, for pea beans, maize, sunflower, root vegetables, cabbage, soy, alfalfa green, tomatoes, dried onions, beans, potatoes, autumn barley, spring barley and peppers, the total increase ranked between 265.3 % (pea beans) and 3.3 % (peppers).

Table 2

**Growth in average production / ha (% compared to previous years)**

<b>Culture</b>	<b>2005/2004</b>	<b>2006/2005</b>	<b>2007/2006</b>	<b>2008/2007</b>	<b>2008/2004</b>
Wheat and rye	-23.51	-57.92	210.71	9.31	9.31
Autumn and spring barley	-33.68	-27.09	79.18	-23.66	-33.86
Maize grain	73.65	13.73	37.26	-14.91	130.67
Peas	-26.17	41.42	41.42	-18.01	21.06
Beans	-28.48	16.67	32.77	13.83	26.11
Sunflower	42.87	15.00	21.42	-16.97	65.65
Soy	35.90	-29.62	11.77	3.08	10.19
Sugar beet	176.67	-38.98	77.85	-16.47	150.79
Tobacco	0.64	-6.00	12.10	-39.73	-36.09
Autumn potatoes	25.48	-12.48	77.66	-22.99	50.24
Tomatoes - total	5.69	42.48	39.69	-27.62	52.24
Dried onions	-3.44	7.96	46.63	-12.49	33.76
Cabbage	12.61	11.07	19.94	0.82	51.25
Peppers	-9.92	25.90	1.07	3.40	18.51
Root vegetables - total	1.39	29.70	10.29	-11.90	27.77
Old and new perennial plants	15.03	-2.41	-32.96	78.89	34.64
Alfalfa	16.36	-2.45	7.36	10.65	34.84

Thus, the data presented in figure 1 reveals that in 2008, compared with the reference year, only five crops (root vegetables, dried onions, sunflower, cabbage-total and annual of hay and green mass), the total production had an upward trend; as for the other crops, the total production decreased between - 36.9 % (tobacco) and - 33.86 % (autumn barley and spring barley). The causes which generated this situation are related to the development areas grown and the average yield per hectare (Chiran A. et al., 1997; Gavrilescu D., 1996).

As far as the evolution of the average production per hectare is concerned, it was different for the main crops in the county of Galati (table 2). In 2008 over 2004, of the 17 cultures analyzed and two groups of crops, only tobacco and barley decreased, while for the other cultures, the trend was upward, with figures ranging between 9.31 % (wheat and rye) and 150.79 % (sugar beet) (Chiran A. et al., 1998; 2007; Gavrilescu D., 1996; Mateoc-Sîrb Nicoleta, 2002).

## CONCLUSIONS

1. By analyzing the structure of crops in the period 2004 to 2008, it can be concluded that the variety of crops which have optimum conditions in the area, allow farmers to choose diversified crop structures, adapting to market demands. The hilly terrain allows the full mechanization of agricultural operations using modern heavy duty equipment. However, during the period under review, the areas planted in Galati county had a tendency to decrease, the most dramatic reductions occurring in tomatoes, green corn mass, beans, soy etc.

2. Of the 17 main crops analyzed, only seven crops (root vegetables, tomatoes, dried onions, corn silage, wheat and rye, cabbage and sunflower), the average yield had a positive influence on the evolution of total output, while for the other crops, whose production per hectare was decreasing, the influence was negative.

3. For Galati county, the increase of the share of vegetables in the daily human diet is expected to be quite significant, this presently being only 23-25 %. The general objectives of vegetable crops aim to bring it to the standards of the new European market, which requires the coexistence of three strategies: "*conventional*" technologies, "*rational*" technologies, "*green*" technologies. The need for modernization and development of the agricultural production by expanding the share of horticultural production, will lead to a diversification of the vegetables assortment, in the two large pools of vegetables: Tecuci and Galati.

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# THE STUDY OF ORGANOPHOSPHORUS PESTICIDE RESIDUES IN SOIL AND VEGETABLE PRODUCTS IN DIFFERENT GROWING SYSTEMS

## STUDIUL REZIDUURILOR DE PESTICIDE ORGANOFOFORICE DIN SOL SI LEGUME, IN DIFERITE SISTEME DE CULTIVARE

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**Abstract.** *In this paper are presented the research results obtained in 2010, in SIECOLEG Project, regarding the assessment of some organophosphoric pesticide residues (55 active substances) from 80 samples soils and 25 samples vegetables from different growing systems (ecological, in conversion and conventional). In all samples analysed the organophosphoric pesticide residues were included in admissible limits (Regulation (EC) nr. 396/2005).*

**Key words:** residues, organophosphoric pesticides, soil, vegetables.

**Rezumat.** *În lucrarea de față sunt prezentate rezultatele cercetării obținute în anul 2010, în cadrul proiectului 52141/2008 – SIECOLEG, cu privire la evaluarea unor reziduuri de pesticide organofosforice (55 substanțe active), din 80 probe sol și 25 probe de legume, în diferite sisteme de cultivare (ecologic, în conversie și convențional). În toate probele analizate reziduurile de pesticide organofosforice s-au încadrat în limitele maxime admise (conform Regulamentului (EC) nr. 396/2005).*

**Cuvinte cheie:** reziduuri, pesticide organofosforice, sol, legume.

## INTRODUCTION

Irrational use of pesticides in agriculture causes pollution of large areas of soil and food with nitrate / nitrite, pesticides and heavy metals.

In most cases, pesticides used to protect crops exerts its toxic action not only as to pests and pathogens, but also to animals; there is a risk that people can be affected due to toxic residues ingested with food (Hura, 2005, 2007 ).

Given the importance of this issue and the fact that in our country amounts were used, it was useful considered to know the content of pollutants in some soils cultivated with vegetables, as well as in fresh vegetable products.

The aim of the research is to assess the extent to which chemical factors are risk factors for plants and humans exceed the limits above which are pollutants. In this way producers and consumers become aware of the importance of organic vegetable production and the negative influence of during the use of pesticides on the ecological balance and the harvest, that human health.

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## MATERIAL AND METHOD

Organophosphorus pesticide residue content was analyzed in 105 samples, of which 85 soil samples and 25 samples of plant products (tomatoes, peppers, eggplants, cabbage, onions), in three cultivation systems (organic, in conversion and conventional), using standard methods. The soil samples were collected during 2010 in two phases, as follows: spring (before the establishment of crops) and summer (at harvest maturity).

Samples of soil (table 1) and plants (table 2) was carried out in certain locations, as follows:

- certified organic land: Bacau Vegetable Research Station - SCL and Iasi University of Agriculture - USAMV;
- land in conversion: Andrieseni (Family Association - FA Rotariu C.)
- conventional land: Roman (AgroFlamanzi), Tg. Frumos (Family Association - FA Maxim I., Family Association - FA Vavilov M.), Matca (Family Association - FA V. Marin).

Table 1

**Number of soil samples analyzed and their codification**

Land status	Location	No. of samples	Samples codification
<b>Ecological</b>	SCL Bacau	12	S32, S33, S34, S35, ..... S43
	USAMV/ spring	3	S5, S6, S7
	USAMV/ autumn	6	S26, ..... S31
<b>In conversion</b>	Andrieseni Iasi	11	S59, ..... S69
<b>Conventional</b>	Sere Roman/ spring	4	S1, S2, S3, S4
	Sere Roman/ autumn	4	S78, S79, S80, S81
	Tg. Frumos/ spring	7	S8, S9, S10, S11, S12, S13, S14
	Tg. Frumos/ autumn	14	S44, S45, S46, S47, S48, S49, S50, S51, S52, S53, S54, S55, S56, S57, S58
	Matca	11	S15, S16, ..... S25

In the study were determined organophosphorus pesticide residues (44 active substances) in soil samples and vegetable products.

Table 2

**Number of plant samples analyzed in different areas**

Land status	Location	No. of samples	Samples codification
<b>Ecologic</b>	SCL Bacau	4	V9, V10, V11, V12
<b>In conversie</b>	Andrieseni Iasi	7	V19, ..... V25
<b>Conventional</b>	Tg. Frumos	6	V13, ..... V18
	Matca	8	V1, V2, ..... V8

Determination of pesticide residues was performed according to standards, as follows: SR EN12393-1, 2, 3:2009 – Fat-free foods. Multireziduu methods for determining pesticide residues GC and SR EN 15662 / 2009 - Foods of plant origin. Determination of



pesticide residues by GC-MS and / or LC-MS/MS after extraction / partition with acetonitrile and purified by dispersive method SPE-QuEChERS.

After processing the samples by extraction with organic solvents (acetonitrile, petroleum ether), pesticide residues were analyzed by gas chromatography method using a Shimadzu GC, model 2100, equipped with autosamples and using NPD detector for analysis of organophosphorus pesticides. Were used as standards for determining pesticide residues by gas - chromatography, these mixtures of pesticides: Pesticides Mix 17, Mix 154, Mix 155, Dr. Ehrenstorfer.

Interpretation of results on pesticide residues was carried out in accordance with Regulation (EC) no. 396/2005 on maximum residue limits of pesticides in fruits, vegetables, cereals and other plant products.

## RESULTS AND DISCUSSIONS

Results on organophosphorus pesticide residues content (23 active ingredients - Mix 154) in soil samples collected from vegetable farms in 2010, are presented in table 3. Organophosphorus pesticide residues were not detected in any sample analyzed at the farm USAMV (samples S5, S6, S7). The soil samples collected from vegetable farms in Roman (samples S1, S2, S3) and Tg. Frumos (S8, S9, S10, S11, S12, S13, S14) were detected Omethoate residues, Phorate and Phosmet.

Organophosphorus pesticide residues (21 active ingredients - Mix 155) in soil samples collected from farms studied in 2010 were not detected in any sample analyzed. In table 4 the results on the content of organophosphorus pesticide residues (23 active ingredients - Mix 154) in soil samples collected from vegetable farms in the survey taken in August / 2010.

These residues were not detected in any sample analyzed from USAMV farm (samples S26 - S31). In the soil samples collected from conventional vegetable farms Tg. Frumos (sample S15 - S25), residues were detected in low concentrations Omethoate and Phosmet. Omethoate content ranged from 0.005 (S23) and 0.02 mg / kg (S20). Phosmet content ranged from 0.003 (S15, S18) and 0.01 mg / kg (S17, S20).

Organophosphorus pesticide residues (21 active ingredients - Mix 155), from soil samples collected from vegetable farms studied in 2010 - were not detected in any sample analyzed.

In table 5 are shown the contents of organophosphorus pesticide residues in vegetable samples collected from areas Targu Frumos and Matca. The pesticide residues were not detected in most samples analyzed. Residues like Omethoate (V3-V8, V14 - V17), Phorate and Metribuzin in tomatoes fruit (V7) and Phosmet (V1 - V4, V7 - V8 and V13-V17) were detected, but within acceptable limits (< 0.01 mg / kg).

In table 6 are shown the contents of organophosphorus pesticide residues in vegetable samples collected from organic farms or in the process of conversion. The content of these pesticide residues have been detected in fresh produce from certified organic farms, in contrast to FA Rotariu have found remains of Omethoate (V20-V24) and Phosmet (V20, V21, V24, V25) but within acceptable limits (< 0.01 mg / kg).

Table 3

**Contents of organochlorine pesticide residues (Mix 154) from soil samples  
In phase I (mg/kg)**

Pesticides (active substances)	Samples codification													
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
Methamidophos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Mevinphos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Molinate	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptenophos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Omethoate	0.02	0.03	0.01	0.02	nd	nd	nd	0.02	0.05	0.05	0.04	0.01	0.05	0.05
Naled	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Monocrotophos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phorate	nd	0.001	nd	nd	nd	nd	nd	nd	0.002	0.002	0.001	0.003	0.02	0.003
Fonofos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Parathion- methyl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metalaxyl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Malathion	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fenthion	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Parathion-ethyl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Isofenphos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Mecarbam	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phenthoate	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Myclobutanil	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fensulfothion	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phosmet	0.004	0.006	0.01	0.006	nd	nd	nd	0.01	0.006	0.007	0.006	0.008	0.006	0.007
Phosalone	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Demeton-S- methyl-sulfoxide	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

nd - undetectable

Table 4

## Contents of organochlorine pesticide residues (Mix 154) from soil samples in phase II (mg/kg)

Pesticides (active substances)	Samples codification																
	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31
Methamidophos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Mevinphos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Molinate	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptenophos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Omethoate	0.008	0.01	0.01	0.01	0.01	0.02	0.007	0.01	0.005	0.01	0.008	nd	nd	nd	nd	nd	nd
Naled	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Monocrotophos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phorate	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fonofos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metribuzin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Parathion-methyl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Metalaxyl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Malathion	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fenthion	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Parathion-ethyl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Isofenphos	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Mecarbam	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phenthoate	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Myclobutanil	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fensulfothion	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Phosmet	0.003	0.004	0.01	0.003	0.004	0.01	0.004	nd	0.007	0.005	0.006	nd	nd	nd	nd	nd	nd
Phosalone	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Demeton-S-methyl-sulfoxide	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

nd - undetectable

Table 5

**The content of organophosphorus pesticide residues (Mix 154)  
in vegetable samples (mg/kg)**

Species / cultivar	Samples codification	Pesticides (active substances)			
		Omethoate	Phorate	Metribuzin	Phosmet
Peppers/California	V3	0.007	nd	nd	0.004
Peppers/Fidelio	V4	0.01	nd	nd	0.002
Tomatoes/Magnus	V5	0.01	0	nd	nd
Cucumbers/Merengue	V6	0.003	nd	nd	nd
Tomatoes/Magnus	V7	0.002	0.001	0.002	0.003
Cucumbers/Mirabelle	V8	0.001	nd	nd	0.001
Cucumbers/Merengue	V14	<0.01	nd	nd	<0.01
Peppers/Maradona	V15	<0.01	nd	nd	<0.01
Tomatoes/Belladona	V16	<0.01	nd	nd	<0.01
Cucumbers/Merengue	V17	<0.01	nd	nd	<0.01

Table 6

**The content of organophosphorus pesticide residues (Mix 154) in plant samples  
collected in 2010 (mg/kg)**

Species / cultivar	Samples codification	Pesticides (active substances)			
		Omethoate	Phorate	Metribuzin	Phosmet
Peppers/Belladona	V19	nd	nd	nd	nd
Tomatoes/Primadona	V20	<0.01	nd	nd	<0.01
Eggplant/Aragon	V21	<0.01	nd	nd	<0.01
Cucumbers/Merengue	V22	<0.01	nd	nd	nd
Onion/Stuttgart	V23	<0.01	nd	nd	nd
Green beans/Saxa	V24	<0.01	nd	nd	<0.01
Cabbage/Gloria	V25	nd	nd	nd	<0.01

## CONCLUSIONS

1. In most of the analyzed samples of soil and plant products on the soils, the content of the main chemical contaminants have been detected and analyzed were within the maximum allowed under European and national regulation.

2. In conventional farms from Roman, Tg. Frumos and Matca a series of organophosphorus pesticide residues (Phorate, Phosmet, Omethoate) were detected, in majority of soil samples analyzed.

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# OPTIMAL DETERMINATION OF FREEZING TEMPERATURE OF RASPBERRY FRUIT IN INTENSIVE CULTURE ON ORGANIC BASES

## DETERMINAREA TEMPERATURII OPTIME DE CONGELARE A FRUCTELOR DE ZMEUR ÎN CULTURA INTENSIVĂ PE BAZE ECOLOGICE

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**Abstract.** We studied the influence of temperature -16°C, -18°C and -20°C on the degree of modification of biochemical indicators, technological fruits of raspberry and mycological culture obtained intensive ecological basis for a period of 123 days of storage. Experimental data were obtained on the change of sucrose, titratable acids, ascorbic acid, total carbohydrate and fruit tissues monosaccharides. Optimum temperatures were determined by freezing raspberry fruit crop obtained organic bases.

**Key words:** raspberry, organic fruit, storage, biochemical indicators, technological and mycological.

**Rezumat.** S-a studiat influența temperaturilor de -16°C; -18°C și -20°C asupra gradului de modificare a unor indicatori biochimici, tehnologici și micologici ale fructelor de zmeur obținute în cultura intensivă pe baze ecologice pe durata unei perioade de 123 zile de păstrare. S-au obținut date experimentale referitoare la modificarea conținutului de zaharoză; acizilor titrabili, acidului ascorbic; glucidelor totale și monoglucidelor în țesuturile fructelor. S-a stabilit temperatura optimă de congelare a fructelor de zmeur obținute în cultura pe baze ecologice.

**Cuvinte cheie:** zmeur, fructe ecologice, păstrare, indicatori biochimici, tehnologici și micologici.

## INTRODUCTION

Berry crops have an important role in feeding the human body with vitamins, organic acids, carbohydrates, minerals etc. Due to the biological properties of raspberries, the fruit consumption of this species is only possible on a relatively short period of the year. Extending the period of consumption of these fruits is only possible by keeping them in cold storage. In present days, there are two methods for keeping wild berry fruit: keep the refrigerated and frozen fresh.

In the present project, along with the development and implementation of technology for growing and obtaining organic fruit Razzie was important to determine the optimum storage temperature of fresh and frozen fruit.

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## MATERIAL AND METHOD

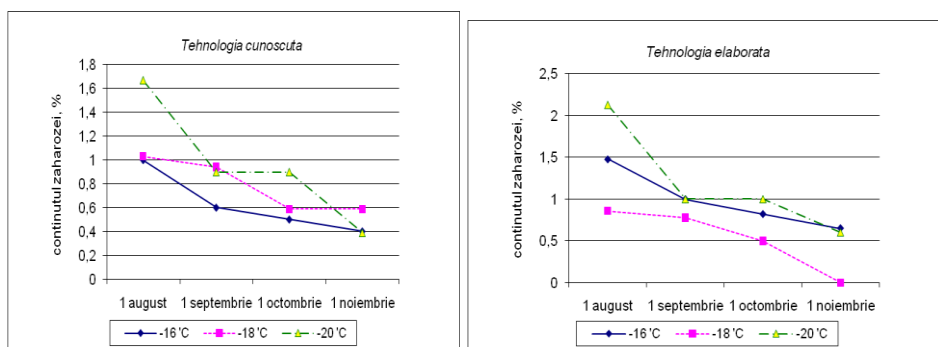
Raspberry fruit variety were harvested Fertöd Zamalos Mollnasarjai during "ripening harvest" in the plastic packaging with a volume of 0.7 to 1.0 kg. For developing technology for keeping fruit cultivated raspberry frozen organic bases, it was necessary to research the influence of temperature -16C, -18C and -20C on the degree of change in biochemical indices, technological and mycological a period of 123 days of storage. By the storage of plastic packaging raspberry fruit were weighed, their weight causing further appreciation of the initial degree of tissue dehydration during the entire period of frozen storage. Also in the same day as when determining the optimal period of storage of fresh raspberry fruit, samples were selected for the determination of sucrose, moncarbohydrates and their sum, and the titratable ascorbic acid. The degree of modification of the content of plastic substances, aids and mycological index was measured every 30 days to retain raspberry fruit frozen and stored at three temperatures -16C, -18C and -20C.

Along with raspberry fruit Fertöd Zamalos Mollnasarjai variety, grown on organic bases during shock freezing fruits were investigated and the same variety, grown under known technology. Freezing food shock unlike traditional freezing processes has many advantages, the main ones being: reduction in weight loss product and time to set freezing temperature, maintaining a high level of flavoring substances and plastic, minimizing the conditions for the development of pathogen agents.

Findings of the plastic changes in the content of substances raspberry fruit stored at three freezing temperatures was carried out after every 30 days the period of freezing dynamics. The frozen food biochemical substances resulting changes in the content much more slowly than those kept fresh. However, during the 123 days retention raspberry fruit, was able to determine the influence of the three freezing temperatures (-16, -18 and -20C) on the intensity of these processes.

## RESULTS AND DISCUSSIONS

Studying the influence of freezing temperatures on the modification applied raspberry fruit sucrose content (fig. 1) moncarbohydrates (fig.2) and their total amount (fig. 3) was obtained, that they have influence.

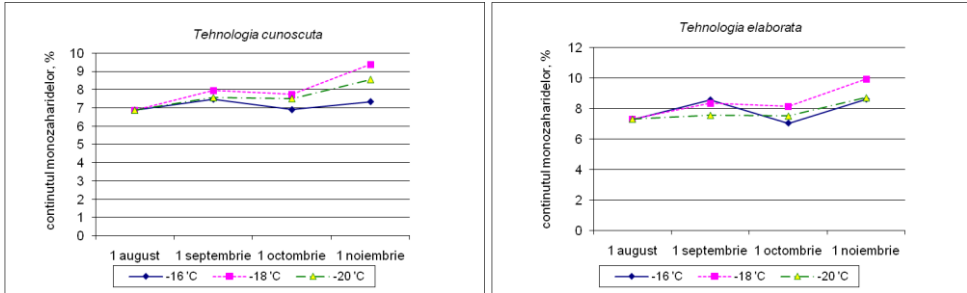


**Fig.1** - Assess the degree of change in sucrose content in raspberry fruit variety Fertöd Zamalos Mollnasarjai the temperature of freezing applied.

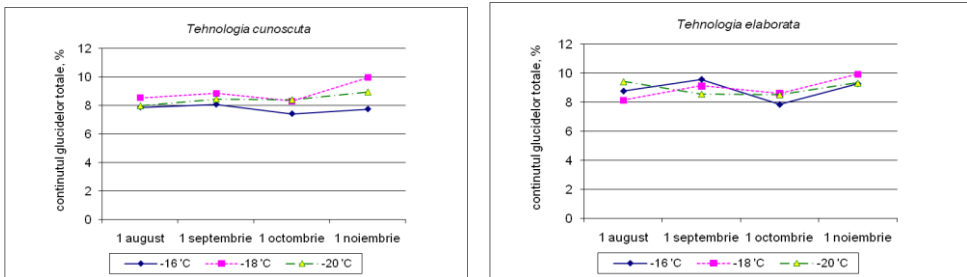
The lowest consumption of sucrose during the 123 days of storage was recorded raspberry fruit storage at freezing temperature of -16C, both bases grown organic fruits and in those obtained according to known technology.

During the storage period, under the influence of temperature increase in raspberry fruit polysaccharide hydrolysis processes (cellulose, hemicellulose, pectic substances), located in cell membranes. Intensification of these processes leads to a weakening of the structure of tissues, their deformation and release the juice of monocarbohydrates cell (glucose).

Figure 2 and 3 shows that the increased hydrolysis process, followed by high amounts of monocarbohydrates and total carbohydrates were obtained from fruits stored at freezing temperatures of -18 and -20C.

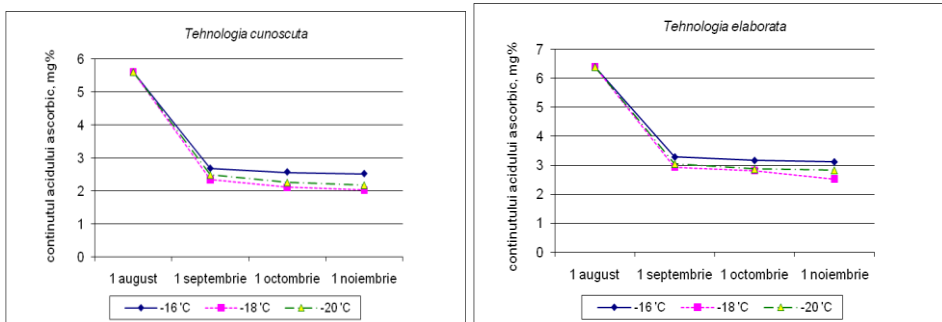


**Fig. 2 -** Determining the degree of change in tissue content monoglucidelor raspberry fruit variety Fertőd Zamalos Mollnasarjai the temperature of freezing applied.

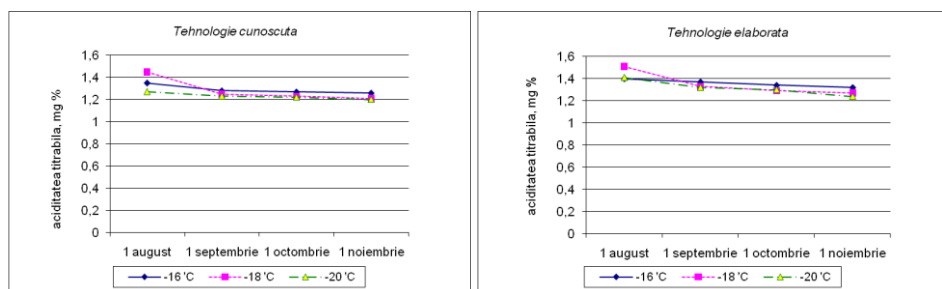


**Fig. 3 -** Determining the degree of change in total carbohydrate content in raspberry fruit tissues Fertőd Zamalos Mollnasarjai variety depending on the temperature of freezing applied

Studying the degree of biodegradation of ascorbic acid (fig. 4) and titratable acids (fig. 5) shows that these processes have also evolved differently. The lowest losses of ascorbic acid content and that of titratable acids, regardless of the technology of rearing were recorded in fruit stored at freezing temperature of -16C (fig. 4 and 5).



**Fig. 4 -** Biodegradation of ascorbic acid in raspberry fruit variety grown Fertöd Zamos Molnasarjai ecological basis and in accordance with known technology according to the freezing temperature applied.



**Fig. 5 -** Biodegradation of titratable acid in raspberry fruit variety grown Fertöd Zamos Molnasarjai ecological basis and in accordance with known technology according to the freezing temperature applied.

## CONCLUSIONS

Therefore, the result of the research degree of modification of the content of biodegradation of plastic substance raspberry fruit tissues stored at different freezing temperatures, it was found that the optimal temperature, was used for this purpose the -16C.

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# SOME ISSUES OF LATERAL BEARING WALNUT CULTIVARS UNDER GROWING CONDITIONS IN ROMANIA

## UNELE PROBLEME ALE SOIURILOR DE NUC CU FRUCTIFICARE LATERALĂ ÎN CONDIȚIILE CULTIVĂRII ÎN ROMÂNIA

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**Abstract.** *The modernization of walnut growing (high productivity and high quality of fruit) involves using a variety assortment of valuable cultivars and modern growing technology. During the last years, along with the terminal bearing walnut cultivars (mostly of Romanian origin) number of cultivars with lateral bearing (originally from California and southern France) were introduced. 16 years ago cultivars walnut trials were established at SCDP Valcea and USAMV Iasi where 22 terminal bearing cultivars and 10 lateral bearing cultivars were planted. Their behavior regarding to the climatic and technological conditions in Romania was evaluated. The lateral bearing cultivars are strongly influenced during growing and bearing fruits by the technology applied in the orchard (pruning, phytosanitary treatments, fertilization, etc.). Without adequate growing technology, the bearing capacity of lateral cultivars is decreasing drastically, sometimes even lower then the terminal bearing ones, which are more rustic. Growing of lateral bearing walnut cultivars is recommended in those micro areas of Romania where damaging low temperatures during winter and spring do not occur very often and also where bacterial diseases of walnut do not cause major losses on fruits and shoots.*

**Key words:** walnut cultivars, lateral bearing, terminal bearing, *Juglans*

**Rezumat.** *Modernizarea culturii nucului (productivitate ridicată și calitate superioară a fructelor), implică folosirea unui sortiment valoros de soiuri și a unei tehnologii superioare. În ultimii ani și-au făcut apariția, alături de soiurile de nuc cu fructificare terminală (majoritatea românești) și o serie de soiuri cu fructificare laterală (originare din California, SUA și sudul Franței). În urmă cu 16 ani, s-au înființat câmpuri de cercetare la SCDP Valcea și USAMV Iași, în care s-au folosit 22 soiuri cu fructificare terminală și 10 soiuri cu fructificare laterală. S-au stabilit unele diferențe privind comportarea acestora față de condițiile climatice și tehnologice din România. Soiurile cu fructificare laterală sunt influențate puternic în creștere și fructificare și de lucrările tehnologice aplicate în plantație (tăieri, tratamente fitosanitare, fertilizări etc.). Fără o tehnologie superioară, capacitatea de fructificare se diminuează până sub nivelul celor cu fructificare terminală care sunt mai rustice. Cultura soiurilor de nuc cu fructificare laterală se recomandă în acele microzone din România care nu creează dificultăți privind temperaturile minime din iarnă (geruri) sau primăvară și în care bacterioza nucului nu are impact nefavorabil asupra plantelor și fructelor.*

**Cuvinte cheie:** soiuri de nuc, fructificare laterală, fructificare terminală, *Juglans*

## INTRODUCTION

The walnut has been cultivated in Romania since long time. The Latin poet Ovidius, exiled 2000 years ago in Tomis (actual city of Constanta), wrote about the

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walnut that “it is not pretentious, it grows on the side of the road and does not fear nor the wind, nor the rain, nor the heat or the cold” (Bordeianu, 1963). Currently, the walnut modern culture requires favorable ecological conditions that allow obtaining high yields, while an assortment of valuable cultivars and high-technology culture.

The favorable environmental conditions, especially in walnut growing geographical region of Oltenia, creates new opportunities for culture, as current world production does not meet the need of human consumption (FAO Stat Database, 2010).

Assortment cultivars of walnut has been the subject of research on assessment in terms of productive potential and ecological valence of cultural areas in Romania (Botu, 2000; Botu and Tudor, 2005; Cociu, 2003; Tudor 2010).

The choice of the cultivars and their extension into culture is an objective necessity to modernize the walnut growing.

## MATERIAL AND METHOD

The study has been conducted between 2008-2010 at University of Craiova - SCDP Valcea and U.A.S.V. M. Iasi in a trial with 14-16 years old trees.

The biological material consisted of 22 cultivars with different origins and terminal bearing and 10 lateral bearing cultivars.

The cultivars are grafted on *Juglans regia* seedlings. Each cultivar is represented by 5-10 trees. Planting distance was 9.0 x 8.0 m (139 trees per hectare).

The research methods have been in relationship with the purpose of the work and included complex observations and determinations regarding trees' habit, growth and fruit-yielding phases etc.

Data was processed using analysis of variance ( $s^2$ ).

In the study period the annual average temperatures ranged from 10.8 °C (2010) and 12.0 °C (2009) (multi-annual average 10.2 °C) and the absolute minimum ranged from -12.5 °C (2008) and - 18.4 °C (2010) (absolute minimum of the area is – 27°C (1967)).

In the spring (April and May), during flowering male and female flowers, there were no negative temperatures (2008-2010). The annual average rainfall was 771 mm.

## RESULTS AND DISCUSSIONS

The walnut cultivars grown in the North of Oltenia have different geographic and genetic origin and shows a different behavior during growth and fruit ripening phases (table 1).

In the 16<sup>th</sup> leaf 2cultivars showed very high vigor ('Argesan' and 'Geoagiu 65'), 21 cultivars emphasized high vigor and only 9 cultivars show medium growth vigor ('Germisara', 'Velnița', 'Hartley', 'Payne', 'Tehama', 'Pedro', 'Vina', 'Lara' and 'Ferjeau').

In the process of flowering, which occurred between 4.04 - 20.05 the walnut cultivars showed a differential dichogamy. A total of 13 cultivars are generally protogynous type and the remaining 19 cultivars were found to be protandrous type. Romanian cultivars are mostly protogynous type (12) and only 3 are protandrous type. Foreign cultivars are protandrous type except 'Idaho' (protogynous). In some years the type of flowering can be changed.

Type of bearing is terminal for a 22 cultivars and lateral bearing for 10cultivars. Between the lateral bearing cultivars and the terminal bearing ones there are no more than 4 to 10 days of flowering timing differences.

Table 1

**The vigor, type of dichogamy and bearing of walnut cultivars in the North area of Oltenia**

No.	Cultivar	Origin	Tree vigor	Flowering type (dichogamy)	Bearing type	Obs.
1	Sarmis	Romania	High	Protogynous	Terminal	
2	Sibişel 44	Romania	High	Protogynous	Terminal	
3	Valcor	Romania	High	Protandrous	Terminal	
4	Valmit	Romania	High	Protogynous	Terminal	
5	Valrex	Romania	High	Protandrous	Terminal	
6	Jupâneşti	Romania	High	Protogynous	Terminal	
7	Argeşean	Romania	Very high	Protogynous	Terminal	
8	Geoagiu 65	Romania	Very high	Protogynous	Terminal	
9	Germisara	Romania	Medium	Protogynous	Mixt	Dominant terminal
10	Muscelean	Romania	High	Protandrous	Terminal	
11	Orăştie	Romania	High	Protogynous	Terminal	
12	Velniţa	Romania	Medium	Protogynous	Terminal	
13	Adams 10	USA	High	Protandrous	Terminal	
14	Chase D9	USA	High	Protandrous	Terminal	
15	Geisenheim 139	Germany	High	Protandrous	Terminal	
16	Franquette (c)	France	High	Protandrous	Terminal	
17	Howe	USA	High	Protandrous	Terminal	
18	Idaho	USA	High	Protogynous	Terminal	
19	Uzlop 10	Bulgaria	High	Protandrous	Terminal	
20	Valstar	Romania	High	Protogynous	Terminal	
21	Valcris	Romania	High	Protogynous	Terminal	
22	Timval	Romania	High	Protogynous	Terminal	
23	Ferjean	France	Medium	Protandrous	Lateral	
24	Fernette	France	High	Protandrous	Lateral	
25	Fernor	France	High	Protandrous	Lateral	
26	Hartley	USA	Medium	Protandrous	Mixt	Dominant lateral
27	Lara	France	Medium	Protandrous	Lateral	
28	Payne	USA	Medium	Protandrous	Lateral	
29	Serr	USA	High	Protandrous	Lateral	
30	Tehama	USA	Medium	Protandrous	Lateral	
31	Pedro	USA	Medium	Protandrous	Lateral	
32	Vina	USA	Medium	Protandrous	Lateral	

Fruit yields of the walnut cultivars with terminal bearing (14<sup>th</sup> - 16<sup>th</sup> leaf) varied from one cultivar to another but also according to annual conditions (table 2).

Average nut production was between 1.6 t/ha ('Howe') and 2.45 t/ha ('Valcor'). Compared with the average of all cultivars (1.84 t/ha) yield 'Valcor', 'Valmit', 'Jupinesti', 'Velnița', 'Valstar' and 'Valcris' is very significant positive and only 'Franquette' and 'Timval' is significantly positive (but all shows an average production of over 2 t/ha).

Table 2

**Walnut fruit yields of terminal bearing cultivars in the 14<sup>th</sup> to 16<sup>th</sup> leaf in the subCarpathian area of Oltenia (2008-2010)**

No.	Cultivar	Fruit yield (t/ha)			Average yield (t/ha)	Dif. $\pm$	Signification
		2008	2009	2010			
1	Sarmis	1.6	2.0	2.25	1.95	+0.11	
2	Sibişel 44	1.5	2.0	1.30	1.60	-0.24	o
3	Valcor	1.7	2.3	3.35	2.45	+0.61	***
4	Valmit	1.7	2.2	2.85	2.25	+0.36	***
5	Valrex	1.6	2.1	2.18	1.96	+0.12	
6	Jupâneşti	2.1	2.2	2.66	2.32	+0.48	***
7	Argeşean	1.6	2.0	1.86	1.82	0.02	
8	Geoagiu 65	1.4	1.9	2.82	2.04	0.20	
9	Germisara	1.7	2.1	1.90	1.90	0.06	
10	Muscelean	1.5	2.2	1.04	1.58	-0.26	o
11	Orăştie	2.1	1.7	1.78	1.86	+0.02	
12	Velniţa	1.7	2.1	2.86	2.22	+0.38	***
13	Adams 10	1.5	1.7	0.85	1.35	-0.49	ooo
14	Chase D9	1.6	1.9	1.24	1.58	-0.26	o
15	Geisenheim139	1.3	1.9	1.24	1.48	-0.36	ooo
16	Franquette	1.9	2.0	2.40	2.10	+0.26	*
17	Howe	1.3	1.7	1.18	1.39	-0.44	ooo
18	Idaho	1.5	1.9	1.56	1.65	-0.19	
19	Uzlop 10	1.4	1.8	1.34	1.51	-0.33	ooo
20	Valstar	1.6	2.4	2.60	2.20	+0.36	***
21	Valcris	1.9	2.4	2.60	2.30	+0.46	***
22	Timval	1.5	2.2	2.50	2.06	+0.22	*
	Mean	1.62	2.03	1.88	1.84		

LSD 5.0%=0.202; LSD 1.0 %=0.265; LSD 0.1%=0.320

The cultivars 'Adams 10', 'Howe', 'Uzlop-10' and others have achieved significantly negative (1.06 to 1.48 t/ha) yields. The cultivars with lateral bearing have had higher yields than the terminal bearing cultivars in the terms of very favorable climate years (table 3).

Table 3

**Walnut fruit yields of lateral bearing cultivars in the 14<sup>th</sup> to 16<sup>th</sup> leaf in the subCarpathian area of Oltenia (2008-2010)**

No.	Cultivar	Fruit yield (t/ha)			Average yield (t/ha)	Dif. $\pm$	Signification
		2008	2009	2010			
1	Ferjean	3.4	3.1	2.11	2.87	+0.38	***
2	Fernette	2.0	2.5	3.54	2.68	+0.19	*
3	Fernor	2.3	2.7	1.82	2.27	-0.22	oo
4	Hartley	2.7	3.3	4.56	3.52	+1.03	***
5	Lara	2.8	1.6	2.24	2.21	-0.28	oo
6	Payne	2.0	2.7	4.60	3.10	+0.61	***
7	Serr	1.7	2.6	2.90	2.40	-0.09	
8	Tehama	1.8	2.7	2.70	2.40	-0.09	
9	Pedro	1.8	2.6	3.06	2.48	-0.01	
10	Vina	2.7	3.5	4.66	3.62	+1.13	***
	Mean	2.32	2.73	2.42	2.49	-	

LSD 5.0%=0,168; LSD 1.0 %=0,192; LSD 0.1%=0,285

The average yields of these cultivars ranged between 2.21 t/ha ('Lara') and 3.62 t/ha ('Vina'). Compared to average 2.49 t/ha the cultivars 'Ferjean', 'Hartley', 'Payne' and 'Vina' shows a very significant positive production and the cultivar 'Fernette' is significantly positive. The yields of cultivars 'Fernette' and 'Lara' are distinct significantly negative compared with the average.

The terminal bearing cultivars recording a average production of 1.84 t / ha with 0.65 t / ha lower than average production of lateral bearing cultivars (table 4).

Table 4

**Yield differences between terminal and lateral bearing walnut cultivars (14<sup>th</sup>-16<sup>th</sup> leaf)**

No.	Specification	Average fruit yield (t/ha)			
		2008	2009	2010	Mean
1	Mean – terminal bearing cvs.	1.62	2.03	1.88	1.84
2	Mean – lateral bearing cvs.	2.32	2.73	2.42	2.49
	Diference ±	+0.70	+0.70	0.54	0.65
	Significance (LSD 5.0%=0.265)	*	*	*	*

The yields differences are significant, but they are obtained in terms of the absolute minimum temperatures in winter did not affect the walnut plants, and during flowering were not recorded negative temperatures.

Walnut cultivars with a terminal bearing show fruit yields affected by bacterial blight in percentage of 4.58% (limits of the attack was 3.2% for 'Valrex' and 6.7% fo 'Idaho').

The lateral bearing cultivars has low resistance to bacterial blight attack, the fruits are attacked at the rate of 10.54% (from 8.6% in 'Lara' and 14.1% in 'Pedro') (tab. 5).

Under the weather conditions of Romania the lateral bearing walnut cultivars, although relatively more productive, are influenced by the low temperatures in winter (under-22°C), level of bacteriosis attack and culture techniques.

For these reasons, choosing and using the lateral bearing cultivars in the orchards require deep knowledge of climatic elements in the growing microregions in order to prevent loss of production and even trees.

In the case of the microregions with the most favorable conditions, the lateral bearing cultivars can be grown along with the terminal bearing walnut cultivars.

Table 5

**Behaviour of walnut cultivars to bacteriosis (*Xanthomonas campestris* pv. *juglandis*) in the subCarpathian area of Oltenia**

No.	Specification	Amount of fruit yield affected by bacteriosis		Limits of bacteriosis attack	
		%	Kg/ha	Minimum	Maximum
1	Mean – terminal bearing cvs.	4.58	84	'Valrex' (3.2%) - 63 kg/ha	'Idaho' (6.7 %) - 111 kg/ha
2	Mean – lateral bearing cvs.	10.54	262	'Lara' (8.6%) - 190 kg/ha	'Pedro' (14.1 %) - 350 kg/ha
	Difference of attack	+ 5.96	+ 178	+ 5.4 / 127	+ 7.4 / 239

## CONCLUSIONS

Walnut cultivars with different genetic and geographic origin emphasized a differentiated behavior in the bearing process in the sub-Carpathian area of Oltenia.

The studied walnut cultivars were grouped into terminal bearing cultivars (22) and lateral bearing ones (10).

Depending on type of dichogamy 13 are of protogynous type and 19 are protandrous.

Highest average yields of fruits were achieved by terminal bearing cultivars 'Valcor' (2.45 t/ha), 'Jupinesti' (2.32 t/ha), 'Valmit' (2.25 t/ha), 'Velnita' (2.22 t/ha) etc.

The most productive lateral bearing cultivars proved to be: 'Vina' (3.62 t/ha), 'Hartley' (3.52 t/ha), 'Payne' (3.10 t/ha).

The fruit yields of lateral bearing cultivars under climatic conditions without low temperatures, which can also affect the trees, was higher than those of terminal bearing cultivars (1.84 t/ha, comparatively with 2.49 t/ha).

The culture of lateral bearing walnut cultivars is possible into the microregions with very favorable climate, especially as complementary or minor cultivars, in order to avoid the risk of totally loss of yield and trees.

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# RESEARCH REGARDING THE INFLUENCE OF PRUNING AND PLANTING DISTANCE ON THE GROWTH AND FRUCTIFICATION OF SOME APPLE TREE VARIETIES WITH BIOLOGICAL RESISTANCE

## CERCETĂRI PRIVIND INFLUENȚA TĂIERII ȘI A DESIMII DE PLANTARE ASUPRA CREȘTERII ȘI FRUCTIFICĂRII UNOR SOIURI DE MĂR CU REZISTENȚĂ BIOLOGICĂ

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**Abstract.** *The research was conducted in a high density plantation, 2777 trees/ha, with four varieties resistant to diseases: Pionier, Prima, Generos and Florina and four pruning variants (shortening the semiscaffold with 1/2-1/3 of length with and without shortening of annual branches). The reaction of the trees to the pruning of different intensity was particular per variety regarding the trunk growth, fruit bud differentiation and obtained production. Only the growth of the shoots was directly influenced by the intensity of the pruning. Generally, the shortening of the semiscaffold with 1/2 with and without shortening the annual branches led to better results on average for the varieties Prima, Pionier and Generos, and for the Florina the shortening of the semiscaffold with 1/3 of length.*

**Key words:** apple culture, pruning, resistance varieties

**Rezumat.** *Cercetările au fost efectuate într-o plantație de desime mare 2777 pomi/ha, cu 4 soiuri rezistente la boli: Pionier, Prima, Generos și Florina și 4 variante de tăiere (scurtarea semischeletului cu 1/2-1/3 din lungime cu și fără scurtarea ramurilor anuale). Reacția pomilor la tăierea de intensitate diferită a fost particularizată la nivel de soi în ceea ce privește creșterea trunchiului, diferențierea mugurilor de rod și producția obținută. Numai creșterea lăstarilor a fost direct influențată de intensitatea tăierii. În general scurtarea semischeletului cu 1/2, cu și fără scurtarea ramurilor anuale, a dat pe medie rezultate mai bune la soiurile Prima, Pionier și Generos, iar la soiul Florina scurtarea semischeletului cu 1/3 din lungime.*

**Cuvinte cheie:** cultura marului, tăiere, soiuri rezistente

## INTRODUCTION

Apple culture has been and remains one of the basic species by which fields more or less proper to other agricultural cultures can be capitalized. Choosing the assortment that is to be cultivated is correlated with the conditions that the area offers, with the requirements of the consumers but

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also with the ecological plasticity and tolerance to biotic and abiotic stress factors. The introduction of varieties with biological resistance made it possible to reduce the costs of phytosanitary protection and to reduce the negative impact of chemisation on the environment.

The plant management and pruning systems are important to capitalize better the light and to ensure quality fruit production constant in over time. By using less vigorous rootstocks, it was gradually passed from higher and higher culture density in order to reduce the size of the trees and to increase the yield for manual works, especially for pruning and harvesting. Also, the small trees ensure, apart from large productions and a very good quality, for most of the varieties, more than 90% of the fruit of extra quality.

In order to establish how trees react to different pruning interventions on the semiscaffold, it was organized the present experiment, the results of which will be presented below.

## **MATERIAL AND METHOD**

The experiment was conducted at ICPP Pitești Mărăcineni, in 2004-2006, in an apple tree plantation founded in 1995, with four resistant apple tree varieties: Pionier, Prima, Generos and Florina, grafted on M9 and planted at a distance of 3,6/1m resulting 2777 trees/ha.

The following pruning variants were used:

V1 – shortening the semiscaffold  $\frac{1}{2}$  of length;

V2 - shortening the semiscaffold  $\frac{1}{2}$  of length + shortening the annual branch with  $\frac{1}{2}$  of length;

V3 – shortening the semiscaffold  $\frac{2}{3}$  of length;

V4 - shortening the semiscaffold  $\frac{2}{3}$  of length + shortening the annual branch with  $\frac{2}{3}$  of length.

The plant management was made as vertical ax, supported on trellis with horizontal wires, the soil was maintained grassed between rows and worked on the rows, the applied technology was the one specific for the fruit plantations.

Observations and determinations were made regarding the growth in thickness of the trunk, shoot growth, fruit bud differentiation and obtained production.

## **RESULTS AND DISCUSSIONS**

The growth of the trees was influenced both by the variety and by the pruning variants used.

Thus, for the Pionier variety, the transversal section area of the trunk (TSA) was higher for the variants V2 and V3 and lower for V1 and V4 during the entire study period (table 1).

For the Prima variety, the rate of increase of TSA was higher for the V3 variant, 3,71 cm<sup>2</sup>, the variants V2 and V4 were relatively equal and V1 had the lowest value (table 2).



Table 1

**The influence of pruning on the increase of transversal section area of the trunk for Pionier variety (cm<sup>2</sup>)**

Variant	2004	2005		2006		Average rate
	TSA	TSA	rate	TSA	rate	
V1	7,90	9,09	1,19	9,87	0,78	0,99
V2	11,94	13,20	1,26	13,98	0,78	1,02
V3	10,31	11,47	1,16	12,63	1,35	1,26
V4	7,31	7,95	0,46	8,50	0,55	0,51

Table 2

**The influence of pruning on the increase of transversal section area of the trunk for Prima variety (cm<sup>2</sup>)**

Variant	2004	2005		2006		Average rate
	TSA	TSA	rate	TSA	rate	
V1	9,90	11,40	1,50	15,27	3,87	2,69
V2	14,02	16,81	2,79	20,17	3,36	3,08
V3	16,26	19,29	3,03	23,68	4,39	3,71
V4	11,59	14,14	2,55	17,68	3,54	3,05

For the Generos variety, the rate of increase of TSA was higher for the variant V4, followed by V1 and lower for V2 and V3 (table 3).

Table 3

**The influence of pruning on the increase of transversal section area of the trunk for Generos variety (cm<sup>2</sup>)**

Variant	2004	2005		2006		Average rate
	TSA	TSA	rate	TSA	rate	
V1	8,52	9,70	1,18	11,49	1,79	1,49
V2	8,92	9,90	0,98	11,86	1,96	1,47
V3	9,59	11,37	1,78	12,22	0,85	1,32
V4	10,68	12,81	2,13	15,06	2,25	2,19

For the Florina variety, the best increase was recorded for the variant V1, followed by V4, and the lowest for V3 (table 4).

Table 4

**The influence of pruning on the increase of transversal section area of the trunk for Florina variety (cm<sup>2</sup>)**

Variant	2004	2005		2006		Average rate
	TSA	TSA	rate	TSA	rate	
V1	19,10	22,25	3,15	27,44	5,19	4,17
V2	13,14	15,98	2,84	20,44	4,46	3,65
V3	11,73	13,93	2,20	17,63	3,70	2,95
V4	12,990	14,73	1,83	20,59	5,86	3,85

The sum of shoot growths was influenced by the variety, climatic year and pruning variant used. Thus, the average data per variant showed that the intensity of the growth was directly influenced by the growth intensity, as seen in table 5.

Table 5

**The sum of shoot growths depending on the pruning variant (cm)**

Variant	2004	2005	2006	Average
V1	510,7	486,9	513,2	503,60
V2	597,6	607,3	567,0	590,63
V3	636,3	606,5	606,7	616,50
V4	754,8	678,3	921,7	784,93

The average number of fruit buds differentiated per variety was higher for the variety Prima, followed by Pionier, and lower for Generos (table 6). The differentiation was rather influenced by the climatic year, the values being different per variety, at times the amplitude exceeding 100% from one year to another.

Table 6

**Capacity to differentiate fruit buds  
(average data per variety)**

Variety	2004	2005	2006	Average
Pionier	201,3	117,6	289,3	202,7
Prima	163,7	182,4	285,5	210,5
Generos	173,1	179,9	129,5	160,8
Florina	183,7	217,5	109,4	170,2

The obtained fruit production was very different both between the varieties and between the used variants. Also, the climatic year highly influenced the production for the same variant. As seen in table 7, the values obtained per three years of research show very wide limits of the production: over 40 t/ha for Prima in 2006, variants V2 and V3 and Florina in 2005 for V2 and values under 20 t/ha for Florina in 2006, variants V1, V2, and V3, and Generos in 2006 varinat V4 and Pionier in 2005, varinats V3 and V4. From this data it can be observed the particlar way in which the variety reacts to pruning depending on the climatic conditions of the area. High variability of the data, without a direct connection with the pruning variant or with the variety, showed that the experiment was not statistically ensured, the differences compared to the average being insignificant.

Table 7

Apple production depending on the variety and pruning variant

Variety	Var.	2004	2005	2006	Ave- rage	Difference	Significance
Pionier	V1	26,32	23,02	34,32	27,89	111,39	N
	V2	24,52	22,41	33,12	26,68	106,58	N
	V3	26,88	17,35	25,63	23,28	93,01	N
	V4	25,57	16,85	22,74	21,72	86,77	N
Prima	V1	26,74	28,49	42,12	32,45	129,61	N
	V2	28,54	31,40	40,15	33,37	133,27	N
	V3	23,88	28,10	27,93	26,64	106,40	N
	V4	24,24	26,74	26,29	25,76	102,88	N
Generos	V1	24,07	32,99	32,21	29,76	118,85	N
	V2	27,32	31,18	20,49	26,33	105,18	N
	V3	26,32	26,88	21,18	24,79	99,04	N
	V4	28,35	23,90	13,96	22,07	88,17	N
Florina	V1	25,77	34,62	17,46	25,95	103,66	N
	V2	22,29	40,59	16,46	26,45	105,66	N
	V3	26,27	38,26	17,74	27,42	109,54	N
	V4	22,29	23,90	15,19	20,46	111,39	N
Average		25,59	27,92	25,44	26,31	100	Mt

DL 5% - 42,12

DL 1% - 56,83

DL 0,1% - 75,43

## CONCLUSIONS

1. The behavior of the resistant varieties in density plantations was generally good, but with a particular reaction of the variety to the thinning interventions.

2. Shortening the semiscaffold influenced differently the growth in thickness of the trees, only for the Prima variety the growth was directly influenced by the growth intensity;

3. The sum of shoot growths was directly influenced by the pruning variants, the highest growths were for the variant V4;

4. The fruit production was influenced by the pruning, variety, climatic year and the interaction between these factors, without establishing a direct connection with any of them.

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# MICROPROPAGATION OF RASPBERRY CULTIVARS BY TERMINAL AND LATERAL BUD EXPLANTS

## MICROPROPAGAREA UNOR SOIURI DE ZMEUR DIN EXPLANTE DE MUGURI TERMINALI ȘI LATERALI

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**Abstract:** The purpose of this study was to establish the optimal conditions for *in vitro* micropropagation of two raspberry cultivars (Opal and Cayuga). Axillary and terminal buds, nodal meristems and leaf discs were used as explants. After sterilization, the explants were placed on MS medium supplemented with different concentrations of cytokinins (BAP, TDZ and K) and auxins (2,4D and IAA) added alone or in combination with GA<sub>3</sub>. For both cultivars, the greatest number of shoots, approximately 4.67 per explant, was induced on medium containing 0.5mg/l AIA+ 1mg/l BAP + 0.5mg/l GA<sub>3</sub> and the maximum shoot length, approximately 2.58 cm, was obtained on medium containing 0.5mg/l AIA+ 1mg/l BAP. We concluded that the organogenesis process can be efficiently induced for both raspberry cultivars from terminal buds on MS medium supplied with 0.5mg/l 2,4D+ 1mg/l TDZ or 1mg/l AIA+ 1mg/l BAP + 0.5mg/l GA<sub>3</sub>.

**Key words:** Raspberry, cytokinines, GA<sub>3</sub>, organogenesis

**Rezumat:** Scopul acestui studiu este de a stabili condițiile optime de propagare *in vitro* a două soiuri de zmeur (Opal și Caiuga). Mugurii terminali și axilari decatafilizati, meristeme nodale și porțiuni de limb foliar au fost plasați, după sterilizare, pe mediul de cultura MS suplimentat cu diferite tipuri de citochinine (BAP, TDZ, K) și auxine (2,4D și AIA) adăugate singular sau în combinație cu giberelina (GA<sub>3</sub>). Cel mai mare număr de lăstari, 4.67 per explant, s-a obținut pe mediul suplimentat cu 0.5mg/l AIA+ 1mg/l BAP + 0.5mg/l GA<sub>3</sub>, iar cea mai mare lungime a lăstarilor, aproximativ 2.58 cm, pe mediul suplimentat cu 0.5mg/l AIA+ 1mg/l BAP. În concluzie, procesul de organogeneza poate fi indus eficient în ambele soiuri din muguri terminali și pe mediu MS suplimentat cu 0.5mg/l 2,4D+ 1mg/l TDZ sau 1mg/l AIA+ 1mg/l BAP + 0.5mg/l GA<sub>3</sub>.

**Cuvinte cheie:** zmeur, citochinine, GA<sub>3</sub>, organogeneza

## INTRODUCTION

*In vitro* micropropagation of raspberry cultivars can be used for large-scale multiplication of selected genotypes, germplasm conservation and breeding of new cultivars better adapted to specific soil and climate conditions. Therefore, it is necessary to first determine the optimal conditions for *in vitro* micropropagation. Studies on raspberry micropropagation have been carried out since the 80's to augment or replace the common propagation methods and to

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produce virus free plants. Recently various aspects of raspberry tissue culture have been studied to develop a methodology. Ability to produce adventitious shoots varies from genotype to genotype in *Rubus* sp. (Cousineau M. and Donnelly, 1991; Turk et al., 1994; Graham et al., 1997). Genetic differences of raspberry cultivars require certain modifications of standard growth conditions to produce viable *in vitro* plants. Regeneration of adventitious shoots of *Rubus* spp. from different explants has been reported for leaves (Fiola et al., 1990; Swartz et al., 1990; Owens y de Novoa, Conner, 1992), petioles (Cousineau, Donnelly, 1991), leaf discs and internodal stem segments (McNicol, Graham, 1990), cotyledons (Fiola et al., 1990) and mature embryos (Fiola, Swartz, 1990). Many regeneration studies have focused on the optimal culture media composition. Early reports on *Rubus* species used the cytokinin N6-benzyladenine (BA) for initiating organogenesis process from different explants. Zeatin, another cytokinin, has been found to be more effective for shoot proliferation of some woody species, e.g., in *Vaccinium* (Debnath 2003). Thidiazuron, a cytokinin-like compound, was found to be very effective for stimulation of adventitious shoots in *Rosaceous* crops, including fruit trees (Korban et al., 1992). Similar results were reported for *Rubus* spp. (Fiola et al., 1990; Swartz et al., 1990; Cousineau, Donnelly, 1991). Studies made with raspberry leaf tissues (Cousineau, Donnelly, 1991), or cotyledons of blackberry-raspberry hybrids (Fiola et al., 1990) also illustrated that organogenesis may be affected by growth regulators, incubation temperature or photosynthetic radiation. The goal of this work was to develop a protocol for inducing a high regeneration rate by testing the response of different explants of two *Rubus* to different culture media.

## MATERIAL AND METHOD

**Plant material.** Primocanes from *Opal* and *Cayuga* cultivars were collected from plants grown in the greenhouse using sterile razor blades, placed in plastic bags and stored at 4 C. Under a laminar flow hood, 3–5 cm long stem segments from terminal or medial part of primocane, with a healthy bud were immersed in 70% ethanol for 5 s, and then transferred to a solution containing 0.6% sodium hypochlorite with two drops of Tween-20 for 25 min. After being immersed in solution three times they were rinsed with sterile water and then kept submerged in sterile water, prior to being trimmed and placed on culture medium. The same sterilization process was applied to nodal meristems and 2–3 cm leaf discs. All explants were placed for regeneration on MS medium with different combination of growth regulators (tab 1). Cultures were checked daily for any sign of contamination and they were sub-cultured every 6 weeks. Proliferating explants were kept at 25C and 16-h photoperiod in the growth chamber at  $70 \mu\text{mol m}^{-2} \text{s}^{-1}$ . The number of responsive explants and shoots/explant was recorded after 21 days of culture. Individual shoots were excised and subcultured for shoot growth on the same media and shoot length was recorded after 45 days of culture.

## RESULTS AND DISCUSSIONS

Analyzing morphogenetic reaction of different explants (table 1) we found that leaf discs responded only by cell proliferation, but the other explants

developed organogenesis or cell dedifferentiation depending on the hormonal composition of culture media.

The adventitious and terminal bud explants had a different reaction. The terminal buds developed shoots on all media variants excepting those supplied with kinetin where only cell proliferation occurred. Lateral buds developed shoots only on media supplied with TDZ and GA3. The nodal meristems had a similar reaction with lateral buds, except on medium supplied with TDZ it only produced callus.

Table 1

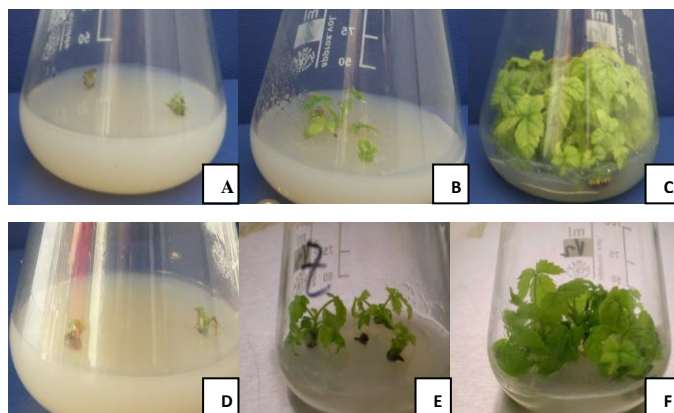
**Morphogenetic reaction intensity of different explants of Opal and Cayuga varieties on MS basal medium supplemented with different plant growth regulators**

MS medium supplemented with:	Explant type	Morphogenetic reaction	
		Opal	Cayuga
0.5mg/l 2,4D+ 1mg/l BAP	Terminal buds Lateral buds Nodal meristem Leaf disc	Organogenesis 19% Cell proliferation 2% Cell proliferation 3% -	Organogenesis 21% Cell proliferation 5% Cell proliferation 17% -
0.5mg/l 2,4D+ 1mg/l TDZ	Terminal buds Lateral buds Nodal meristem Leaf disc	Organogenesis 61% Organogenesis 11% Cell proliferation 27% Cell proliferation 3	Organogenesis 67% Organogenesis 17% Cell proliferation 11% Cell proliferation 3%
1mg/l AIA+ 2mg/l BAP	Terminal buds Lateral buds Nodal meristem Leaf disc	Organogenesis 20% Cell proliferation 36% Cell proliferation 19% -	Organogenesis 24% Cell proliferation 32% Cell proliferation 21% -
1mg/l AIA+ 1mg/l BAP	Terminal buds Lateral buds Nodal meristem Leaf disc	Organogenesis 11% Organogenesis 3% - -	Organogenesis 15% Organogenesis 7% Organogenesis 3% -
1mg/l AIA+ 1mg/l BAP + 0.5mg/l GA3	Terminal buds Lateral buds Nodal meristem Leaf disc	Organogenesis 88% Organogenesis 81% Organogenesis 84% -	Organogenesis 98% Organogenesis 91% Organogenesis 94% -
1mg/l 2,4D+ 5mg/l AIA + 1mg/l K	Terminal buds Lateral buds Nodal meristem Leaf disc	Cell proliferation 81% - Cell proliferation 78% Cell proliferation 81%	Cell proliferation 82% - Cell proliferation 88% Cell proliferation 86%

Different organs used as source of explants had different levels of carbohydrates, proteins and growth regulators in their tissues. The effect of organ source on explant regeneration is thought to be mostly due to the changes in endogenous levels of growth substances. Explants taken from young tissues generally undergo direct organogenesis better than those taken from older tissues. Takayama and Misawa (1982) showed that buds and roots were produced from young leaf explants of *Begonia*, whereas mature leaf explants usually died in culture.

The intensity of morphogenetic reaction in raspberry cultivars was dependent on both explant type and hormonal balance. Terminal buds were the

most responsive explants. In Cayuga 98% of the terminal buds showed morphogenetic reaction on medium supplied with GA3.



**Fig. 1** - Multiple shoot development from terminal buds on Cayuga (a-c) and Opal (d-f) varieties

Very good results were obtained when culture medium was supplied with TDZ (61% of apical buds from Opal and 67% from Cayuga develop shoots). However, the supplementation of medium with BAP resulted in a weaker morphogenetic reaction regardless if it was combined with 2,4 D (maximum 19% at Opal and 21% at Cayuga) or IAA (maximum 20% at Opal and 24% at Cayuga).

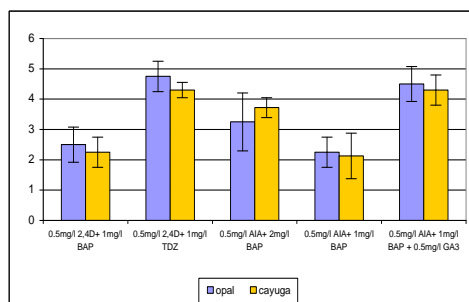
Generally, stimulation of multiple shoot or bud formation is achieved by culturing explants on medium supplemented with relatively high levels of cytokinins. TDZ has been shown to promote shoot regeneration in woody plant species (Briggs et al., 1988; Preece et al., 1991; Baker and Bhatia, 1993), at a much lower concentrations than adenine-type of cytokinins. TDZ induced organogenesis via a reduced dominance of the apical meristem, resulting in formation of adventitious and/or axillary buds directly on the cultured shoot tips (Huetteman and Preece, 1993; Lu, 1993).

On the medium supplemented with BAP in combination with GA3 the morphogenesis was significantly enhanced. Independent on the explant type, more than 81% in Cayuga and 91% in Opal of the explants showed morphogenetic reaction.

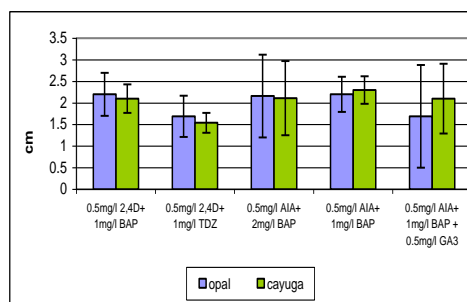
The highest rate was obtained for cultures initiated from terminal bud of Cayuga where 98% of them gave shoots. The application of exogenous gibberellins and cytokinins (GA3 and BA) could induce the emergence of bud from dormancy which might explain the increase in the number of explants with organogenetic response. GA3 also improved plant regeneration via elongation of the embryo axis and by acceleration of the embryo maturation. Several previous studies provided clues for cross talk between GA and cytokinin.



Cytokinins act early during shoot initiation to control meristem activity (Schmulling, 2002), and GAs act at later stages, regulating cell division and expansion to control shoot elongation (Richards et al., 2001).



**Fig. 2 -** Effect of PGR type and concentration on number of shoots per explants from two *Rubus* genotypes



**Fig. 3 -** Effect of PGR type and concentration on shoots length produced from terminal buds of two *Rubus* genotypes

Multiple shoot development was common for both raspberry cultivars used in this study. Large numbers of shoots were produced on media supplemented with TDZ and BAP+GA3 (up to 4 shoots/explant). A good multiplication rate (more than 3 shoots/explant) was obtained on media with high level of BAP (2 mg/l).

On media supplemented with BAP the shoots obtained were longer than on the variants supplemented with TDZ. However, difficulties in the regeneration of plantlets from shoots, poor elongation of shoots and inadequate rooting (Huetteman and Preece, 1993; Lu, 1993) were reported for shoots obtained on TDZ-supplemented media. This impaired growth of TDZ-induced regenerates may result from the use of high TDZ concentrations in the medium or the prolonged exposure of the cultured tissue to this compound.

## CONCLUSIONS

1. The organogenesis process can be efficiently induced for both raspberry cultivars (Opal and Cayuga) from terminal buds on MS medium supplied with 2,4D and TDZ or BAP and GA3
2. High auxine concentration in combination with kinetin induced calusogenesis in both cultivars
3. TDZ and GA3 improved the multiple shoot development, but BAP improved the shoot elongation

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# STUDY CONCERNING *IN VITRO* PROPAGATION OF CHERRY CLONAL ROOTSTOCK GISELA 5

## STUDIU PRIVIND ÎNMULȚIREA *IN VITRO* A PORTALTOIULUI VEGETATIV DE CIREȘ GISELA 5

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**Abstract.** *In the process of in vitro propagation of Gisela 5 cherry vegetative rootstock, the influence of the culture medium composition and the type of explant were analyzed. Different concentrations of growth regulators added to the culture media M&S, QL and LF induced a different behaviour in the cultures. The initiation phase was started by using two types of explants: meristems from the buds in February and mini seedlings taken from herbaceous shoots in May. The best results were obtained on the M&S medium with 95% of explants regenerated from the meristems and 82% of explants regenerated from the single bud mini seedlings. The hormonal balance in this case was of 0.1 mg/L<sup>-1</sup> GA<sub>3</sub> and 1 mg/L<sup>-1</sup> IBA respectively. The multiplication rate with the highest value of 1:7 was produced on the M&S culture medium with the hormonal balance of 1 mg/L<sup>-1</sup> BAP, 0.1 mg/L<sup>-1</sup> GA<sub>3</sub> and 0.2 mg/L<sup>-1</sup> NAA. At the stage of root development, the evolution of the plants was assessed by analyzing the time of rooting, root number and root length. Taking these issues into account, the M&S culture medium with 1.5 mg/L<sup>-1</sup> IBA had the highest efficiency compared with ½ MS, LF and QL media.*

**Key words:** explant type, culture medium, growth regulators, rooting

**Rezumat.** *În procesul de propagare in vitro la portaltoiul vegetativ de cireș Gisela 5 a fost analizată influența compoziției mediului de cultură și a tipului de explant. Concentrațiile diferite de regulatori de creștere adăugați în mediile de cultură M&S, QL și LF au indus culturilor, un comportament diferit. Faza de inițiere s-a pornit folosind două tipuri de explante: meristeme obținute din muguri în luna februarie și minibutași confecționați din lăstari ierbacei în luna mai. Cele mai bune rezultate de 95 % explante regenerare în cazul meristemelor și 82 % explante regenerare în cazul minibutașilor cu un mugure au fost obținute pe mediul M&S. Balanța hormonală în acest caz a fost 0.1 mg /L<sup>-1</sup> GA<sub>3</sub>, respectiv 1 mg/L<sup>-1</sup> IBA. Rata de multiplicare cu cea mai înaltă valoare 1:7, s-a produs pe mediul de cultura M&S cu balanța hormonală 1 mg/L<sup>-1</sup> BAP, 0.1 mg/L<sup>-1</sup> GA<sub>3</sub> și 0.2 mg/L<sup>-1</sup> NAA. În faza de înrădăcinare evoluția plantelor a fost apreciată analizând timpul de înrădăcinare, numărul de rădăcini și lungimea rădăcinilor. Ținând seama de aceste aspecte, mediul de cultură M&S cu 1.5 mg/L<sup>-1</sup> IBA a avut cea mai mare eficiență comparativ cu mediile M&S ½, L F și QL.*

**Cuvinte cheie:** tip explant, mediu de cultură, regulatori de creștere, înrădăcinare

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## INTRODUCTION

Gisela 5 cherry vegetative rootstock is the most used rootstock in the establishment of the intensive cherry orchards. The interest aroused by this rootstock, because of its properties, lead to its testing in multiplication both through classical and modern methods: the *in vitro* propagation.

This method provides great opportunities for industrial-scale multiplication in a very short time. But there are fundamental differences regarding the response of the explants cultured *in vitro* depending on the species, genotype, explant type, the time when the explant is harvested, culture media components etc.

The study of the above listed factors showed different results. Investigating the effect of different culture media, Nacheva L. (2009) found that the evolution of Gisela 5 rootstock in the multiplication phase is different depending on the type of carbohydrates (sorbitol and sucrose). Arsov T. (2009) obtained the best rooting percentage (42.2%) when he used 0.5 mg/L<sup>-1</sup> IBA. By using the MS culture medium with the addition of IBA at a concentration of 1mg/L<sup>-1</sup>, Hossini AD (2010) obtained a different cherry rootstock, the Gisela 6 rootstock, with a rooting of 92%. Every nutrition element in the plant gives its full effectiveness only in the presence of all the other elements involved in the metabolic reactions (Trifu, M.1997).

Based on the statements above, the objective of the research conducted at the Research Institute for Fruit Growing, Pitesti was to determine the best protocol for a large-scale *in vitro* propagation of Gisela 5 rootstock, with the explant type and the culture medium as experimental factors.

## MATERIAL AND METHOD

### Biological material

*Explant type A*, represented by meristems from buds collected from Gisela 5 adult plants in February;

*Explant type B*, represented by single bud mini seedlings taken from herbaceous shoots in May.

**Disinfection of biological material** consisted of:

*Explants type A*:

- washing with water and liquid detergent;
- immersion in a conc. of 6% of Ca-hypochlorite for 20 minutes;
- immersion in 96 vol-% alcohol for 10 minutes;
- washing with sterile distilled water for 3 x 10 minutes.

*Explants type B*:

- washing with water and liquid detergent;
- immersion in a conc. of 6% of Ca-hypochlorite for 2 minutes;
- immersion in 96 vol-% alcohol for 5 minutes;
- washing with sterile distilled water for 3 x 10 minutes.

The **culture media** were represented by Murashige&Skoog media (MS - 1962), Lee & Fossard (LF - 1977), Quoirin & Lepoivre (QL - 1977), based on several alternatives:

#### - for the differentiation-phase

V1 = MS+ 1 mg/l BAP + 0,1 mg/l GA<sub>3</sub> + 0,2 mg/l NAA; V2 = LF +1 mg/l BAP + 0,1 mg/l GA<sub>3</sub> + 0,2 mg/l NAA; V3 = QL + 1 mg/l BAP + 0,1 mg/l GA<sub>3</sub> + 0,2 mg/l NAA

Each culture was established with a total of 30 explants.

#### -for the multiplication phase

V1 = MS+ 1 mg/l BAP + 0,1 mg/l GA<sub>3</sub> + 0,2 mg/l NAA; V2 = LF +1 mg/l BAP + 0,1 mg/l GA<sub>3</sub> + 0,2 mg/l NAA; V3 = QL + 1 mg/l BAP + 0,1 mg/l GA<sub>3</sub> + 0,2 mg/l NAA

#### -for the rooting phase

V1 = MS +1,5 mg/l IBA+0.01 mg/l GA<sub>3</sub>; V2= ½ M&S (coded 120) +1,5 mg/l IBA+0.01 mg/l GA<sub>3</sub>; V3= QL+1,5 mg/l IBA+0.01 mg/l GA<sub>3</sub>; V4 = LF(coded 117)+1,5 mg/l BA + 0.01 mg/l GA<sub>3</sub>.

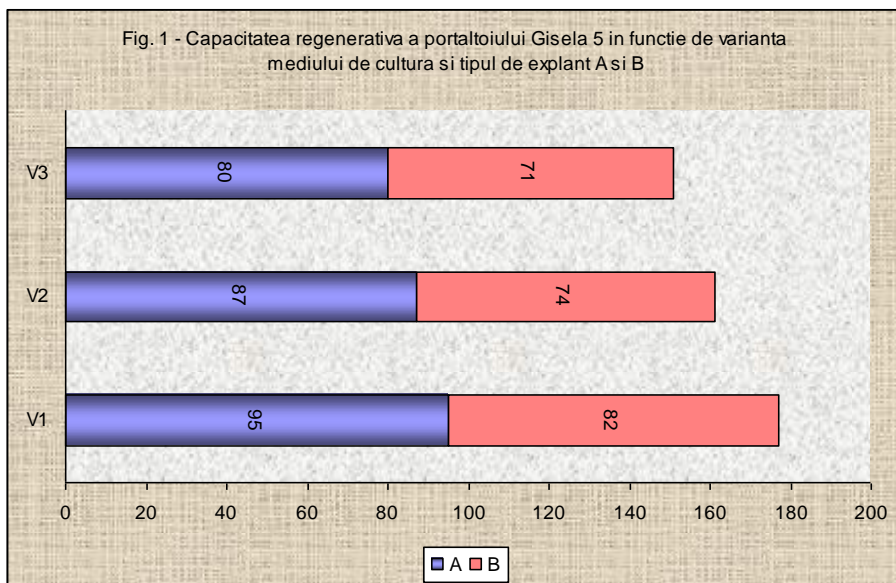
All the culture media contained 40 g/l dextrose, 9 g/l agar and 32mg/l Na Fe EDTA.

The **culture conditions** consist in: temperature of  $23 \pm 1^{\circ}$  C. An irradiance of  $30 \mu\text{mol m}^{-2} \text{s}^{-1}$  from cool-white fluorescent lamps (L40W) was provided throughout a 16-h daily photoperiod.

## RESULTS AND DISCUSSIONS

The **regenerative capacity** of the Gisela 5 explants was studied by analyzing two factors: the culture medium and the explant type (fig. 1).

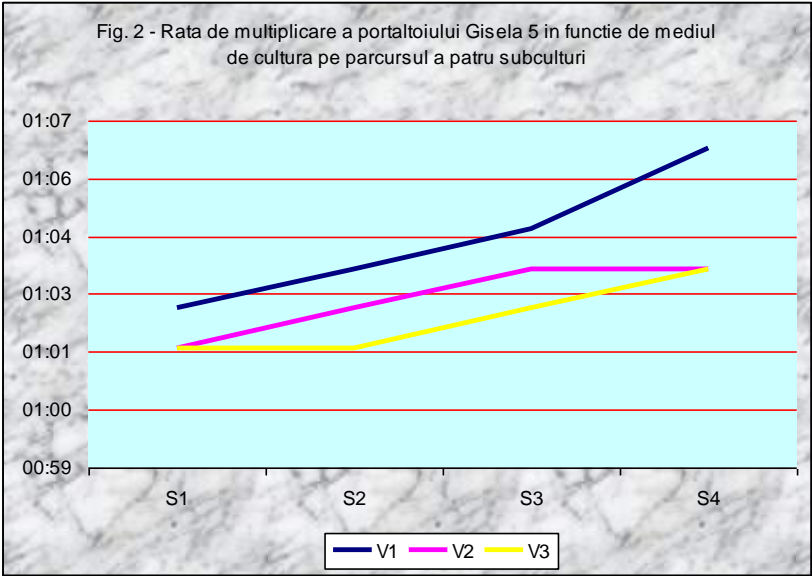
The explant type has a substantial influence on the regeneration capacity of explants. The type A explants differentiated in a higher number with values ranged between 80% and 95%. There are important differences between the explants of this type and those of B type, the values being comprised between 71% and 82% of explants regenerated in the second case.



**Fig.1** - The regenerative capacity of Gisela 5 rootstock depending on the variant of the culture medium and explant type: A and B.

Regardless of the size of the explant, significant differences were also found between the V1 medium variants (82-95% differentiated explants) and V2 variants (74-87% differentiated explants), V3 (71-80% differentiated explants).

The **multiplication rate** was significantly influenced by the culture medium composition during the four subcultures (fig. 2).



**Fig. 2** - The multiplication rate of Gisela 5 rootstock depending on the culture medium during four subcultures

Transferring the differentiated biological material in a fresh multiplication medium led to a higher number of the obtained plants, with a multiplication rate in the first subculture of 1:3 on the MS medium and 1:2 on the LF and QL media. The MS culture medium provided, through its components, better conditions in obtaining shoots throughout the multiplication phase, with a rate of 1:7 shoots in the fourth subculture compared to the LF and QL media, with a multiplication rate of 1:4.

**Rootedness.** The representations made to the set rooting cultures revealed a different evolution depending on the culture medium (table 1, fig.3).

Table 1

**Influence of the culture medium on the process of rootedness**

Variants of culture media	Average rooting time (number of days)	Average number of roots	Average length of root (cm)	Rooting (%)
V1	20	5,2	6	94
V2	30	2,0	5	70
V3	30	3,5	4	69
V4	30	3	2,5	20



**Fig. 3 - Evolution of Gisela 5 rootstock during the rooting phase**

V1 has provided the best conditions for this purpose. The percentage of the plants which showed well formed roots that can be transferred to acclimation was of 94%. V2, represented by the same culture medium but with a halving of macro and microelements, provided conditions for the rooting of 70% of the plants.

A similar situation was recorded on V3 too, which showed a rooting for 69% of the plants. Another difference was that on V1, the rootedness process evolved with approx. 2 weeks earlier than on V2 and V3. The lowest rooting capacity of plants was on the culture medium V4. The first roots also appeared later than on V1.

## CONCLUSIONS

1. Gisela 5 rootstock behaviour *in vitro*, following the protocol map, indicates the possible multiplication on a large scale by using this method.

2. The recommended culture medium is Murashige & Skoog, which proved better results in all the three covered phases: 95% initiation, 1:7 multiplication, 94% rooting.

3. Both types of explants differentiated, with good results: the meristems harvested in February by 95% and the mini seedlings taken from shoots in May by 82%.

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# CHOOSING THE ASSORTMENT OF FREESIA HYBRIDA CULTIVARS, IN ORDER TO OBTAIN FLOWERS IN THE SEASON OF WINTER-SPRING

## ALEGEREA SORTIMENTULUI DE SOIURI LA SPECIA *FREESIA HYBRIDA*, ÎN VEDEREA OBTÎNERII DE FLORI ÎN SEZONUL IARNĂ-PRIMĂVARĂ

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**Abstract.** *In the present research, we have used 20 new cultivars of Freesia, with different characteristics of flowering. The research done in three years has shown, that for a better lagging of flowering it is important to use a great variety of cultivars in order to assure the cut flower needs of the market at a certain time. We notice the cultivars that have flowered early each year during the research (Cascade, Mosella) and also those that have a great period of flowering (Cascade, Galaxi, Mosella, Santana, Yvonne) no matter the experimental conditions.*

**Key words:** *Freesia*, cultivars, flowering, lagging

**Rezumat.** *În prezentul studiu s-au utilizat 20 de soiuri noi de Freesia, cu caracteristici diferite de înflorire. Cercetările efectuate în decursul a trei ani au arătat că pentru eşalonarea înfloritului la această specie este importantă folosirea unui număr cât mai mare de soiuri care să asigure astfel necesarul de flori pe piaţă la momentul cerut. De remarcat sunt soiurile la care s-a constatat o precocitate a înfloritului de-a lungul celor trei ani de studiu (Cascade, Mosella) dar şi cele care au o perioadă îndelungată a înfloritului (Cascade, Galaxi, Mosella, Santana, Yvonne), indiferent de condiţiile de experimentare.*

**Cuvinte cheie:** *Freesia*, soiuri, înflorire, eşalonare

## INTRODUCTION

Being one of the most important species cultivated for cut flowers, *Freesia hybrida* should deserve a better place in the growers choices when setting a crop. There are many reasons to do that but few of the most important are the relatively easy cultivation of the species, few pests and diseases, low costs of cultivation management and a wide number of cultivars and hybrids to choose from (Ngone A., 2001). About the last one mentioned above we would like to debate in this paper.

It is well known that the modern technology used in horticulture permits the obtainance of flowers in every season. Freesia is no exception. Although the classic technology says Freesia should be planted from August to October to obtain flowers in the late winter – early spring season (Băla Maria, 2007;

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Cantor Maria, Pop Ioana, 2008; Șelaru Elena, 2002), the bulbs can be planted anytime if we have modern cultivation spaces that permit us to assure the species needs (Băla Maria, Iordănescu Olimpia Alina, 2000; Berecici D., Băla Maria, 2010). Of course this is mainly practiced in countries with a developed horticulture like Holland and Japan but there is place for more (Singh A.K., 2006).

In Romania, the species is cultivated mainly after the classic technology, so that the flowering will take place at the end of February beginning of March (Toma F., 2009; Zamfir Vâșcă Diana, 2005). Throughout the season, the market needs for Freesia are low, these being covered by the imports from other countries.

## **MATERIAL AND METHOD**

The research was carried out between 2008 and 2010 in the modern greenhouse belonging to the Discipline of Floriculture from the Faculty of Horticulture and Forestry from Timisoara.

For the research 20 new *Freesia hybrida* cultivars bought from Holland in the summer of 2008, have been used: Albatros, Algarve, Blue Bayou, Blue Sky, Calgary, Cascade, Figaro, Galaxi, Honeymoon, Mosella, Medeo, Pink Fountain, Purple Rain, Santana, Santiago, Santorini, Striped Sun, Texas, Troubadur, Yvonne.

Each year we have followed aspects of the phaenology of flowering like: the day of the appearance of the floral spike, the day of flowering, the mass flowering period, the end of the flowering.

In 2008 the planting of the bulbs was done on the 3<sup>rd</sup> of October, in 2009 the planting was done on the 2<sup>nd</sup> of October and in 2010 on the 12<sup>th</sup> of October. Also, each year, the inside temperature of the greenhouse during the vegetation period was different as it follows: in 2008 the minimum was 15°C and the maximum 20°C, in 2009 the minimum was 12°C and the maximum 17°C and in 2010 the minimum was 10°C and the maximum 15°C. Each year, during the flowering period the inside temperature of the greenhouse was setted to be minimum 10°C and maximum 15°C.

## **RESULTS AND DISCUSSIONS**

### **1. Results regarding the flowering of the Freesia cultivars in the first year of culture 2008-2009**

In the first year, the temperature interval in the greenhouse was between 15°-20°C. At this temperature, the Freesia cultivars behaved different, so that the earliest cultivar to ear was Honeymoon cv. (28.12) , meaning 86 days after planting the bulbs and the latest one was Blue Bayou cv. (22.01), 111 days after planting the bulbs.

The first cultivar to flower was Pink Fountain cv. (5.01) but since that was only one plant we have just note it as an extreme, the first cultivars to bloom were Cascade cv., Mosella cv. and Pink Fountain cv. (28.01). Mosella

cv. was the first cultivar that ended to flower (11.03) while the last one was Galaxi cv. (21.04).

Table 1

**The flowering of the Freesia cultivars in the first year of culture (2008-2009)**

Cultivar	YEAR							
	2008 - 2009							
	SPIKE APPEARENCE		FLOWERING					
	Beginning	N.D.P	First flower	N.D.P.	Heyday	End	N.D.P	N.D.F.F.
ALBATROS	10.01	99	8.02	128	20.02	24.03	172	44
ALGARVE	8.01	97	14.02	134	25.02	30.03	178	44
BLUE BAYOU	22.01	111	18.02	138	8.03	16.04	195	57
BLUE SKY	15.01	104	9.02	129	23.02	27.03	175	46
CALGARY	15.01	104	12.02	132	27.02	10.04	189	57
CASCADE	3.01	92	28.01	117	16.02	16.03	164	47
FIGARO	6.01	95	8.02	128	25.02	20.03	168	40
GALAXI	19.01	108	15.02	135	7.03	21.04	200	65
HONEYMOON	28.12	86	2.02	122	19.02	17.03	165	43
MEDEO	12.01	101	10.02	130	27.02	3.04	182	52
MOSELLA	2.01	91	28.01	117	20.02	11.03	159	42
PINK FOUNTAIN	8.01	97	5.01 28.01	94 117	24.02	31.03	179	85 62
PURPLE RAIN	14.01	103	9.02	129	2.03	8.04	187	58
SANTANA	29.01	118	31.01	120	19.02	24.03	172	52
SANTIAGO	11.01	100	14.02	134	27.02	6.04	185	51
SANTORINI	18.01	107	13.02	133	25.02	30.03	178	45
STRIPED SUN	13.01	102	8.02	128	17.02	19.03	167	39
TROUBADUR	17.01	106	10.02	130	28.02	11.04	190	60
TEXAS	20.01	109	16.02	136	5.03	18.04	197	61
YVONNE	3.01	92	6.02	126	24.02	7.04	186	60

*N.D.P.*-number of days from planting; *N.D.F.F.*-number of days from the opening of the first flower

## 2. Results regarding the flowering of the Freesia cultivars in the second year of culture 2009-2010

The second year was different to the first one, as the vegetation conditions were different too. The first cultivar that eared was Cascade cv. (8.01) while the latest was Blue Bayou cv. (28.01).

Also Cascade cv.was the first cultivar to flower, after 121 days from planting and the last one was Honeymoon cv., after 144 days from planting. The longest flowering period was registered by Yvonne cv. (64 days) and the shortest by Figaro cv. (36 days).

Table 2

The flowering of the *Freesia* cultivars in the second year of culture (2009-2010)

Cultivar	YEAR							
	2009 - 2010							
	SPIKE APPEARANCE		FLOWERING					
	Beginning	N.D.P	First flower	N.D.P.	Heyday	End	N.D.P	N.D.F.F.
ALBATROS	15.01	105	17.02	138	3.03	6.04	185	47
ALGARVE	15.01	105	20.02	141	1.03	9.04	188	47
BLUE BAYOU	28.01	118	17.02	138	2.03	7.04	186	48
BLUE SKY	14.01	104	6.02	127	20.02	5.04	184	57
CALGARY	13.01	103	18.02	139	26.02	4.04	183	44
CASCADE	8.01	98	31.01	121	17.02	2.04	181	60
FIGARO	13.01	103	14.02	135	27.02	23.03	171	36
GALAXI	21.01	111	18.02	139	5.03	18.04	197	58
HONEYMOON	16.01	106	23.02	144	7.03	10.04	189	45
MEDEO	14.01	104	15.02	136	4.03	13.04	192	56
MOSELLA	11.01	101	2.02	123	25.02	20.03	168	45
PINK FOUNTAIN	14.01	104	8.02	129	27.02	27.03	175	46
PURPLE RAIN	22.01	112	22.02	143	16.03	20.04	199	56
SANTANA	12.01	102	9.02	130	1.03	10.04	189	59
SANTIAGO	18.01	108	16.02	137	3.03	15.04	194	57
SANTORINI	20.01	110	11.02	132	26.02	6.04	185	53
STRIPED SUN	12.01	102	4.02	125	25.02	24.03	172	47
TROUBADUR	13.01	103	13.02	134	4.03	12.04	191	57
TEXAS	26.01	116	19.02	140	16.03	22.04	201	61
YVONNE	16.01	106	21.02	142	14.03	27.04	206	64

*N.D.P.*-number of days from planting; *N.D.F.F.*-number of days from the opening of the first flower

### 3. Results regarding the flowering of the *Freesia* cultivars in the third year of culture 2009-2010

The third year of culture was also different to the ones before in terms of vegetation conditions inside the greenhouse.

The temperature had the lowest value of the previous years so that the minimum was 10°C and the maximum was 15°C. At this temperature, the first cultivar to ear was Mosella cv., after 69 days from planting the bulbs and the last one was Yvonne cv. after 113 days from planting. Mosella cv. was also the cultivar that started to flower first after 93 days from planting while Yvonne cv. flowered the last after 148 days from planting.

The longest flowering period was registered by Mosella cv. (61 days) while the shortest flowering period was observed in the case of Santorini cv. (32 days).

Table 3

## The flowering of the Freesia cultivars in the third year of culture 2010-2011

Cultivar	YEAR							
	2010 - 2011							
	SPIKE APPEARANCE		FLOWERING					
	Beginning	N.D.P	First flower	N.D.P.	Heyday	End	N.D.P	N.D.F.F.
ALBATROS	17.01	97	21.02	132	14.03	7.04	177	45
ALGARVE	24.01	104	2.03	141	19.03	15.04	185	44
BLUE BAYOU	21.01	101	18.02	129	16.03	8.04	178	49
BLUE SKY	18.01	98	16.02	127	11.03	31.03	170	43
CALGARY	3.01	83	8.02	119	7.03	25.03	164	45
CASCADE	26.12	75	18.01	98	24.02	18.03	157	59
FIGARO	12.01	92	14.02	125	11.03	24.03	163	38
GALAXI	13.01	93	22.02	133	21.03	12.04	182	49
HONEYMOON	10.01	90	18.02	129	6.03	29.03	168	39
MEDEO	21.01	101	23.02	134	17.03	11.04	181	47
MOSELLA	20.12	69	13.01	93	11.02	15.03	154	61
PINK FOUNTAIN	28.12	77	26.01	106	2.03	21.03	160	54
PURPLE RAIN	26.01	106	22.02	133	10.3	4.04	174	41
SANTANA	14.01	94	11.02	122	7.03	6.04	176	54
SANTIAGO	28.01	108	3.03	142	18.03	11.04	181	39
SANTORINI	1.02	112	24.02	135	11.03	28.03	167	32
STRIPED SUN	12.01	92	4.02	115	28.02	1.04	171	56
TROUBADUR	24.01	104	28.02	139	22.03	11.04	181	42
TEXAS	31.01	111	4.03	143	21.03	13.04	183	40
YVONNE	2.02	113	9.03	148	24.03	18.04	188	40

*N.D.P.* - number of days from planting; *N.D.F.F.* - number of days from the opening of the first flower

## CONCLUSIONS

1. Three intervals of temperature have been used each year during 2008-2011 to follow the differences that can occur at different temperatures in matters of flowering phenology;

2. In the first year of culture ( $T^{\circ} 15^{\circ}\text{C}-20^{\circ}\text{C}$ ) the first cultivars to flower were Cascade, Mosella and Pink Fountain while the latest one was Blue Bayou. In the same year the longest flowering period was noticed by Galaxi cv. (65 days);

3. In the second year of culture ( $T^{\circ} 12^{\circ}\text{C}-17^{\circ}\text{C}$ ), Cascade cv. was the first cultivar that flowered while the last one was Honeymoon cv. The longest flowering period was noticed by Yvonne cv. (64 days) and the shortest one by Figaro cv. (36 days);

4. In the third year of culture ( $T^{\circ} 10^{\circ}\text{C}-15^{\circ}\text{C}$ ), the cultivar that started to flower first was Mosella while Yvonne flowered the last. The longest flowering

period was registred by Mosella cv. (61 days) and the shortest flowering period by Santorini cv. (32 days).

We recomand the cultivation of all the cultivars presented in this paper as all of them have valuable characters that were presented in the previous papers and will follow to be presented in further papers.

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# EXPERIMENTS RELATED TO PRESERVATIVE TECHNOLOGIES OF SOIL WORKS MECHANIZATION FOR MAIZE GRAIN, EFFECTUATED AT EZĂRENI FARM OF THE AGRONOMICAL UNIVERSITY FROM IAȘI

## EXPERIMENTĂRI PRIVIND TEHNOLOGIILE CONSERVATIVE DE MECANIZARE A LUCRĂRILOR SOLULUI LA PORUMBUL PENTRU BOABE, REALIZATE LA FERMA EZĂRENI A UNIVERSITĂȚII AGRONOMICE DIN IAȘI

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**Abstract.** *In the countries with a transition economy, as it is Romania, the problems regarding the sustainable development of the agricultural exploitation are much more connected with poverty and lack of productive technologies rather than the application of some polluting technologies and the high levels of consumption as therein the developed countries. Must be known the fact that if the farmers will produce sustainable and organic, will obtain a smaller production. So they must recover the expenses and the unfinished production by products price, fact that leads us to the question if Romania are prepared to support these high prices*

**Key words:** works for grains, conventional tillage, minimum tillage, no-till, soil tillage.

**Rezumat.** *În țările cu o economie în tranziție, cum este România, problemele legate de dezvoltarea durabilă a exploatării agricole sunt mult mai legate de sărăcia și lipsa de tehnologii de producție, mai degrabă decât aplicarea unor tehnologii poluante și de consum față de țările dezvoltate. Trebuie să fie cunoscut faptul că în cazul în care agricultorii vor produce durabil și ecologic, vor obține o producție mai mică. Deci, acestea trebuie să recupereze diferența de producție, fapt care ne conduce la întrebarea dacă România este pregătită pentru a sprijini aceste prețuri mai ridicate.*

**Cuvinte cheie:** porumb pentru boabe, tehnologii convenționale, minimum de lucrări, fără lucrări, lucrările solului

## INTRODUCTION

At world level important funds are given to research for promoting agricultural development financed research activities, providing services and other forms of help, stimulating production by giving subventions. This fact permit a four time increase of the agricultural production till the start of the century, contributing to the development of society in general, but, in the time, agricultural pollution increase and the quality of a certain number of landscapes was deteriorated (Guș P., Rusu T., 2005).

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Advocates of sustainable agriculture establish unconventional systems for soil works which are better than the classical ones, telling that it is necessary to apply those variants which correspond to the local specific conditions. At the actual stage of knowledge, it is considered that direct drill represent the most advanced technology which could be apply in agriculture. No other technology is not so close to an effective stoppage of soil erosion and to achievement a durable agriculture (Jițăreanu G. et al., 2007).

## MATERIAL AND METHOD

Research took place at Ezăreni Farm, Iași, belonging to "Ion Ionescu de la Brad" University of Agricultural Sciences and Veterinary Medicine, in years 2008 and 2009, on a mezocalcaric cambic chernozem weak, with a „loamy clay” texture, reaction is weak acid to weak alkaline, it is a soil with a useful edaphic volume quite great and a good air-hydric regime. Soil is relatively refined; exception is under-tillage layer which is low compacted.

Experience is mono-factorial, the crop is represented by maize grain, and the aim is to track the influence of different mechanization technologies on soil, yield, energetic and qualitative indexes. Placement method of experiment is a linear one in 5 variants each of them with 3 repetitions.

### Experimental factors:

*Variant V1* - (control), conventional technology. In autumn, tillage with unit Valtra T-190 tractor + Opal 140 reversible mouldboard plough. In spring, prepare germinating bed by two passes with unit U-650 tractor + GD-3.2 disk harrow and sowing with the aggregate tractor U-650 + SPC-8 sowing machine. Weeding two times with aggregate U-650 tractor + CPU-8 cultivator.

*Variant V2* - In autumn, tillage with unit Valtra T-190 tractor + Opal 140 reversible mouldboard plough. Preparing germinating bed with aggregate Valtra T-190 tractor + BS 400 A combinator (kompaktor) and sowing with unit U-650 tractor + SPC-8 sowing machine. Weeding two times with aggregate U-650 tractor + CPU-8 cultivator.

*Variant V3* - In autumn, tillage with aggregate Valtra T-190 tractor + Opal 140 reversible mouldboard plough. In spring, preparing germinating bed with aggregate Valtra T-190 + FRB-3 vertical rotary hoe (540 rpm at tractors' PTO) and sowing with unit U-650 tractor + SPC-8 sowing machine. Weeding two times with aggregate U-650 tractor + CPU-8 cultivator.

*Variant V4* - In autumn, tillage with aggregate Valtra T-190 tractor + Opal 140 reversible mouldboard plough. In spring, preparing germinating bed with aggregate U-650 tractor + FDL-1.3 unbalanced rotary hoe for orchard (540 rpm at tractors' PTO) and sowing with unit U-650 tractor + SPC-8 sowing machine. Weeding two times with aggregate U-650 tractor + CPU-8 cultivator.

*Variant V5* - In autumn, tillage with aggregate Valtra T-190 tractor + Opal 140 reversible mouldboard plough. In spring, preparing germinating bed in stripes and sowing with aggregate U-650 tractor + complex unit compound of FPL-4 weeding rotary hoe for vegetables and SPC-4 sowing machine. Weeding two times with aggregate U-650 tractor + CPU-8 cultivator.



## RESULTS AND DISCUSSIONS

The influence of different mechanization technologies on soil by determination on each variant of soil's penetration resistance was measured with electronic penetrometer and analysed by comparing the six obtained means (graph below). Agro-technical norms establish that in the case of penetration resistance up to 2.5 MPa plants' roots have a normal growing. When the penetration resistance is between 2.6 – 10.0 MPa exist a partial limitation of roots growing.

Table 1

Soil penetration resistance (maize grain)

Year	Variants of tillage and sowing	Average soil penetration resistance, 0-30 cm		Difference (MPa)	Significance
		MPa	% to witness		
Media 2008-2009	V <sub>1</sub>	0,36	100,0	0	martor
	V <sub>2</sub>	0,37	102,8	0,01	-
	V <sub>3</sub>	0,39	108,3	0,03	-
	V <sub>4</sub>	0,68	188,9	0,32	xxx
	V <sub>5</sub>	0,87	241,7	0,51	xxx

The values of weighted average diameter of soils' structure elements are presented in figure 1.

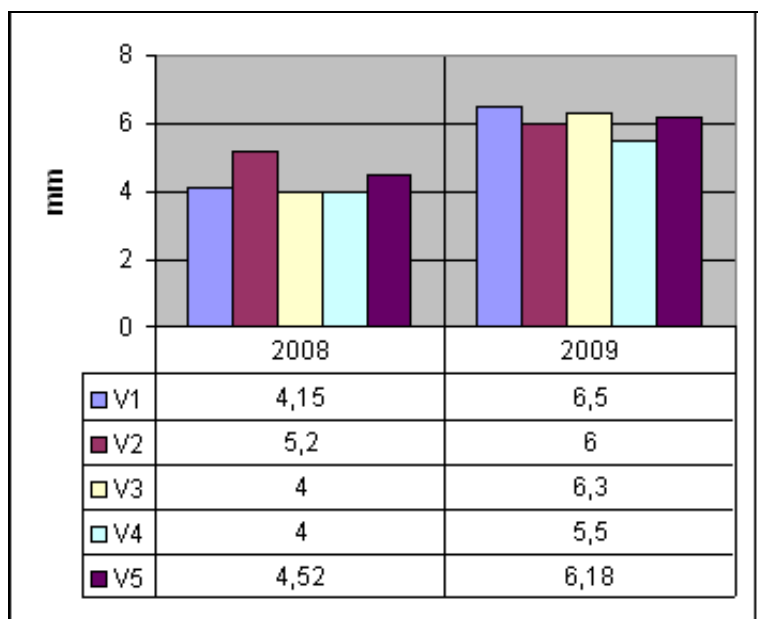
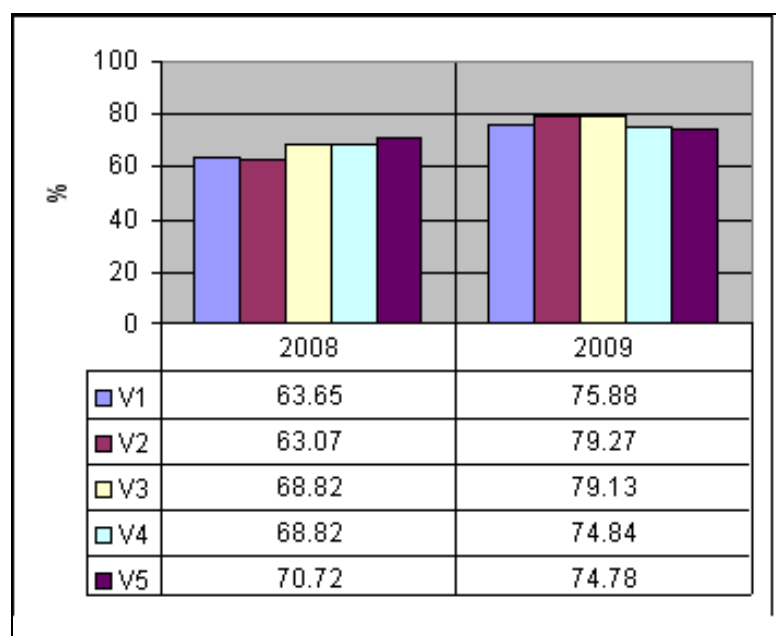


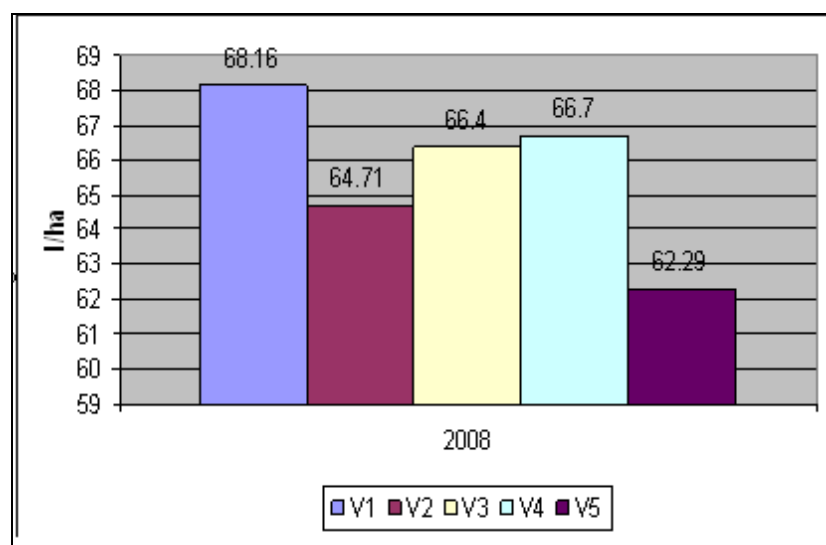
Fig. 1 - Weighted average diameter (mm)

For 0 – 30 cm depth could be considered that the weighted average diameter of soils' structure elements is corresponding (from agronomic point of view, particles with diameter of 2 – 5 mm most interested).

Since the fluid stability of the structure exceeds 60% (figure 2), it falls in the "extremely high".



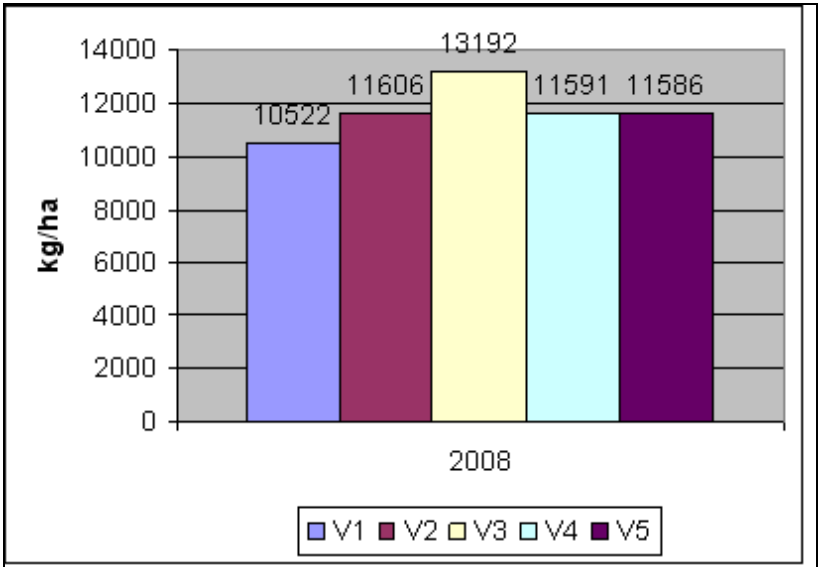
**Fig. 2** – Fluid stability (%)



**Fig. 3** - Diesel consumption (l / ha)

Was calculated the total quantity of consumed diesel for maize grain, by summing the quantities consumed at all the realised works, from fertilization, tillage till harvest (figure 3).

Seed yield obtained at an agricultural crop depends on many factors, such as the quality of soil works and sowing (figure 4).



**Fig. 4 – Maize grain yields (kg/ha)**

### CONCLUSIONS

1. At variants at which the soil was processed with mouldboard plough and spherical disk harrow, soil layer 0 – 9 cm is refined, with a medium glomerular structure, but also exist compacted lumps, which are resistant to breaking up.
2. In the case of the soil processed with rotary hoes, soil structure is glomerular, dominating structural elements having small dimensions, fact that favours an accentuated compaction of soil during vegetation period.
3. At the effectuated tests we observe that soils' penetration resistance had, in general corresponding values. Not notified an increase of penetration resistance due to the usage of some units.
4. Must be mention the fact that, however, after a number of years, due to misuse of equipment, soil degradation will appear, soil will be compacted, will take place fragmentation of structural elements, will be produce an accentuated mineralization of organic matter, humus etc. For these reasons must be used those

technologies of soil processing mechanization which assure soil preservation in the highest degree.

5. In case in which are conditions for using unconventional systems for soil works, technological variants of soil works mechanization which will be used, starting with the best one, are: V5, V3, V2, V4.

6. Will be avoid the application of variant V1, classic technology, due to the high fuel consumption and weak results regarding the determine indexes.

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# RESEARCHES REGARDING THE MECHANIZATION PRESERVATIVE TECHNOLOGIES RELATED TO THE SOIL WORKS OF THE AUTUMN CORN, MADE WITHIN THE REDIU COMPANY OF THE AGRONOMICAL UNIVERSITY IN IAȘI

## CERCETĂRI PRIVIND TEHNOLOGIILE CONSERVATIVE DE MECANIZARE A LUCRĂRILOR SOLULUI LA GRÂUL DE TOAMNĂ, EFECTUATE ÎN CADRUL FERMEI REDIU A UNIVERSITĂȚII AGRONOMICE DIN IAȘI

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**Abstract.** *The paper presents the result of researches that were done during 2006-2009 period, on the experimental field of Mechanization Agriculture, within the Rediu Farm of the Agronomical University in Iasi, on a cambic chernozem soil. The aim this study was to evaluate the influence of the unconventional and conventional tillage system on the soil.*

**Key words:** conventional tillage, minimum tillage, no-till, autumn corn, soil tillage.

**Rezumat** *.Lucrarea prezintă rezultatul unor cercetări care au fost efectuate în perioada 2006-2009 perioada, pe câmpul experimental de Mecanizare Utilaje agricole, în cadrul agricole Rediu a Universitatii Agronomice din Iasi, pe un sol cernoziom cambice. Scopul acestui studiu a fost de a evalua influența sistemului de lucrare neconventionale și conventionale pe sol.*

**Cuvinte cheie:** lucrări convenționale, minimum de lucrări, fără lucrări, grâu de toamnă, lucrarea solului

## INTRODUCTION

Research regarding soil works show that it is a tendency to replace tillage with plough with works realized with harrow disk or with aggregates that not turn up side down the furrow (chisel, paraplow), and also direct sowing in un-worked soil, systems that aimed to reduce soil spreading and compaction, to decrease soil erosion and to cut off the production costs (Rădulescu Carmen Valentina, 2003).

In soil preserving system are also important the maintenance crop works, integrate pest, disease and weed combat which are based on a rational mix of all the protection methods (chemical, biological, physical, agro-technical) and application of the chemical treatments only when exist a justification from technological, ecological and economical point of view (Jităreanu G. et al., 2007).

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## MATERIAL AND METHOD

Research were carried out at Rediu Farm, Iași, belonging to "Ion Ionescu de la Brad" University of Agricultural Sciences and Veterinary Medicine, in years 2006, 2007 and 2008, on a cambic chernozem, with a loamy clay texture, the depth of appearance of calcium carbonate being at 92 cm. Longitudinal slope of the field is around 3 degrees. Rediu Farm is placed in silvo-steppe bioclimatic area, in the North part of Iași City, Hilly plain of inferior Jijia and Bahlui, in Rediu village, being placed at geographical coordinates of 47°22' Nordic latitude and 27°5' Eastern longitude.

Experience is a mono-factorial one, the crop is winter wheat, and the aim is to track the influence of different mechanization technologies on soil, yield and energetic and qualitative indexes. Placement method of the experience is a linear one in 6 variants each of them with 3 repetitions.

### **Experimental factors:**

*Variant V1* – Conventional technology means tillage in autumn with Valtra T-190 tractor + Opal 140 reversible plough and after that are done four passes with U-650 tractor in unit with GD-3.2 light disk harrow and 2GCR-1.7 adjustable teeth harrow. Sowing is realised with U-650 tractor + SUP-29 universal sowing machine.

*Variant V2* – Technology of minimum tillage with multifunctional aggregates, suppose soil processing with Valtra T-190 tractor in unit with heavy disk harrow GDG – 4.2. Preparation of germinating bed is realised with Valtra T-190 tractor and complex aggregate compound from FRB – 3 rotary hoe and SPU – 24DR sowing machine (540 rpm at tractors' PTO).

*Variant V3* – Technology of minimum tillage with chisel and complex aggregate, suppose soil processing with U-650 tractor in unit with PC-7 chisel plough. Preparation of germinating bed and sowing are realised with Valtra T-190 tractor and AGPS – 24DR complex aggregate, compound from FRB – 3 rotary hoe and SPU – 24DR sowing machine (540 rpm at tractors' PTO).

*Variant V4* – Technology of minimum tillage with disk harrow includes soil processing with Valtra T-190 tractor in unit with GDG-4.2 heavy disk harrow. Preparation of germinating bed is realised by 4 passes with U-650 tractor in aggregate with GD-3.2 light disk harrow and 2 GCR-1.7 teeth harrow. Sowing is realised with U-650 tractor in unit with SUP-29 universal sowing machine.

*Variant V5* – Technology of minimum tillage with complex aggregates and raising bodies, suppose raising of the non-tillage soil, preparation of germinating bed and sowing with Valtra T-190 tractor+ soil raising bodies attached in the front of AGPS-24DR complex aggregate, compound of FRB-3 rotary hoe and SPU-24DR universal sowing machine (540 rpm at tractors' PTO).

*Variant V6* – Direct drill (no tillage) in non-tillage soil, with Valtra T-190 tractor in unit with MCR-2.5 combined machine for soil processing on rows and sowing (1000 rpm at tractors' PTO).

## RESULTS AND DISCUSSIONS

The influence of different mechanization technologies on soil by determination on each variant of soil's penetration resistance was measured with electronic penetrometer and analysed by comparing the six obtained means (graph below). Agro-technical norms establish that in the case of penetration resistance up to 2.5 MPa plants' roots have a normal growing (Toma Dr., Sin Gh., 1987).

When the penetration resistance is between 2.6 – 10.0 MPa exist a partial limitation of roots growing (table 1).

Table 1

Soil penetration resistance (wheat)

Year	Variants of tillage and sowing	Average soil penetration resistance, 0-30 cm		Difference (MPa)	Significance
		MPa	% to witness		
Media 2006-2009	V <sub>1</sub>	0,36	100,0	0	martor
	V <sub>2</sub>	0,37	102,8	0,01	-
	V <sub>3</sub>	0,39	108,3	0,03	-
	V <sub>4</sub>	0,68	188,9	0,32	xxx
	V <sub>5</sub>	0,86	214,7	0,51	xxx
	V <sub>6</sub>	0,92	255,5	0,56	xxx

The values of weighted average diameter of soils' structure elements are presented in figure 1. For 0 – 30 cm depth could be considered that the weighted average diameter of soils' structure elements is corresponding (from agronomic point of view, particles with diameter of 2 – 5 mm most interested).

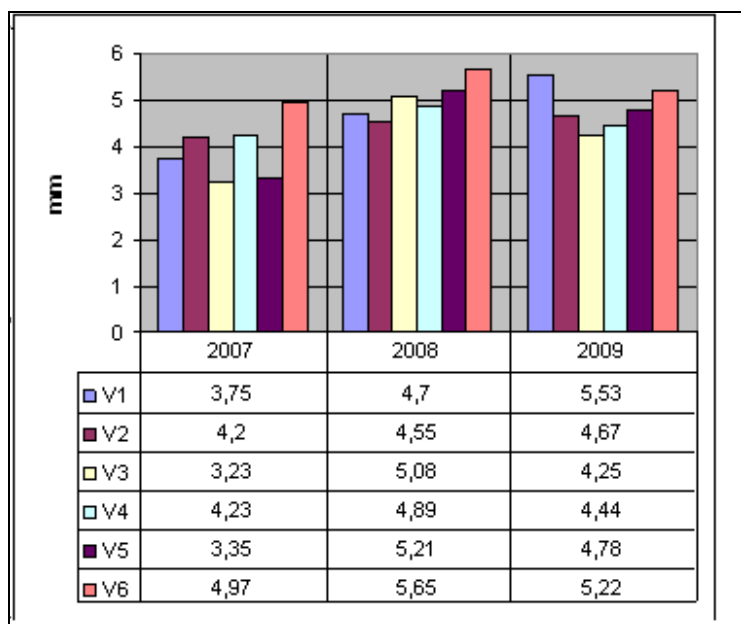
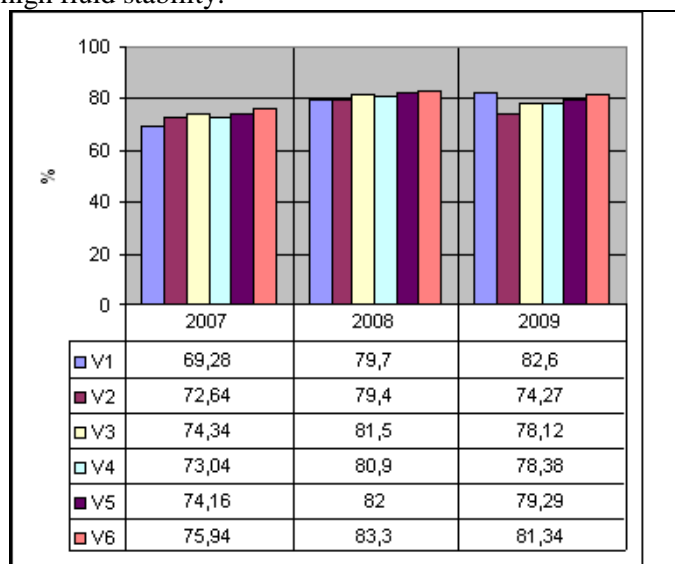


Fig. 1 - Weighted average diameter (mm)

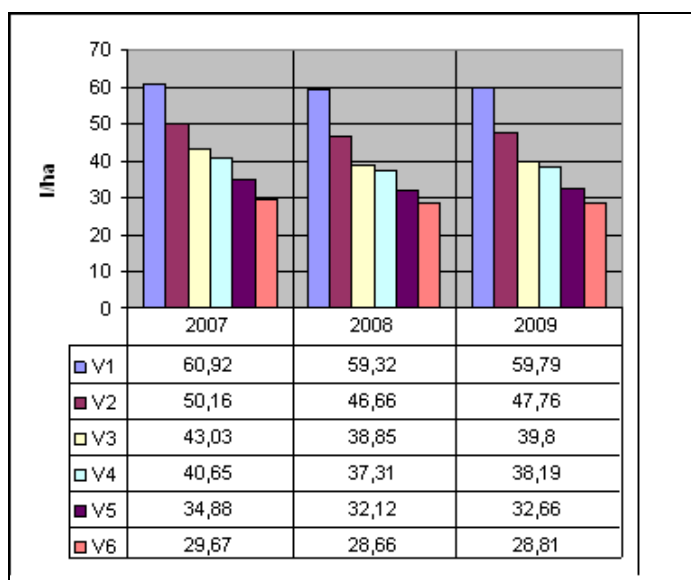
Because fluid stability overpass 60% (figure 2), this one is placed in the "extremely high" class. In fact it is well known the fact that at Rediu farm

belonging to Didactic Station of University of Agricultural Sciences and Veterinary Medicine from Iași, soil of cambic chernozem type has a structure with a very high fluid stability.



**Fig. 2 – Fluid stability (%)**

Also we calculate the total quantity of consumed diesel for wheat crop, by summing the quantities consumed at all the realised works, from fertilization, tillage till harvest and transport of seeds and secondary products (figure 3).

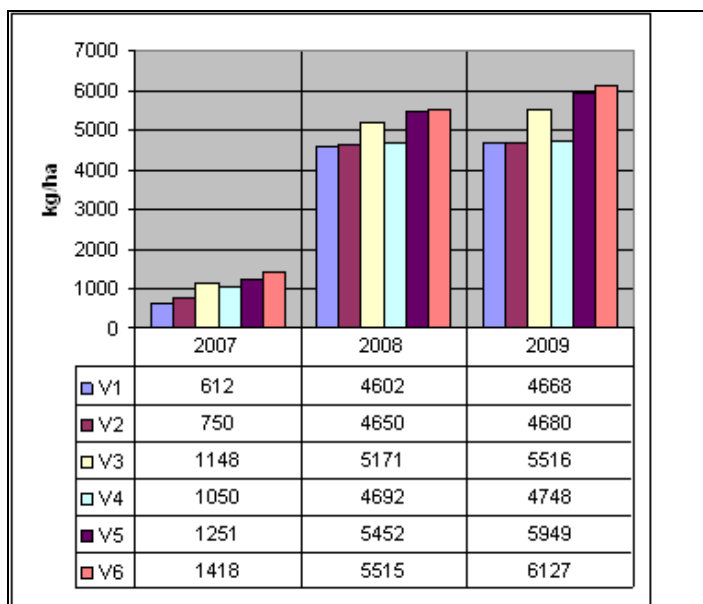


**Fig. 3 - Diesel consumption (l / ha)**



Seed yield obtained at an agricultural crop depends on many factors, such as the quality of soil works and sowing.

In the case of wheat sowed in 2006 seed yield obtained was low (figure 4). Cause that determine the decrease of wheat seed yield is the decreasing of rainfall quantities in September ... December 2006 and April ... July 2007, face to the monthly multiannual averages (averages on 30 years, respectively 1971 ... 2000). For years 2007 and 2008 wheat yield was good.



**Fig. 4 – Wheat yields (kg/ha)**

## CONCLUSIONS

1. In variant at which the soil was processed with mouldboard plough, spherical disk harrow and vertical rotary hoe, soil layer 0 – 8 cm is refined, with a medium glomerular structure, but also exist compacted lumps, which are resistant to breaking up.

2. Soil processing with chisel and vertical rotary hoe had a good effect on raising of it. It was improved the physical state of soil by destruction of compacted soil layer, known as “hardpan”.

3. In conditions of a draught autumn, direct drill (with soil processing in stripes, using horizontal rotary hoe and simultaneous sowing) had a favourable effect on wheat plant emergence.

4. In case of soil processed with heavy disk harrow and vertical rotary hoe, the soil structure is glomerular, the dominant structural elements having small

dimensions, fact that favours a higher compaction of soil during vegetation period.

5. At the effectuated tests we observe that soils' penetration resistance had, in general corresponding values. Not notified an increase of penetration resistance due to the usage of some units. Contrary, because of their usage it was observed a certain decreasing of penetration resistance.

6. Could appreciate that stability of soils' structure elements had, in general, corresponding values. Certain is that stability indexes of structure elements were modified, function of passing numbers of units, intensity of soil processing by these ones, but the values of those indexes were in the limits imposed by agro-technical demands.

7. Must be mention the fact that, however, after a number of years, due to misuse of equipment, soil degradation will appear, soil will be compacted, will take place fragmentation of structural elements, will be produce an accentuated mineralization of organic matter, humus etc. For these reasons must be used those technologies of soil processing mechanization which assure soil preservation in the highest degree.

8. In case in which are conditions for using unconventional systems for soil processing, technological variants of soil works mechanization which will be used, starting with the best one, are: V6, V5, V3.

9. If tillage with mouldboard plough is imposed, will be applied variant V2, due to the better determine indexes.

10. Will be avoid the application of variant V1, classic technology, due to the high fuel consumption and weak results regarding the determine indexes.

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# THE INFLUENCE OF PHYTOSANITARY TREATMENTS AND FERTILIZERS UPON *CHRYSANTHEMUM* CULTIVARS

## INFLUENȚA TRATAMENTELOR FITOSANITARE ȘI A FERTILIZĂRILOR ASUPRA SOIURILOR DE CRIZANTEME

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**Abstract.** *In the flower market demand grows, so it grows massively the imports of flowers, including the genus Chrysanthemum, who occupies an important place. By increasing competition, the producers in our country are ever more affected financial. Chrysanthemum cultivation importance derives from its esthetic qualities, what make it to match for any occasion, also the diversity of shapes, sizes and colors, the suitability for modern homes makes the chrysanthemum to be highly appreciated by the general public, and in the same time to be economical a profitable crop. In this study was experienced the behavior of some Chrysanthemum multiflora varieties, regarding the effect of protection and nutritional substances. During the experiences were made some observation and determination on the difference in plants development, degree of flowering, the resistance for diseases and pests, and finally the selling price, according their quality. At the obtained data was made their average and were statistically interpreted, using the results obtained, which can lead to some conclusions on low or not, the dose administration of these substances, and ultimately decrease production cost. The best results were registered at the variants which was benefit of phytosanitary treatment and fertilizers.*

**Key words:** daisy cultivars, nutrition, protection, profitability.

**Rezumat.** *Cererea pe piață a plantelor floricole crește, astfel cresc masiv și importurile de flori, între care genul Chrysanthemum ocupă un loc important. Prin creșterea concurenței, producătorii din țară sunt afectați din ce-n ce mai mult financiar. Importanța cultivării crizantelei derivă din calitățile sale estetice ce o fac să se potrivească pentru orice ocazie, iar diversitatea de forme, mărimi și culori, pretabilitatea pentru locuințe moderne, fac ca crizantema să fie foarte apreciată de marele public și în același timp din punct de vedere economic, să fie o cultură rentabilă. În această lucrare s-a studiat compararea unor soiuri de Chrysanthemum multiflora, cu privire la efectul aplicării sau suspendării substanțelor de fitoprotecție și nutriție. Pe parcursul desfășurării experiențelor s-au efectuat observații morfologice, s-au înregistrat date cu privire la creșterea și dezvoltarea plantelor, rezistența la boli și dăunători și ulterior privind prețul de valorificare și calitatea producției. Datele obținute au fost interpretate statistic. Rezultatele obținute arată că aplicarea sau suspendarea tratamentelor fitosanitare și a fertilizanților determină în mare măsură calitatea producție și costul produsului finit. Cele mai bune rezultate s-au înregistrat la variantele care au beneficiat atât de tratamente fitosanitare cât și de nutriție.*

**Cuvinte cheie:** soiuri de crizanteme, nutriție, calitate, profitabilitate.

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## INTRODUCTION

The *Chrysanthemum* has been cultivated in China for more than 2500 years and was a favorite flower of the Mandarins (Swift, 2003). The flower may have been brought to Japan in the 8th century, and the Emperor adopted the flower as his official seal. There is a "Festival of Happiness" in Japan that celebrates the flower.

In Europe appears in the 18<sup>th</sup> century, for the first in France. Intensively was cultivated by Blanchard horticulturist beginning with 1789, in England.

The range of types is wide also includes the outdoor *Chrysanthemum* (also known as border and early-flowering chrysanthus) and greenhouse chrysanthus (also known as late-flowering mums). Greenhouse types include flowering pot plants which are usually "Dwarf" varieties as well as "Charm" varieties. "Incurved" varieties have flowers with florets that turn towards the center, thereby creating the impression of ball. Reflexed types have florets that turn outwards and downwards (Swift, 2003). Incze (1964) described 12 types of mums: Simple, Half dense, Pompon, Flat, Half globe, Globe, Ruffle globe, Cannular, Spoon, Needle-like, Thorn-like, and Spider. The flowers also can be daisy-like, decorative and buttons (Cantor, 2005).

Today the chrysanthus has another international classification system with 13 types: Irregular incurve, Reflex, Regular Incurve, Decorative, Intermediate Incurve, Pompon, Single/Semi-Double, Anemone, Spoon, Quill, Spider, Brush & Thistle, Exotic (<http://en.wikipedia.org/wiki/Chrysanthemum>).

This genus contains many hybrids and thousands of cultivars developed for horticultural purposes. In addition to the traditional yellow, other colors are available, such as white, purple, and red. The most important hybrid is *Chrysanthemum* × *morifolium* (syn. *C.* × *grandiflorum*), derived primarily from *C. indicum* but also involving other species.

Regarding the propagation, mums can be easy propagating by cuttings. In 1982 Pasquier *et al.*, have compared several culture media (peat moss, perlite, fine pine bark shavings, rough pine bark shavings and a mixture of rough pine bark and peat) for rooting and growth of pot *Chrysanthemum* cuttings obtained on the commercial market: *Chrysanthemum morifolium* Ramat cv 'Always Pink'. The rooting was earlier in perlite and peat moss than in other substrates.

This hardy perennial is most useful: this flower very late in the season and make large clumps by slow-spreading, short stolons. In landscape design can be combined with different grasses, *Perovskia*, *Fuchsia magellanica*, *Sedum*, *Aster*, *Solidago* and *Salvia* (Carter, 2007).

## MATERIAL AND METHOD

Experiences regarding the influence of phytosanitary treatments and fertilizers upon grown and development of chrysanthus cultivars, were made at a private company from Covasna County, in 2009. The studied *Chrysanthemum multiflora* cultivars were: **Filmstar**, **Mermaid Yellow** (fig. 1), **Musi Jaune**, **Titane Rouge** (fig. 2), **Tonka Rose Lilas** and **Yahou Lilas** (fig. 3). The cuttings have been brought from a

german private company: Brandkamp.

The rooting substrate was „Plantaflor”, compound by well decomposed black peat with half decomposed brown peat, macro and micro elements. The pH was between 5.2-6.

After the rooting of cuttings they were transferred into another substrate: „Plantobalt”.

It was applied the classical pot technology, and the plants were conducted to obtained flowers in autumn (September-October). Experimental variants were organized on four groups. The first and the second group benefit of fasial fertilization with Complex III and OsmocotePro. At the first and third group were administrated phytosanitary treatments in the next combination: Previcur + Mospilan și Novoziv + Decis. The phytosanitary treatments were applied weekly. In the case of four groups does not apply any fertilizer or phytosanitary treatments (it was considered the experience control).

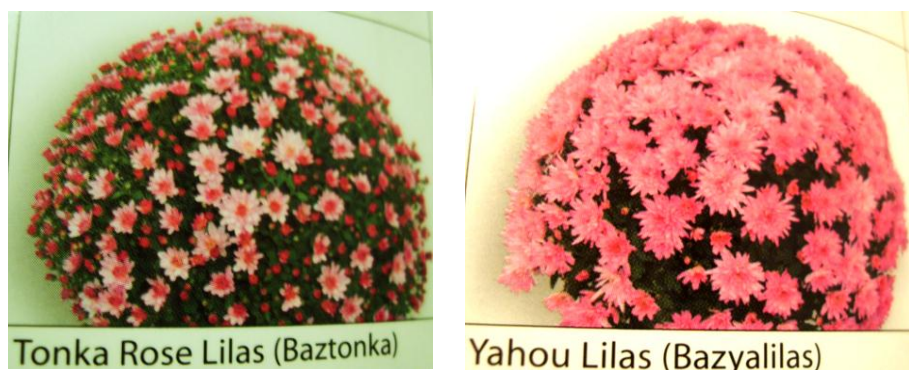
Most frequently problem at four groups was created by *Puccinia horiana*, *Tetranychus urticae* and *Aphididae*.



**Fig. 1 - Filmstar and Mermaid Yellow cultivars**



**Fig. 2 – Musi Jaune and Titane Rouge cultivars**



**Fig. 3** –Tonka Rose Lilas and Yahou Lilas cultivars

## RESULTS AND DISCUSSIONS

The recorded data concerning the influence of phytosanitary treatments and fertilizers upon grown and development of chrysanthemums cultivars were statistical interpreted with „t” test. It is remarkable the superiority of first group, which benefit of water, nutrition substances and phytosanitary treatments. Plants were healthy, vigorous, and compact with typical characteristic of cultivars.

At the second group which benefits of water, nutrition substances without phytosanitary treatments it is manifest a massif attack of *Puccinia horiana* (white rust). Due to good supply of nutrients this attack did not externalize very strong.

At the plants of the third group which benefit of water and phytosanitary treatments without nutrition substance was observed inflorescence defects (small in size and number), less compacted bushes and leaves yellow at the base.

Plants that have been studied in group IV, which received only water, showed a very thin shoot, flower buds appeared 3 weeks later than the plants in group I. There was a massive attack of *Puccinia horiana*, *Tetranychus urticae* and *Aphididae*.

Table 1

**Summarize table of the shooting capacity of the chrysanthemums cultivars**

No. of group	Experimental variants	No. of principal shoots	± d (shoots/plant)	Value t	Signification of difference
IV.	Water (Control)	5 ± 0,32	-	-	-
III.	Water + phytosanitary treatments	7 ± 0,26	+ 2	11,7	***
II.	Water + fertilizers	11 ± 0,26	+ 6	54,5	***
I.	Water + phytosanitary treatments + fertilizers	12 ± 0,14	+ 7	70	***

Table 1 show that all experimental variants shoot very well regardless the applied treatment. It was remarks high values at the plants of group I, which exceed the control with a difference of 7 shoots.

Regarding the number of flowers per plants it was recorded positive significant differences at all experimental variants. Group I exceed the control of the experience with a difference of 51 flowers / plant. Relatively close values are presented at group II (table 2).

*Table 2*

**Summarize table regarding the number of flowers/shoot at chrysanthemums cultivars**

No. of group	Experimental variants	No. of flowers/ plant	$\pm d$ (flowers/ plant)	Value t	Signification of difference
IV.	Water (Control)	45 $\pm$ 0.24	-	-	-
III.	Water + phytosanitary treatments	52 $\pm$ 0.29	+ 7	50	***
II.	Water + fertilizers	80 $\pm$ 0.26	+ 35	250	***
I.	Water + phytosanitary treatments + fertilizers	96 $\pm$ 0.36	+ 51	364.3	***

*Table 3*

**Summarize table regarding the high of plants at chrysanthemums cultivars**

No. of group	Experimental variants	High of plants (cm)	$\pm d$ (high of plants)	Value t	Signification of difference
IV.	Water (Control)	20 $\pm$ 0.23	-	-	-
III.	Water + phytosanitary treatments	26 $\pm$ 1.06	+ 6	5.5	***
II.	Water + fertilizers	30 $\pm$ 1.04	+ 10	9.3	***
I.	Water + phytosanitary treatments + fertilizers	36 $\pm$ 0.36	+ 16	36.6	***

*Table 4*

**Summarize table regarding the diameter of rosette at chrysanthemums cultivars**

No. of group	Experimental variants	Diameter of rosette (cm)	$\pm d$ (diameter of rosette)	Value t	Signification of difference
IV.	Water (Control)	3 $\pm$ 0.13	-	-	-
III.	Water+ phytosanitary treatments	4 $\pm$ 0.2	+1	4	***
II.	Water+fertilizers	6 $\pm$ 0.16	+3	18.7	***
I.	Water+ phytosanitary treatments +fertilizers	6 $\pm$ 0.16	+3	18.7	***

Studying the plant height, it was registered a very good vigor of plants in group I, which showed a very significant difference of 16 cm, this exceed the control of experience (table 3). As the diameter of rosette, groups I and II show the same level exceeding with 3 cm the control of experience. All variants have achieved very significant differences regarding the control (table 4).

## CONCLUSIONS

1. At the first group plants were healthy, vigorous and exceed the control in each case.

2. Plants from second group has superior characteristics, but appears white rust, due to good supply of nutrients this attack did not externalize very strong.

3. In the case of third group, which has only phytosanitary treatments was observed some deficiency of flowering, inflorescence was small, less compacted bushes and leaves were yellow at the base.

4. At the four group were observed the importance of phytosanitary treatments and fertilizers because the plants from this group has a lower development and resistance, buds appears later with 3 weeks than plants of first group, it shows flower deficiency, inflorescences were small. It is presented disease (white rust) and pests (spiders and aphids).

5. The higher profitability was registered in the case of first group.

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# RESEARCHES ON BEHAVIOR OF A NEW HYACINTHUS ASSORTMENT FOR FORCED CULTURE

## CERCETĂRI PRIVIND COMPORTAREA UNUI SORTIMENT NOU DE ZAMBILE ÎN CULTURA FORȚATĂ

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**Abstract.** Throughout this experiment, we tried to mark out the characteristics of some hyacinth cultivars, and it's suitability to be produced in greenhouses, in order to determine the preferences to certain environmental factors, which provides the plant a good length and quality flowers. The experiment was conducted in the greenhouse of USAMV Cluj-Napoca, Floriculture Department. The biological material were imported from Holland and it is represented by nine *Hyacinthus orientalis* L. cultivars: 'Amethyst', 'Blue Jacket', 'Carnegie', 'Delft Blue', 'Fondant', 'Peter Stuyvesant', 'Pink Pearl', 'Purple Star' and 'Splendid Cornelia'. The variants used in the experience are: V1- garden soil+peat+sand; V2 - garden soil; V3 - garden soil + sand. Following research, on the new nine cultivars of hyacinths, concluded that the mixture of standing garden soil peat and sand provides the requirements of Hyacinth, and it is recommended to be used as a potting soil for producing hyacinth in greenhouses. Remarkable varieties with outstanding results, 'Carnegie', 'Pink Pearl', 'Splendid Cornelia' and 'Peter Stuyvesant' which is recommended for promotion to culture forcing.

**Key words:** cultivars, forcing, temperature treatment, soil substrate

**Rezumat.** Prin studiile și cercetările efectuate, în cadrul prezentei lucrări, s-a încercat să se evidențieze particularitățile fenotipice ale unor soiuri noi de zambile și pretabilitatea lor la cultura forțată, cu scopul de a determina preferințele lor față de anumiți factori de mediu, și anume substratul de cultură care corespunde evoluției soiurilor din punct de vedere al vigorii de creștere și calității florilor. Studiile au fost efectuate în serele USAMV Cluj-Napoca, Disciplina de Floricultura. Materialul biologic a fost importat din Olanda și a cuprins 9 soiuri de *Hyacinthus orientalis* L. (zambile): 'Amethyst', 'Blue Jacket', 'Carnegie', 'Delft Blue', 'Fondant', 'Peter Stuyvesant', 'Pink Pearl', 'Purple Star' și 'Splendid Cornelia'. Acestea au fost studiate în 3 variante de substrat: Varianta I - pământ de grădină+ turbă+nisip, Varianta II - pământ de grădină, Varianta III - pământ de grădină+nisip. În urma cercetărilor efectuate, la cele nouă soiuri de zambile, se poate trage concluzia că amestecul de pământ de grădină, turbă și nisip corespunde cu cerințele zambilelor și se recomandă ca substrat de cultură pentru forțarea acestora. Se remarcă cu rezultate deosebite soiurile 'Carnegie', 'Pink Pearl', 'Splendid Cornelia' și 'Peter Stuyvesant' care se recomandă pentru extinderea în cultură forțată.

**Cuvinte cheie:** soiuri, forțare, tratament termic, substrat de cultură

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## INTRODUCTION

Hyacinth (*Hyacinthus orientalis*) or jewel of the Orient is considered one of the most beautiful bulbous plants with flowering in winter, in the culture of forced and early spring in normal (fig. 1). Forced hyacinths culture enables us to enjoy spring flowers in the cold days of winter, but this advantage requires that certain conditions and requirements to get flowers as a prolonged period decor.

Culture production and floral national research continues to make their presence felt in higher education institutions where research is developing programs that will improve the assortment with new creations obtained worldwide and creating permanent new varieties or new production technologies implementation of the performance, including environmental, in accord with trends in Europe and worldwide. Among the concerns and achievements since 1990 include: enriching the range of species and varieties, implementation of environmental technologies, establishing for the first time the *in vitro* production protocol and the behavior of its seedlings in field crops and greenhouses and plant species such as tuberose and indoor plants (Toma, 2005).



Fig. 1 - *Hyacinthus orientalis*

The varieties grown today, especially the Dutch, are characterized by large flowers, bearing 40-50 simple flowers, or 20-30 abundant flowers, arranged in bloom gaining overall cylindrical shape. There are approximately 265 species in the genus *Hyacinthus*: *H. albulus*, *H. augustifolius*, *H. belgicus*, *H. bifolius*, *H. campanulatus*, *H. candicans*, *H. lineatus*, *H. litwinowii*, *H. muscari*, *H. nanus*, *H. orientalis*, *H. transcaspicus*, *H. romanus* ([www.zipcodezoo.com](http://www.zipcodezoo.com)).

*Hyacinthus orientalis* Linnaeus 1753, is the species used most as genitors for varieties of hyacinths (Cantor and Pop, 2008). By selection, hyacinths, particularly in the Netherlands, have reached a high level of perfection in aspect and pointing out beautiful colors and abundance of single or double flowers. Applying heat treatment technique for forcing hyacinths under glass was introduced earlier this century. Like tulips and other bulb plants, hyacinths flowers do not produce superior long enough floral stems or if bulbs are not subject to a period of low temperature.

Unlike other species of tulip bulbs, hyacinth bulbs are not subject to low temperatures, no pre-cooling before planting before forcing. Subject to thermal treatments during storage bulbs are considering flower bud formation and preservation of vegetation until the bulb release. Heat treatment of bulbs involves three stages: floral bud formation, leaf formation and stem elongation flowers.

Growing success is due to forced bulbs properly applied thermal treatments for conservation floral bud and ensure optimum cold period after planting. The training period is accelerated leaf high temperature during the culture of bulbs, and thus shelf-life of floral bud is rushed. Compared with other plant bulbs, flower bud formation and conservation of the hyacinth, the specific temperature is achieved by ensuring this phase. This can be achieved by taking early bulbs, and storage rooms with air conditioning to ensure the heat treatment. Depending on harvest time and heat treatment applied is the difference between forcing bulbs in pots or intended for cut flowers. Thus, flowering bulbs destined for the December-January are harvested in early June and held first two weeks at 30°C. Thereafter, the temperature is lowered to 25.5°C for three weeks and then maintained at 23°C until the flower is fully formed. From now and until planting takes place in September, storage temperature is 17°C. The bulbs will be subject to late forcing (flowering in February-March), harvested in late June, and then kept at 25.5°C until planting (mid November).

Other variants of heat treatments are as follows:

- immediately after harvesting, the bulbs are kept at 25°C for 8 weeks and then up to planting, at 18°C;
- immediately after harvesting, the bulbs are kept at 33°C for 2 weeks, then at 25°C, within 5-6 weeks, followed by 3-4 weeks at 15°C and finally, the bulbs are kept at 12°C until planting.

Bulbs to be grown outdoors as propagating material, they will keep the temperature of 35°C for 5 weeks early varieties, and 8 weeks later varieties, followed by 17°C until planting in the field (Toma, 2005). For bulbs that heat treatments were applied for training and conservation floral bud temperature storage until planting bulbs is 17°C. During this period occurs floral stem elongation stage. Although the flower bud is formed, this period is very important for quality flowers. A temperature below 17°C is not recommended because it increases the risk of attack this time of *Penicillium*. For bulbs that have not applied thermal treatments, were harvested later stage of flower stem elongation begins four weeks before planting. If bulbs are planted in the forcing after December 15, storage temperature must be higher, 25°C until planting, to prevent formation of a possible attack roots and *Penicillium*. In this case the cold period should be extended by 1-2 weeks.

The study was conducted under controlled atmosphere, the private firm with 80 m<sup>2</sup> area. Throughout the storage until the time for planting, bulbs were stored in a dry room at a temperature of 17-18°C. The root chamber, pots were kept at a temperature between 4-9°C and during forcing in heated greenhouses, the temperature was kept at 20-23°C day and 12-16°C at night.

## MATERIAL AND METHOD

The experience was carried out in USAMV Cluj-Napoca greenhouses between 15 November 2010 - March 30, 2011. Biological material consisted of nine varieties of hyacinths (*Peter Stuyvesant*, *Delft Blue*, *Blue Jacket*, *Amethyst*, *Splendid Cornelia*, *Purple Star*, *Fondant*, *Pink Pearl*, *Carnegie*) which were forced on three types of mixed soil (table 1). Processing and interpretation of statistical data were analyzed using the mean characteristics for each variety studied. All data were statistically interpreted for each character, and test significance of differences between the test versions using Duncan (Ardeleanu *et al.*, 2002).

Table 1

The biological material studied in the experience

Nr.	Varieties	Number of pots studied/substrate		
		Garden soil + peat + sand	Garden soil	Garden soil + sand
1	Peter Stuyvesant	10	10	10
2	Delft Blue	10	10	10
3	Blue Jacket	10	10	10
4	Amethyst	10	10	10
5	Splendid Cornelia	10	10	10
6	Purple Star	10	10	10
7	Fondant	10	10	10
8	Pink Pearl	10	10	10
	Carnegie	10	10	10

In this experience were studied 270 bulbs, 10 pots of each variety and each kind of mixture of soil substrate. The hyacinth bulbs were planted on November 15, 2010, and stratified in the cellar, found room for rooting. They were placed in heated greenhouse on 21 February 2011, after a period of 10 weeks of cold. Two phytosanitary treatments were applied with 0.2% Dithane, first to plant bulbs and the 2<sup>nd</sup>, two weeks after planting in the rooting chamber. After planting bulbs watering was applied, and then in the greenhouse, while forcing pot kept moist at all times. No fertilizers were applied.

## RESULTS AND DISCUSSIONS

The results for the hyacinth flower stem length, for three types of substrates used are shown in table 2.

After statistical processing of vigor flowers, it appears that the varieties Delft Blue, Blue Jacket, flux, Carnegie in the version I and Delft Blue, Blue Jacket, Founder and Carnegie, the third variant, differs statistically compared to the average experience considered the control variant (26.1 cm). Of these, Carnegie (29 cm) of variant I differs significantly positive, Fondant (29.9 cm) of variant III shows a distinct difference significant, and the other six variants differs significantly from to the average experience.

Varieties: *Peter Stuyvesant*, *Amethyst*, *Splendid Cornelia*, *Purple Star*, *Fondant*, *Pink Pearl* and Carnegie in the version II, Pink Pearl of variant III were characterized by a reduced average height of the average experience.

It should be noted that variety: Carnegie and Fondant differ significantly positive on the mixture of garden soil and peat, respectively garden soil + sand, and the same two varieties differ significantly negative for garden soil.

Table 2

**Results of the *Hyacinthus* flower stem height (cm), under the influence of variety and mix of land used for forcing**

Variants	Variety	Flower stem height (cm)	Relative height of flower stem%	d ±	Significant difference
I.1	Peter Stuyvesant	28.0	107.3	+1.9	-
I.2	Delft Blue	34.0	130.3	+7.9	***
I.3	Blue Jacket	34.5	132.2	+8.4	***
I.4	Amethyst	25.6	98.1	-0.5	-
I.5	Splendid Cornelia	28.7	110.0	+2.6	-
I.6	Purple Star	26.7	102.3	+0.6	-
I.7	Fondant	33.1	126.8	+7.0	***
I.8	Pink Pearl	25.0	95.8	-1.1	-
I.9	Carnegie	31.7	121.5	+5.6	***
II.1	Peter Stuyvesant	15.6	59.8	-10.5	000
II.2	Delft Blue	24.5	93.9	-1.6	-
II.3	Blue Jacket	28.2	108.0	+2.1	-
II.4	Amethyst	21.0	80.5	-5.1	000
II.4	Splendid Cornelia	19.1	73.2	-7.0	000
II.6	Purple Star	20.5	78.5	-5.6	000
II.7	Fondant	22.5	86.2	-3.6	0
II.8	Pink Pearl	16.5	63.2	-9.6	000
II.9	Carnegie	21.2	81.2	-4.9	000
III.1	Peter Stuyvesant	26.0	99.6	-0.1	-
III.2	Delft Blue	31.2	119.5	+5.1	***
III.3	Blue Jacket	32.1	123.0	+6.0	***
III.4	Amethyst	25.8	98.9	-0.3	-
III.5	Splendid Cornelia	27.1	103.8	+1.0	-
III.6	Purple Star	26.3	100.7	+0.2	-
III.7	Fondant	29.9	114.6	+3.8	**
III.8	Pink Pearl	22.1	84.7	-4.0	00
III.9	Carnegie	29.0	111.1	+2.9	*
	Average of experiment (Control)	26.1	100.0	-	-

DL 5% = 2.8

DL 1% = 3.7

DL 0.1% = 4.7

Note: Variant I-garden soil + peat; Variant II garden soil; Variant III garden soil + sand

The following table can be seen that the varieties Delft Blue and Blue Jacket have a very significant positive influence on the variety, compared with variety Carnegie.

Based on data from Table 3 can be seen that the two varieties, Delft Blue and Blue Jacket, statistically differences compared to the average experience (26.0 cm) considered as the control variant. These, with an average stem length of 30 cm and 31.6 cm respectively, differs very significantly superior to the average. Peter Stuyvesant varieties (23.2 cm), Amethyst (24.1 cm), Pink Pearl (20.5 cm)

were noted by an average reduced the average length of experience (27.3 cm), with deviations statistically to the control variant.

Table 3

Influence of variety on the hyacinth flower stem length					
Nr.	Variety	The average length of flower stem (cm)	Relative length of the rod floral%	d ±	Significant difference
1	Peter Stuyvesant	23.2	98.2	-2.8	000
2	Delft Blue	30.0	115.4	+4	***
3	Blue Jacket	31.6	121.5	+5.6	***
4	Amethyst	24.1	96.7	-1.9	0
5	Splendid Cornelia	25.0	96.2	-1.0	-
6	Purple Star	24.5	94.2	-1.5	-
7	Fondant	28.4	109.2	+2.4	**
8	Pink Pearl	20.5	78.8	-5.5	000
9	Carnegie	27.3	105.0	+1.3	-
	Average of experiment (Control)	26.0	100.0	-	-

DL 5 % = 1.6
DL 1% = 2.1
DL 0.1 % = 2.7

Table 4 shows that regardless of the variety used in the experience, the mixture of garden soil with peat growth vigour hyacinths prints real and very significantly superior mixture of garden soil + sand, considered as the control variant, while the garden soil hyacinths prints a very significant negative effect of increasing the mixture of garden soil + sand.

Table 4

The influence of culture substrate used on the hyacinth flower stem length				
Culture substrate	The average length of flower stem (cm)	Relative length of the rod floral%	d ±	Significant difference
Garden soil + peat + sand	29.5	106.5	+1.8	***
Garden soil	21.0	75.8	-6.7	000
Garden soil + sand (Control)	27.7	100.0	-	-

DL 5% = 0.9
DL 1% = 1.2
DL 0.1% = 1.6

The results on the number of flowers in the inflorescence are shown in table 5.

Measurement results on the number of flowers in inflorescence and statistical analysis of data leads to the conclusion that the variety Purple Star (62.6) differs significantly distinct positive, statistically, than the average experience (40.0) considered the control variant, while Pink Pearl variety, with an average of 22.2 flowers per inflorescence is significantly distinct negative. Other variants are insignificant compared to the control variant.

Table 5

**Summary of results on the number of flowers in inflorescence**

Nr.	Variety	Average number of flowers	Relative number of flowers%	d ±	Significant difference
1	Peter Stuyvesant	31.4	78.5	-8.6	-
2	Delft Blue	39.4	98.5	-0.6	-
3	Blue Jacket	24.8	62.0	-15.2	-
4	Amethyst	48.4	121.0	+8.4	-
5	Splendid Cornelia	50.8	127.0	+10.8	-
6	Purple Star	62.6	156.5	+22.6	**
7	Fondant	46.6	116.5	+6.6	-
8	Pink Pearl	22.2	55.5	-17.8	0
9	Carnegie	34.2	85.5	-5.8	-
10	Average of experiment (Control)	40.0	100.0	-	-

DL 5% = 15.5

DL 1% = 20.8

DL 0.1% = 27.7

In table 6 is shown the summary of results on the influence of the variety of period decor.

Table 6

**Influence of variety of period decor**

Nr.	Variety	The mean length of decor (days)	Relative duration of the period décor %	d ±	Significant difference
1	Peter Stuyvesant	8.3	86.5	-1.3	0
2	Delft Blue	11.5	119.8	+1.9	***
3	Blue Jacket	10.9	113.5	+1.3	*
4	Amethyst	6.9	71.9	-2.4	000
5	Splendid Cornelia	10.1	105.2	+0.5	-
6	Purple Star	7.4	77.1	-2.2	000
7	Fondant	10.1	105.2	+0.5	-
8	Pink Pearl	11.3	117.4	+1.7	**
9	Carnegie	10.1	105.2	+0.5	-
10	Average of experiment (Control)	9.6	100.0	-	-

DL 5% = 1.1

DL 1% = 1.5

DL 0.1 % = 1.9

The longest period decor was recorded in variety Delft Blue (11.5 days) is very significantly positive different from the average of experience taken as a control (9.6 days). A period decor statistically lower in the varieties occurred Purple Star (7.4 days), Amethyst (6.9 days) and Peter Stuyvesant (8.3 days) compared with media experience.

In the table 7 was presented the results obtained concerning the influence of substrate used on the duration of décor.

Table 7

## Influence of substrate used on the duration of decor

Nr.	Type of substrate	Average duration of décor (days)	Relative duration of decor%	d ±	Significant difference
1	Garden soil + peat	12.0	129.0	+2.7	***
2	Garden soil	7.6	81.7	-1.7	000
3	Garden soil + sand (Control)	9.3	100.0	-	-

DL 5% = 0.7

DL 1% = 0.9

DL 0.1% = 1.1

Regardless of the varieties grown, in terms of statistical mixture of garden soil + peat prints varieties studied a longer period of decoration, and differs very significantly positively to mix garden soil + sand, considered the control variant. Compared to the control, garden soil is statistically inferior, and print durability hyacinth flowers less.

## CONCLUSIONS

1. The study was performed on nine varieties of hyacinths in forced culture and the hyacinths cultivars showed differences both between varieties and between the same varieties grown on different types of mixed soil.

2. Regarding culture substrate consisting of garden soil and peat, there were positive and insignificant differences from the average experience for all characteristics studied in this experience. However it should be noted that varieties „Carnegie”, „Pink Pearl” and „Splendid Cornelia” distinguished themselves by setting a period longer than the other species studied, being recommended for the culture of forced hyacinths. Satisfactory results were obtained for culture in a mixture of garden soil and sand, with minor differences on phenotypic features studied.

3. In contrast, garden soil, showed negative differences in the period setting of flowers and the flower stem height, two important issues worthy of consideration when you want to obtain quality flowers through forced culture of hyacinths.

4. Measurement results on the number of flowers in inflorescence lead to the conclusion that the type of mixture soil used for forced not affect in any flower.

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# ANALYSIS IN THE MORPHOLOGICAL ASPECT AND THE PHENOTYPE WITHIN FLOWERING SPECIES VARIABILITY *ANGELICA ARCHANGELICA* L.

## ANALIZA SUB ASPECTUL MORFOLOGIC ȘI AL VARIABILITĂȚII FENOTIPICE A INFLORESCENȚEI ÎN CADRUL SPECIEI *ANGELICA* *ARCHANGELICA* L.

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**Abstract.** *This paper examines the variability of the main components of the inflorescence for the selection of forms with high performance in terms of seed production at *Angelica archangelica* L. Researches were conducted in the experimental field of Lucian Blaga University in Sibiu, in the period 2009-2010, using morphological description of the plant method. The results revealed a wide variability the number of stems per plant floriferous, umbels diameter, number of umbels, average seed mass per plant (MMS) and thousand grain weight (MMB) based on the following statistical indicators: mean, variance, standard deviation and variability coefficient.*

**Key words:** *Angelica archangelica*, variability, umbel, MMS, MMB

**Rezumat.** *Lucrarea de față analizează gradul de variabilitate a principalelor componente din inflorescență în vederea selecționării unor forme cu performanțe ridicate sub aspectul producerii de sămânță la *Angelica archangelica* L. Cercetările au fost realizate în câmpul experimental al Universității Lucian Blaga din Sibiu, în perioada anilor 2009-2010, folosind metoda descrierii morfologice a plantelor. Rezultatele au scos în evidență marea variabilitate a numărului de tulpini florifere pe plantă, diametrului umbelelor, a numărului de umbelule, a masei medii de sămânță pe plantă (MMS) și a masei a o mie de boabe (MMB) pe baza următorilor indicatori statistici: media, varianța, abaterea standard și coeficientului de variabilitate.*

**Cuvinte cheie:** *Angelica archangelica*, variabilitate, umbelă, MMS, MMB

### INTRODUCTION

*Angelica archangelica* L. species is used as medicinal species, since long time ago, due to its many therapeutic qualities (Bobîț et al., 2002). Over time, there have been proven, based on the aromatic characteristics, different usages in the preparation of confectionery and distilled alcohol beverages, such as vermouth and liqueurs (Lazurcă, 1995). The literature emphasizes that species finds its utility in veterinary medicine or as a honey plant and though the volatile oil extracted from the rhizomes and seed in the cosmetics industry (Pop, 2005).

The species mentioned is a robust plant with erect stems with an height of 150-200 cm, on which are inserted pinnate leaves with lengths up to 90 cm, the

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flowers, grouped in inflorescence globes, are light white-yellow-green (Muntean et al., 2007).

From a biological perspective is a biennial or perennial species pollinated entomofilă cross-fertilized; after flowering aerial parts of the plant die.

Various studies on the development of new policies on dynamic application of the action plans in agriculture, according to environmental factors, the impact of climate change and the degree of tolerance of different local varieties, may lead to increase productivity (Antofie et al., 2010). Is an important to realization a model of sustainable agriculture at the level of the farm in order to obtain healthy vegetal products through applying crop technologies specific for each species, bring a contribut to the maintenance and improvement of soil characteristics (Iagăru, 2010).

Thus, the populations of *Angelica archangelica* L. are composed of numerous biotypes that show a high degree of heterogeneity in all aspects, including the inflorescence one, which, depending on size and degree of branching, can strongly influence seed quality (Pop, 2005). For this reason it is interesting to analyze the variability of flowers and inflorescence, taking into account measurements of the number of branches on flowering stem, number and diameter umbels per plant, depending on the degree of branching.

## MATERIAL AND METHOD

The biological material was provided by National Research Institute for Potato and Sugar Beet, Laboratory of Medicinal Plants, Brasov, in the form of seed. This material belongs to the local Christian population, where 10 selections were chosen. These selections differentiated from a phonetically point of view, under several quantitative characters. Sowing was carried out in autumn, and in the spring of the first vegetation year, thinning was carried out after the first two true leaves appeared. The distances chosen were 60 cm between rows and 40 cm between plants per row, up to a density of 42,000 plants / hectare. In the first year were carried out maintenance work consisting of hoeing and weeding, so, in August, the ground was well covered by the aerial parts of the plant. In the spring of second vegetation year, there were also applied 1-2 mechanical weeding and a manual weeding, the land was quickly covered the entire surface, the aerial parts of the plant. In June, the plants flourished, each strain showing flowering branches which are terminated by a globular inflorescence, umbel type, composed of several umbels. On each flowering stem was formed a primary inflorescence, and based on the degree of branching, there might appear some secondary and even tertiary. In June and July were carried out observations on the flowering process and determinations on the following quantitative characters: the number of branches of the floriferous stem, number of secondary umbels / plant, number of tertiary umbels / plant, primary umbel diameter (cm), secondary umbel diameter (cm), tertiary umbel diameter (cm), average mass seed / plant - MMS (g / pl), the mass of 1000 seeds - MMB (g).

Based on the results obtained from measurements there was calculated the degree of variability of characters analyzed, based on the following statistical indicators:

mean, variance and standard deviation ( $\bar{x}$ ,  $s^2$ ,  $s$ ) and coefficient of variability - (s%) (Arden, 2006) - summarized in tabular form.

The coefficient of variation was interpreted based on indications of literature data, considering that the frequency distributions that have a coefficient of variation less than 10% have a low variability, medium is for those who have a coefficient of 10-20% and those with a ratio of over 20% have a higher variability (Ardelean, Sestraş, 1996)

## RESULTS AND DISCUSSIONS

The values of morphological characters studied in the 10 selections identified in the field of choice of the population is Christian, are presented in table 1 and table 2. Data represent results centralized at the end of second year results of vegetation, in the months of June-July 2010. Data from the field measurements were used to calculate several statistical indicators (table 3).

Table 1

**Results on the morphological characteristics of floriferous organs at *Angelica archangelica* L. selections**

No.	Selection	Number of branches / flowering stem	Number secondary umbels / plant	Number tertiary umbels / plant	MMS (g / pl.)	MMB (g)
1.	G-1	5	4	7	65	4,8
2.	G-2	6	5	6	95	4,2
3.	G-3	4	3	5	53	6,3
4.	G-4	6	5	7	80	3,9
5.	G-5	5	4	6	28	5,1
6.	G-6	4	3	3	50	5,9
7.	G-7	5	4	6	35	5,2
8.	G-8	4	3	6	26	6,2
9.	G-9	3	2	2	32	6,9
10.	G-10	3	2	2	29	7,3

From measurements made results that the number of branches of the floriferous stem presented a wide range, from 3-6, being highlighted the G<sub>2</sub> and G<sub>4</sub> selections, with the highest values, followed by G<sub>1</sub>, G<sub>5</sub> and G<sub>7</sub>. Analysis of tables 1 and 2 show that the number branches of the floriferous stem positively influence the number of secondary and tertiary umbels. This is confirmed by the large number of secondary and tertiary umbels obtained at the same number of selections at which the number of branched of the floriferous stem was the highest.

On the opposite side we can notice the negative influence of the number of branches of the floriferous stem on the primary umbel diameter. The highest values of primary umbel diameter were recorded at G<sub>9</sub> and G<sub>10</sub> selections with 19 cm and 20 cm. The negative influence of the number of branches of the floriferous stem largely occurs also at the secondary and tertiary umbels diameter, the highest value being recorded at G<sub>9</sub> selection. The values recorded in the measurement of all types of umbels diameter ranged between 2,3 cm and 20 cm.

The analysis in table 2 shows a fairly wide range of values of the average seed mass per plant (MMS). These values range from lows of 26, 29 and 32 g per plant, recorded at the G<sub>8</sub>, G<sub>10</sub>, G<sub>9</sub> and highs of 95 and 80 g per plant, recorded G<sub>2</sub> and G<sub>4</sub>

selections. Instead, the analysis of the values of MMB the highest levels are achieved at G<sub>10</sub> and G<sub>9</sub> selections, with 7.3 and 6.9 g, and lowest at G<sub>4</sub> and G<sub>2</sub> selections with 3,9 respectively 4,2 g.

Table 2

**Results on the morphological characteristics of floriferous organs at *Angelica archangelica* L. selections**

No.	Selection	Primary umbels diameter (cm)	Secondary umbels diameter (cm)	Tertiary umbels diameter (cm)
1.	G-1	15	13	3,8
2.	G-2	14	10	2,1
3.	G-3	19	16	3,2
4.	G-4	15	9	1,9
5.	G-5	17	17	2,5
6.	G-6	16	16	3,7
7.	G-7	16	14	2,3
8.	G-8	17	12	4,2
9.	G-9	19	17	5,7
10.	G-10	20	16	4,4

From these data it is very easy to notice that where the amount of seed per plant is high, the seeds are small. Moreover, we stress the positive influence of the size primary umbel diameter and the number of negative influence of the ramifications of floriferous strain on MMB. Thus our results are consistent with those obtained by Galambosi (1994) and Dachler and Pelzmann (1999) which stated that in their studies conducted on *Angelica archangelica* L., the largest seed, with the best quality is given by the primary umbel.

To see the chance to improve the characteristics discussed above for creating seed forms with higher MMB and a flowering with a low degree of branching, was calculated the coefficient of variability (table 3).

Table 3

**Statistical indicators calculated on the ten *Angelica archangelica* L. selections studied**

Character	Variance $s^2$	Standard deviation s	Mean $\bar{x}$	Coefficient of variability s%
Number of branches / flowering stem	1,17	1,08	4,5	24
Number secondary umbels / plant	1,17	1,08	3,5	30,86
Number tertiary umbels / plant	3,78	1,94	5	38,87
Primary umbels diameter (cm)	3,96	1,99	16,8	11,84
Secondary umbels diameter (cm)	8,44	2,91	14	20,76
Tertiary umbels diameter (cm)	1,46	1,21	3,38	35,80
MMS (g / pl.)	578,23	24,05	49,3	48,78
MMB (g)	1,27	1,13	5,58	20,18

All characters analyzed, except the diameter of the primary umbel and the number of umbels in the primary umbel, have a large variability with a coefficient of variability greater than 20%. The diameter of the primary umbel and the number of umbels of primary umbel have a medium variability, with values ranging between 10% and 20%.

Based on the observations made during the flowering period, we noticed that each flowering stem has a main umbel. This will bloom more quickly due to the earlier appearance on the plant. Analyzing the flower openness we note that this is protandru type through a earlier maturation of the anthers than the stigma. This makes the primary umbel flowers pollination to be in high percentage cross-fertilized. The flowers belonging to the secondary and tertiary umbels, due to later openness, on the extent of their occurrence, could not benefit of a high percentage of cross-fertilized pollination. Due to the fact that so far there wasn't found other mechanism to ensure cross-fertilized at *Angelica archangelica* L. Species, other that the protandria described above, it can be assumed that the flowers of secondary and tertiary umbels are exposed to some degree on pollinating pollination. This phenomenon may explain the smaller size of the seed formed in secondary and tertiary umbels. This idea is supported by low values of the MMB at selections with many umbels. Smaller seeds may also have a low germination capacity, leading to problems encountered by the emergence of plants.

## CONCLUSIONS

1. For the production of good seeds we have to use selections with a small number of branches of the floriferous stem, such as G<sub>9</sub> and G<sub>10</sub> for the highest recorded values of MMB, 6,9 g and 7,3 g. The values of the coefficient of variability for both the number of branches and for MMB floriferous stems are large (24% and 20.18% respectively), which gives a chance for selection work to improve these characters.

2. To obtain forms with a large number of both secondary and tertiary umbels we can use the selections with a higher number of branches of the floriferous stems, such as G<sub>2</sub> and G<sub>4</sub>. The large number of umbels enhances the aesthetic quality of the flowers. The values of coefficient of variability for the number of secondary and tertiary umbels is very high 30,86% and 38,87%, which shows possibilities to improve these characters through selection.

3. The coefficient of variability calculated for both diameter of the secondary and tertiary umbel has high values 20,76% and 35,80%. This increases the chance of the selection of works to improve these characteristics.

4. The 10 selections from the Christian population are characterized by a pronounced polymorphism. The general analysis of the data presented in this study highlight a variability that can be correlated with the possibility of applying a high selection pressure for improvement in future works of this species.

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# RESEARCH CONCERNING THE PRODUCTION OF PLANTING MATERIAL USING GENERATIVE PROPAGATION ON *ALBIZZIA JULIBRISSIN* Durazz.

## CERCETĂRI PRIVIND PRODUCEREA MATERIALULUI SĂDITOR PE CALE GENERATIVĂ LA SPECIA *ALBIZZIA JULIBRISSIN* Durazz.

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**Abstract.** *The purpose of this research is to highlight the variation of whole-plant growth characteristics such as height, root collar diameter, number of leaflets and leaf area for Albizzia julibrissin, using different mixtures of soil. For this purpose four experimental trials have been installed. The trials had the following design: V1: 60% manure + 20% sandy + 20% ground leaves, V2: 40% manure + 40% sandy + 20% ground leaves, V3: 50% manure + 30% soil + 20% ground leaves, V4: 30% manure + 50% soil + 20% ground leaves. Biometric observations of seedling were made at 69 days, 123 days and 154 days for each trial. The results indicate the high position of seedlings grown in rooting media composed by 30% manure + 50% sand + 20% ground leaves.*

**Key words:** *Albizzia julibrissin, generative propagation, rooting media.*

**Rezumat.** *Scopul acestei cercetări este de a pune în evidență variația caracterelor: înălțimea puiețului, diametrul la colet al puiețului, nr. de foliole și suprafața foliară în cazul speciei Albizzia julibrissin, folosind diferite amestecuri de pământ. În acest sens, a fost instalată o experiență în patru variante V1 60% mraniță + 20% nisip + 20% pământ de frunze; V2: 40% mraniță + 40% nisip + 20% pământ de frunze; V3: 50% mraniță + 30% nisip + 20% pământ de frunze; V4: 30% mraniță + 50% nisip + 20% pământ de frunze, iar observațiile biometrice au fost efectuate la 69, 123 și 154 de zile de la repicarea puieților pe diferitele medii de cultură. Rezultatele au pus în evidență poziția superioară în ceea ce privește caracterele analizate în cazul puieților crescuți pe mediul de cultură format din 30% mraniță + 50% nisip + 20% pământ de frunze.*

**Cuvinte cheie:** *Albizzia julibrissin, înmulțire generativă, amestec nutritiv.*

## INTRODUCTION

*Albizzia julibrissin* Durazz. (silk tree) is a species of rare beauty. In our country it was introduced in mild climate region, in the West (parks and gardens from Timisoara) and South, where blooms and holds up quite well. The species could not be acclimated at high altitudes, for example in Brașov (Stănescu V., 1997).

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Silk tree is a tree that can reach heights of 10 m (Stănescu V., 1997). Crown is rare and bright. Leaves are alternate, bi-pinnately, compound, with small leaflets. Flowers present radial symmetry; pink and very showy. Fruit are a pod that does not open at maturity to release seeds (Iliescu Ana-Felicia, 1998).

The species' natural range is in the Far East.

Silk tree can be used in green spaces as a tree planted alone or in groups, sheltered by buildings because it is very sensitive to strong winds which can split strain (Poșta Daniela Sabina, 2009).

The literature recommends propagation by seeds harvested in October or November (Poșta Daniela Sabina, 2009). Varieties can be propagated by grafting; no result have been obtained by cuttings.

The purpose of this research is to highlight the variation of whole-plant growth characteristics such as height, root collar diameter, number of leaflets and leaf area for *Albizzia julibrissin*, using different mixtures of soil.

## MATERIAL AND METHOD

The material consists of *Albizzia julibrissin* seedlings, obtained by generative propagation. The seeds were prepared by moisturizing, hot water treatment, stratification and scarification in order to ensure uniform emergence in a high percent and a short time.

*Albizzia julibrissin* seeds were sown on 02/16/2010, on a sowing media composed by 50% manure and 50% sand in the greenhouse. The temperature of 20-22°C, soil moisture of 55-60% and air moisture of 40-55% have been secured. Seedlings were transplanted after 35 days of emergence (fig.1), in different soil mixtures (fig. 2).



**Fig. 1** - Seedlings prepared for transplanted



**Fig. 2** - Experimental trials

Experimental trial are:

- V1: 60% manure + 20% sandy + 20% ground leaves;
- V2: 40% manure + 40% sandy + 20% ground leaves;
- V3: 30%manure + 50% sandy + 20% ground leaves;
- V4: 30% manure + 50% sandy + 20% ground leaves.

The assessment of the characters like stem height (cm), root collar diameter (mm), number of leaflets and leaf area (cm<sup>2</sup>) have been made.

Height was measured using tape measure with an accuracy of 1mm.

Root collar diameter was measured using an electronic caliper with an accuracy of 0.01mm.

Leaf area was determined by the parameters of the leaf, using formulas:



$$S = S_1 + S_2 + S_3$$

Where: S - total leaf area (cm<sup>2</sup>)

S<sub>i</sub> - area for leaflet i (cm)

$$S_i = K \times L \times l$$

Where: K - coefficient (0,751)

L - leaflet length (cm)

l - leaflet width (cm)

To highlight the influence of the rooting media about the studied characters seedlings height, root collar diameter, number of leaflets and leaf area, observations were made at different time intervals. Reported on transplanted date, observations were made at 69 days (30.03.2010 - 7.06.2010 is the first growth period), at 123 days (7.06.2010 - 31.07.2010 is the second growth period of seedlings) at 154 days (31.07.2010 - 31.08.2010 represents the third period of growth).

The dates were statistically analyzed. The mean, standard error of mean, standard deviation and coefficient of variability has been determined.

## RESULTS AND DISCUSSIONS

Calculated statistical parameters show us how the seedlings characters developed according to rooting media. The results are presented in table 1 for character "height", table 2 for the character "root collar diameter", table 3 for character "number of leaflets" and table 4 for character "leaf area".

Table 1

Statistical parameters for the character "height"

Date	The experimental trial	Mean	Standard error of mean	Variances	Standard deviation	Coefficient of variability
June 2010	V <sub>1</sub>	3,74667	0,24840	0,86382	0,96204	25,68
	V <sub>2</sub>	3,78667	0,20676	0,59849	0,80077	21,15
	V <sub>3</sub>	3,53333	0,16581	0,38489	0,64217	18,17
	V <sub>4</sub>	5,11333	0,20139	0,56782	0,77999	15,25
	<b>All groups</b>	<b>4,04500</b>	<b>0,129763</b>	<b>1.01031</b>	<b>1.00514</b>	<b>24,85</b>
July 2010	V <sub>1</sub>	4,58667	0,34238	1,64116	1,32604	28,91
	V <sub>2</sub>	4,66000	0,32423	1,47173	1,25573	26,95
	V <sub>3</sub>	4,03333	0,14886	0,31022	0,57652	14,29
	V <sub>4</sub>	6,81333	0,17751	0,44116	0,68751	10,09
	<b>All groups</b>	<b>5,02333</b>	<b>0,18834</b>	<b>2,12826</b>	<b>1,45886</b>	<b>29,04</b>
August 2010	V <sub>1</sub>	5,28667	0,40706	2,31982	1,57655	29,82
	V <sub>2</sub>	5,52000	0,37151	1,93227	1,43885	26,07
	V <sub>3</sub>	4,62667	0,18985	0,50462	0,73530	15,89
	V <sub>4</sub>	8,02000	0,16071	0,36160	0,62244	7,76
	<b>All groups</b>	<b>5,86333</b>	<b>0,22313</b>	<b>2,98711</b>	<b>1,72832</b>	<b>29,48</b>

Analysis table show higher values for the mean of the character height in experimental trial V<sub>4</sub>. In terms of variability coefficient, the lowest values were obtained for the same experimental trial. We can also notice even a reduction of this coefficient for the last biometric observations.

Table 2

## Statistical parameters for the character "root collar diameter"

Date	The experimental trial	Mean	Standard error of mean	Variances	Standard deviation	Coefficient of variability
June 2010	V <sub>1</sub>	0,27400	0,04430	0,02748	0,17158	62,62
	V <sub>2</sub>	0,39067	0,05290	0,03918	0,20489	52,45
	V <sub>3</sub>	0,24067	0,00836	0,00098	0,03240	13,46
	V <sub>4</sub>	0,43133	0,03363	0,01584	0,13027	30,20
	<b>All groups</b>	<b>0.33417</b>	<b>0.02144</b>	<b>0.02758</b>	<b>0.16606</b>	<b>49,69</b>
July 2010	V <sub>1</sub>	0,34133	0,04927	0,03398	0,19082	55,90
	V <sub>2</sub>	0,48067	0,05401	0,04083	0,20916	43,52
	V <sub>3</sub>	0,30200	0,00863	0,00104	0,03342	11,07
	V <sub>4</sub>	0,56000	0,04518	0,02857	0,17497	31,24
	<b>All groups</b>	<b>0.42100</b>	<b>0.02503</b>	<b>0.03758</b>	<b>0.19386</b>	<b>46,05</b>
August 2010	V <sub>1</sub>	0,42533	0,04669	0,03052	0,18083	42,51
	V <sub>2</sub>	0,60600	0,05396	0,04076	0,20897	34,48
	V <sub>3</sub>	0,37533	0,00999	0,00140	0,03871	10,31
	V <sub>4</sub>	0,76867	0,08566	0,10272	0,33175	43,16
	<b>All groups</b>	<b>0.54383</b>	<b>0.03396</b>	<b>0.06921</b>	<b>0.26308</b>	<b>48,38</b>

In that case, like in previously, the highest average value was obtained for the experimental trial V<sub>4</sub>. It was also found a high variability for the experimental trials studied, excepted the experimental trial 3. In that case the coefficient of variability for root collar diameter is much lower than other trials.

Table 3

## Statistical parameters for the character "number of leaflets"

Date	The experimental trial	Mean	Standard error of mean	Variances	Standard deviation	Coefficient of variability
June 2010	V <sub>1</sub>	9,00000	0,67612	6,40000	2,61861	29,10
	V <sub>2</sub>	9,80000	0,97199	13,22667	3,76450	38,41
	V <sub>3</sub>	9,06667	0,52068	3,79556	2,01660	22,24
	V <sub>4</sub>	11,80000	0,41633	2,42667	1,61245	13,66
	<b>All groups</b>	<b>9.91667</b>	<b>0.362268</b>	<b>7.87429</b>	<b>2.806117</b>	<b>28,30</b>
July 2010	V <sub>1</sub>	11,46667	0,68914	6,64889	2,66905	23,28
	V <sub>2</sub>	12,60000	0,93503	12,24000	3,62137	28,74
	V <sub>3</sub>	11,53333	0,46667	3,04889	1,80739	15,67
	V <sub>4</sub>	15,00000	0,36515	1,86667	1,41421	9,43
	<b>All groups</b>	<b>12.65000</b>	<b>0.36810</b>	<b>8.12966</b>	<b>2.85126</b>	<b>22,54</b>
August 2010	V <sub>1</sub>	14,33333	0,69465	6,75556	2,69037	18,77
	V <sub>2</sub>	15,66667	0,83190	9,68889	3,22195	20,57
	V <sub>3</sub>	13,86667	0,48665	3,31556	1,88478	13,59
	V <sub>4</sub>	18,13333	0,32170	1,44889	1,24595	6,87
	<b>All groups</b>	<b>15.50000</b>	<b>0.36938</b>	<b>8.18644</b>	<b>2.86120</b>	<b>18,46</b>

Regarding the character "number of leaflets", statistics parameter values follow the same line with the values obtained in the case of characters "high" and

“root collar diameter”. It can be notice a decrease for the coefficient of variability from the first observations to the last ones for all experimental trials. We can also notice that the lowest values were obtained for the experimental trial V<sub>4</sub>, just like the character "high".

Table 4

Statistical parameters for the character “leaf area”

Date	The experimental trial	Mean	Standard error of mean	Variances	Standard deviation	Coefficient of variability
June 2010	V <sub>1</sub>	2,66661	0,28887	1,16828	1,11881	41,96
	V <sub>2</sub>	3,87562	0,43081	2,59832	1,66851	43,05
	V <sub>3</sub>	2,31703	0,16526	0,38236	0,64006	27,62
	V <sub>4</sub>	4,97455	0,24351	0,83014	0,94310	18,96
	All groups	<b>3.45845</b>	<b>0.19938</b>	<b>2.38514</b>	<b>1.54439</b>	<b>44,66</b>
July 2010	V <sub>1</sub>	4,76439	0,37586	1,97782	1,45571	30,55
	V <sub>2</sub>	6,30287	0,43001	2,58867	1,66541	26,42
	V <sub>3</sub>	3,58278	0,14987	0,31445	0,58044	16,20
	V <sub>4</sub>	6,48976	0,27866	1,08714	1,07926	16,63
	All groups	<b>5,28495</b>	<b>0,22193</b>	<b>2,95530</b>	<b>1,71910</b>	<b>32,53</b>
August 2010	V <sub>1</sub>	5,48734	0,36972	1,91375	1,43194	26,10
	V <sub>2</sub>	7,47019	0,37384	1,95656	1,44787	19,38
	V <sub>3</sub>	4,34763	0,12418	0,21589	0,48095	11,06
	V <sub>4</sub>	7,65549	0,26988	1,01967	1,04523	13,65
	All groups	<b>6,24016</b>	<b>0,23262</b>	<b>1,80186</b>	<b>3,24672</b>	<b>52,03</b>

Last analyzed character shows, as expected, higher values for the leaf area for the experimental trail where the largest number of leaflets has been recorded. For this trial was obtained the higher value for character “high” and “root collar diameter” also. We are talking about experimental trial 4.

Table 5

Duncan Test

Experimental trials	Analyses characters							
	Height (cm)		Root collar diameter (mm)		Number of leaflet		Leaf area	
	Signifiant differences for p<0.05000							
	p	Sign	p	Sign	p	Sign	p	Sign
V1-V2	0,58752		0,02636		0,13126		0,00013	***
V1-V3	0,12840		0,53024		0,59405		0,01005	*
V1-V4	0,00006	***	0,00014	***	0,00013	***	0,00006	***
V2-V3	0,05199		0,00704	**	0,05441		0,00006	***
V2-V4	0,00011	***	0,04461	*	0,00650	**	0,66613	
V3-V4	0,00005	***	0,00006	***	0,00006	***	0,00005	***

Analysis of variances revealed highly significant influence on the character about substrate (table 5).

It has been found highly significant differences for experimental trial V4. The substrate made by 30% manure, 50% sandy and 20% ground leaves providing the best results.

## CONCLUSIONS

1. The highest values in terms of growth rate regarding the characteristics “high” and “root collar diameter” have been obtained for experimental trial V4. A strong differentiation for the experimental trial V<sub>4</sub> in the third period of growth has been found.

2. The experimental trial with 30% manure + 50% sandy and 20% ground leaves gives the lowest results in terms of growth.

3. The characters “number of leaflets” and “leaf area” is approximately the same.

4. A more special case is found in the experimental trial V<sub>2</sub> which, although the number of leaflets is much smaller than in experimental trial V<sub>4</sub>, leaf area is almost the same. Higher values of root collar diameter and height of seedlings in this trial are a result of increased biomass accumulation and can be explain by the big leaf surface.

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# STUDIES ON THE MAIN QUANTITATIVE TRAITS OF „ROȘIOARĂ”- MOON RADISH VARIETY

## STUDII PRIVIND ÎNSUȘIRILE PRINCIPALELOR CARACTERE CANTITATIVE ALE SOIULUI DE RIDICHE DE LUNĂ „ROȘIOARĂ”

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**Abstract.** For judicious management of the selection process in order to maintain varietal characters and traits of „ROȘIOARĂ” variety, within the specificity and authenticity have been recruited within the limits  $x \pm s$  for each character individually. Experimentation was conducted in 2008-2010 at Vegetable Research and Development Station Bacau, amid continuing selection of “ROȘIOARĂ” radishes variety. The main purpose of the research was to follow the variability of quantitative characters in field study of progenies of mother plants in order to maintain genetic integrity of the variety. For the study of variability measurements were made on a sample of 100 individuals (mother plants) taken at random on the diagonals of the field. The effectuated measurements were made on: the root height (cm); the root diameter (cm); the index form; the root weight (g).

**Key words:** seed production, variability, study of descendants, typical plants

**Rezumat.** Pentru conducerea judicioasă a procesului de selecție în vederea menținerii variabilității caracterelor și însușirilor soiului "ROȘIOARĂ", în limitele de specificitate și autenticitate, selecția s-a făcut în limitele  $x \pm s$  stabilite pentru fiecare caracter în parte. Experimentarea s-a realizat în perioada 2008-2010, la Stațiunea de Cercetare - Dezvoltare pentru Legumicultură Bacău, pe fondul selecției de menținere la ridiche de lună soiul "ROȘIOARĂ". Pentru realizarea studiului variabilității la soiul de ridichi de lună "ROȘIOARĂ", au fost efectuate măsurători la un număr de 100 indivizi (plante-mamă) luați la întâmplare pe diagonalele câmpului. Măsurătorile efectuate au vizat: înălțimea rădăcinii(cm); diametrul rădăcinii(cm); indexul de formă; greutatea rădăcinii(g)

**Cuvinte cheie:** producere de semințe, variabilitate, studiu descendenți, plante tipice

## INTRODUCTION

Due to the practical importance of seed value, it must deepen the nature of links between synthetic and seed quality as the main factors that attribute to influence. Using statistical and mathematical methods in experimental research, in addition to the role it plays in the development and improvement of breeding and selection work, offers comprehensive knowledge of the characteristics of biological material subjected to experiments and theoretical obtaining

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information essential for improving the practical work. (Potlog A.S., Velican V., 1971, Săulescu N., 1968)

Although the comments were ascertained production elements, depending on their anatomical and morphological features, it was found that in many cases, a single element of the production contribute differently to its quality, its been a characteristic of purely related to the variety or hybrid.

In this regard, we illustrate the correlation between the size or specific weight of seeds and their quality expressed by germination energy, germination and vigor.

## MATERIAL AND METHOD

The biological material used was **Roșioară** month radish variety created at VRDS Bacau. Vegetation period: 28 - 30 days, the root is slightly globular, shiny red coloured. It doesn't become woody and yeast, the pulp is juicy, crispy (Brezeanu, 2010).

During the growing season, observations were made on completing the main phenophase (sow-rising, rising - rosette leaf formation, forming the rosette of leaves - beginning of root thickening, starting root's thicken - the end of root development.

Measurements were conducted on 100 families on the following characters: the root height (cm); the root diameter (cm); the index form; the weight (g)

For the study of variability measurements were made on a sample of 100 individuals (mother plants) taken at random on the diagonals of the field.

The experimental field has been placed on an alluvial soil medium developed, and sandy loam texture, pH = 6.2 to 6.5 and 2.5 to 2.7% humus content.

We performed specific tasks selection, the biological purification being made in the fields mother plants in sprouting stage, leaves rosette formation, technological maturity.

In case of seeds fields the biological purification was made at planting time, in floriferous stems stage, flowering and physiological maturity of seeds (Korzenievska, 2008).

## RESULTS AND DISCUSSIONS

The methods of correlations utilized, in analyze of characters variability, revealed interesting results in what concerns the resistance and direction of interactions between genotype and environment (Ambarus, 2005).

In the radish culture, phenologycal observations were made, establishing the total period of phenophases (in days), the total amount of temperature degrees, and prezipitations per each phenophase (table 1).

The correct and efficient application of selection, in the process of seeds production of moon radish variety ROȘIOARĂ involved the accomplishment of a large number of observation and determinations over the main characters (Ambarus, 2010). In order to have more accurate dates, was necessary to have a large number of individuals.

Main phenophase of "ROȘIOARĂ" moon radish variety are presented in table 2.

Table 1

## Main phenophase of "ROȘIOARĂ" moon radish variety

## - Field parent plants-

No.	Phenophase	Period	Phenophase duration (number of days)	The amount of temperature degrees (°C)	Precipitation (mm)
1.	Sowing - seed emergence	10.04-24.04	15	172,7	32,4
2.	Seed emergence - rosette leaf formation	25.04-10.05	16	227,0	18,6
3.	Rosette leaf formation – root's thicken	11.05-23.05	14	181,8	54,5
4.	Root's thicken - the end of root development.	24.05-07.06	15	266,6	50,7
<b>Total vegetation period</b>		25.04-07.06	45	675,4	123,8

Table 2

## Main phenophase of "ROȘIOARĂ" moon radish variety

## - Seed production field –

No.	Phenophase	Period	Duration of phenophase (number of days)	The amount of temperature degrees (°C)	Precipitation (mm)
1.	Planting – Starting vegetation process	08.06-14.06	7	84,8	6,4
2.	Starting vegetation process - floriferous stems	14.06-21.06	7	137,8	69,5
3.	Floriferous stems - blooming	21.06-15.07	24	518,1	34,4
4.	Blooming - physiological maturity	16.07-15.08	31	680,3	26,5
<b>Total: from - starting-vegetation period -to physiological maturity of seed</b>		12.06-15.08	65	1336,2	130,4

The statistical and mathematical processing of data obtained from measurements taken (sample survey) in each link in the selection of variation were calculated within the variety of radishes "ROȘIOARĂ" (table 3).

Table 3

## The study of some characters of "ROȘIOARĂ" moon radish variety

## a. - Mother plants -

No	Character	Link Selection	X	s	s%	Limits of variation	Significance s%
1.	Root height (cm)	Field for choosing mother plants	3,79	0,67	17,68	3,12-4,46	medium variability
		Field study descendants	3,64	0,65	17,86	2,99-4,29	medium variability
2.	Root diameter (cm)	Field for choosing mother plants	3,86	0,37	9,59	3,53-4,27	small variability
		Field study descendants mother plants	3,82	0,38	9,95	3,44-4,20	small variability
3.	The index form	Field for choosing mother plants	0,99	0,097	9,80	0,893-1,087	small variability
		Field study descendants mother plants	0,99	0,099	10,00	0,891-1,089	small variability
4.	Root weight (g)	Field for choosing mother plants	32,59	8,03	24,64	24,56-40,62	high variability
		Field study descendants mother plants	34,10	7,98	23,40	26,12-42,08	high variability

## b. - Seedy plants

5.	Floriferous stem height (cm)	Field for choosing mother plants	72,20	12,99	17,99	59,21-85,19	medium variability
6.	Weight of seeds/plant. (g)	Field for choosing mother plants	22,21	4,68	21,07	17,53-26,89	high variability

The data presented in table 3 shows that variability varies by character:

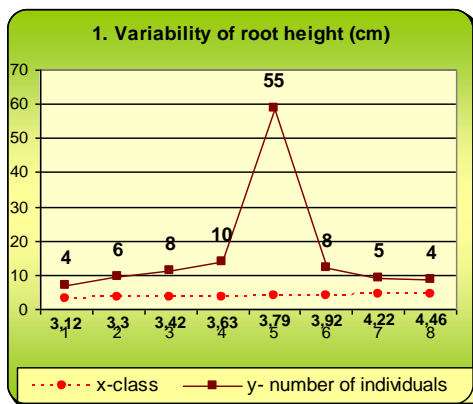
- small in case of the index shape and root's diameter;
- medium at root's height;
- high at the index shape and seeds per plant.

In the same character but in different fields, the coefficient of variability values is close:

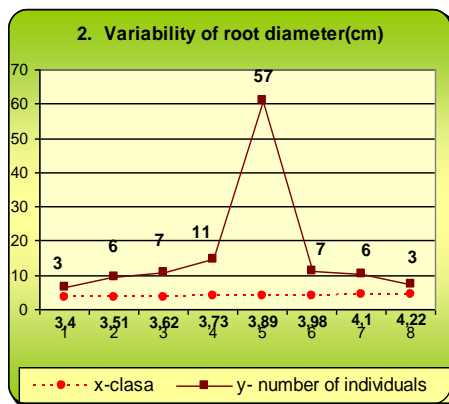
- 9,59 in field for choosing mother plants and 9,95 in field study descendants mother plants at the root diameter;
- 9,80 in field for choosing mother plants and 10,00 in field study descendants mother plants at the index shape;
- 24,64 in field for choosing mother plants and 23,40 in field study descendants mother plants at the root height.

Histograms variations were drawn for each studied character (figure 1-6).

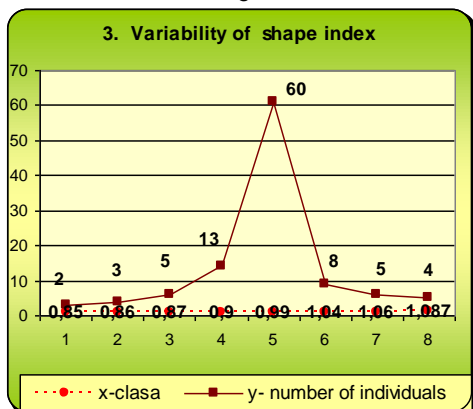




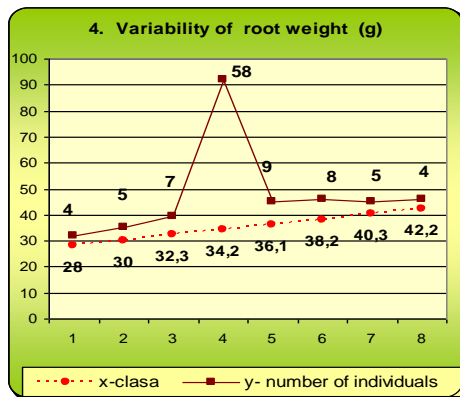
**Fig. 1 - Variability character – the root height**



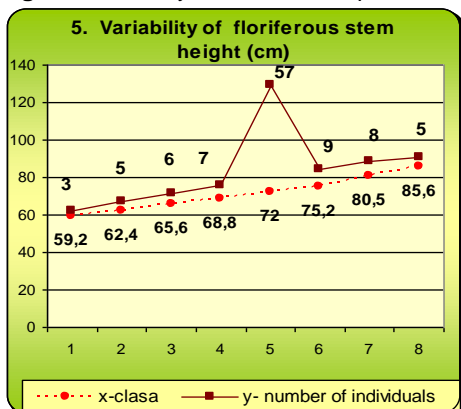
**Fig. 2 - Variability character – the root diameter**



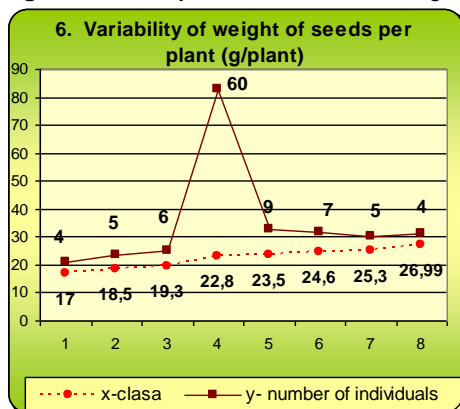
**Fig. 3 - Variability character - shape index**



**Fig. 4 - Variability character the root weight**



**Fig. 5 - Variability character – floriferous stem height**



**Fig. 6 - Variability character – weight of seeds per plant**

## CONCLUSIONS

1. The correct and efficient application of selection, in the process of seeds production of moon radish variety "ROȘIOARĂ" involved the accomplishment of a large number of observation and determinations over the main characters of families that compose the population.

2. In order to have more accurate dates, was necessary to have a large number of individuals from each family.

3. "Roșioară" moon radish variety was within the normal range of variation.

4. The calculation and analyses of variability of this genotype revealed:

- lower in case of shape form and root diameter,
- medium in case of root height;
- high at root weight and seed weight per plant.

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# STUDIES ON THE POTENTIAL CULTURE OF SPECIES *PHASEOLUS AUREUS*

## STUDII PRIVIND POTENTIALUL DE CULTIVARE AL SPECIEI *PHASEOLUS AUREUS*

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**Abstract.** *Phaseolus aureus* is practically unknown in Romania. This paper proposes a bibliographic study of the suitability of cultivation in our country, comparatively analyzing popular culture, technology and patented worldwide and biological requirements of species. In this regard, we presented issues like: special requirements for the environment, cultural practices, production and performance, market challenges to growing and improving in *Phaseolus aureus* growing and consuming countries. Adjacent to the area's climatic conditions are Moldova and thus can be cultivated species in this habitat.

**Key words:** suitability, rusticity, genetic resources

**Rezumat.** Specia *Phaseolus aureus* este practic necunoscută în România. Lucrarea de față își propune un studiu bibliografic al pretabilității cultivării în țara noastră, analizând, în mod comparativ, tehnologia de cultura cunoscută și brevetată la nivel mondial și cerințele biologice ale speciei. În acest sens, vom prezenta aspecte privind: cerințele speciei față de mediu, practicile culturale, producția și performanțele, piața, provocări pentru ameliorare în țări cultivatoare și consumatoare de *Phaseolus aureus*. Adiacent, vor fi prezentate condițiile pedoclimatice ale zonei Moldovei și implicit posibilitatea speciei de a fi cultivată în acest habitat.

**Cuvinte cheie:** pretabilitate, rusticitate, resurse genetice

## INTRODUCTION

*Phaseolus aureus*, also known as *Vigna radiata* it is known worldwide and cultivated especially in the United States, Australia, India, Pakistan where is it appreciated for human consumption, which creates prerequisites researchers to study different aspects species: adaptability, resistance pathogen attack, the quantity and quality of the harvest.

## MATERIAL AND METHOD

The study was carried out in Bacau at the VRDS Bacau. The biological material: *Phaseolus aureus* species. The paper presents a literature review on that species, as a documentation of this species regarding the possibilities for cultivation in North East part of Moldova. The main items analyzed are special requirements for the environment, cultural practices, production and performance.

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## RESULTS AND DISCUSSIONS

**Temperature.** Mungbeans are a warm season crop requiring 90–120 days of frost-free conditions from planting to maturity, depends on variety (Oplinger 1990).

**Water.** High humidity and excess rainfall late in the season can result in disease problems and harvesting losses due to delayed maturity. Adequate rainfall is required from flowering to late pod fill in order to ensure good yield.

**Soil.** Mungbeans do best on fertile sandy, loam soils with good internal drainage. They do poorly on heavy clay soils with poor drainage. Performance is best on soils with a pH between 6.2 and 7.2 and plants can show severe iron chlorosis symptoms and certain micronutrient deficiencies on soils that are more alkaline. Mungbean has phosphorus, potassium, calcium, magnesium and sulfur requirements similar to other legumes, which must be met by fertilizer additions if the soil is deficient in these elements. Mungbean is cultivated on relatively light soils, which are considered marginal for cultivation of other crops.

**Light.** Mungbeans are responsive to length of daylight so short days hasten flowering and long days delay it (Khattak G, 2006). Varieties differ in their photoperiod response. The photoperiod sensitive: "Desi moong" varieties were low yielding (250-500 kg/ha), asynchronous, and late maturing (95-115 days). They had spreading growth, small pods (5-6 cm) and small seed size (20-25 g/1000 seeds). The color of seed was usually green, either dull or shiny. Strong response of these varieties to length day forced farmers to postpone their sowing, which delayed the sowing of the following wheat crop. They were susceptible to both mungbean yellow mosaic virus (MYMV) and cercospora leaf spot (CLS) disease. The photoperiod insensitive: Desi varieties gave relatively better yield (400-600 kg/ha). They had erect growth habit and took 90-95 days to mature in summer (kharif) and about 80 days when sown in spring. They had comparatively bigger pods (7-8 cm) and medium size seed (25-30 g 1000 seeds) with a green, but dull seed coat. They were, for the most part, also susceptible to MYMV and CLS. Long-duration and unsynchronized maturity created strong competition with other crops for land and labor. Susceptibility to diseases made a risky crop, and its dull color made it unattractive to consumers.

**Available material:** All over of the world the varieties of *Phaseolus aureus* are grouped and cultivated after different criteria. Mungbeans (if proper varieties are used) are adapted to the same climatic areas as soybean, drybean and cowpea. Using criteria of variety G.M Popova established three varieties of *Phaseolus aureus* (Olaru, 1982). *Indicus* variety – very common in India, the plants are erect, rarely lying port. The pods are thin 0.25-0.4 cm width and short 4-6 cm length. Seeds are small, with late maturity. *Chinensis* variety - common in China - plants of this variety are lying bush. The pods are 0.5-0.8 cm width and 8-15 cm length. The seeds are bigger than seeds of indicus variety and the maturity is early. *Iranicus* variety – common in Iran, plants of this variety shows peak wrapped. The pods are middle 7-8 cm length, 0.5-0.8 cm width. The maturity is middle. Analyzing these varieties we observed significant differences regarding port of the plant, color and size of pods and seeds, maturity. Using criteria of responsive to length of daylight: the photoperiod sensitive varieties and the photoperiod insensitive varieties. All over the world, thousands of experimental lines of mungbean

have been tested. Much of this testing and research has been coordinated with the Asian Vegetable Research and Development Center in Taiwan, which is the international center responsible for mungbean research worldwide. According Official Catalogue of Varieties of Crop Plants in Romania – full edition 2011 in Romania there are any varieties of *Phaseolus aureus* cultivated in Romania. This was the reason for what at Vegetable Research and Development Station we started a collection process of *Phaseolus aureus* varieties. All collected material was analyzed, described, coded, labeled, and placed in our gene bank (VRDS Bacau). The collection process represent a starting point in a project aimed to establish the suitability of the species for cultivation in North East of Moldova area, and also the right moment for planting, the most appropriate density and to establish some physiological index of *Phaseolus aureus*.

**Features cultivation** In order to establish the most conducive method of cultivation in climatic conditions of Romania, Moldova area, we analyzed different ways successfully applied in countries with a tradition of cultivating the species *Phaseolus aureus*. Because the seed is small, careful handling and attention to planting machinery adjustments is necessary to ensure planting with little damage to the seed. The production is negatively affected by use of mixing seed of different varieties. If mungbean is being planted in a field for the first time the proper nitrogen fixing bacteria must be provided. The inoculants can be applied to the seed just before planting or applied in the furrow in peat or granular form. Care must be taken to distribute inoculants uniformly in the field. It is recommended to use the bacteria that are specific for mungbean or closely related species. Only certified seed should be use so that quality and variety purity are guarantee. The soil should be tile to remove weeds and to prepare a seedbed, which will provide good seed-soil contact. The final seedbed needs to firm with a surface free of clods and debris to allow a good distribution of seeds.

According with **climate condition**:

In USA in Wisconsin and Minnesota climate conditions mungbean should be planted between May 15 and June 6 like the other legumes (field bean, adzuki, cowpea) which are being grown as the major crop on the field. Too late a planting date results in bloom and pod fill during the hottest, driest period of the summer. In some areas, mungbean is planted as a second crop after the small grain is harvested. If this is done, planting should occur immediately after the grain harvest with a minimal disturbance of the seedbed. It is doubtful that the growing season would be long enough to plant after small grain harvest. There are two main planting windows for mungbean in Australian climate condition:

-Spring planted mungbean can produce reasonable yields if specific attention is paid to: stored soil moisture levels at planting, management of trips on seedling plants, special care at flowering moment, desiccation prior to harvest, increased weed pressure. The most consistent results with spring plantings have been achieved with late September/early October plantings in situations with at least 90 cm of stored soil water. Late October/November plantings are considered a riskier proposition in western areas because of the increased risk of experiencing dry, heat wave conditions on the emerging seedlings and on plants at flowering.

-Late planting varieties are preferred for late plantings because they have a degree of resistance to powdery mildew. Late planting can result in lower yields, as the crop often flowers around 35 days after planting, and the small plants fail to achieve canopy closure. If planting on narrower rows, increase the seeding rate by 5 kg/ha for plantings made after mid-January. This helps compensate for smaller plant size.

In Pakistan *Phaseolus aureus* is cultivated in two cropping seasons (Mubarik Ali 2009): The summer season from May to October is called kharif season and crops grown in this season are named kharif crops. The dry winter season from November to April is called rabi season and the crops cultivated in this season are called rabi crops. The proportion of mungbean in the total cropped (kharif and rabi season) area in the major growing districts ranged from 24% to 33%.

The American technologies recommends: planting equipment for soybean, field bean, adzuki and cowpea can be used to plant mungbean but careful adjustments must be made to properly deliver and distribute the very small seed (2700–5500 seeds/kg). In 30" rows, the recommended planting rate is 9 seeds/30.5 cm; in 20" rows 6 seeds/30.5 cm; and in 6"–10" rows 2–3 seeds/30.5 cm. Populations of 300,000–400,000 plants per ha will be achieved with these rates. Because of possible weed outbreaks with early season planting and the need for cultivation to control them, row spacing of 20"–30" are recommended. In later plantings or planting as a second crop the narrow rows will produce higher yields.

The Australian technology recommends two type of system culture: dry land - target population of 200,000–300,000 plants/ha and irrigated - target population of 300,000–400,000 plants/ha. Mungbeans require phosphorus, potassium and certain micronutrients at levels similar to other field beans. Like the other legumes most of the nutrient uptake occurs later in the season so starter fertilizers have not been very helpful. (Jayne Gentry, 2010)

**Weed Control:** Broadleaf weed control options are very limited in mungbeans, and growers should plan a weed strategy prior to planting. Mungbean seed lots containing weed seeds can be difficult to sell, and can incur substantial discounts. The weed control can be realized mechanical and chemical.

**Diseases and control:** Proper rotation, tillage practices, and water management (if under irrigation) can be effective in reducing the impact of these diseases. Mungbeans are susceptible to the usual array of pathogens, which attack other legumes.

**Predators and their control:** In US mungbeans do not generally require insecticide sprays to control problems in the field. Seed corn maggot and wireworms could attack seeds in the early germination period and reduce stand under certain conditions. Occasional grasshopper or caterpillar infestation could occur and result in defoliation. Mungbeans are no more affected by insect problems than the other legumes. Weevils can attack the seed in storage. In Australia insects can significantly affect the overall profitability of a mungbean crop, reducing both yield and seed quality. Accordingly, insect damage is one of the main reasons for downgrading mungbeans. Crops should be inspected regularly (weekly) from the vegetative stage through to budding, and twice weekly from the start of budding-flowering through to the completion of pod fill. Crops that are producing buds, but not flowers, may contain

damaging levels of sucking insects, causing the buds to abort before the flowers open. Mungbeans can compensate for early damage by setting new buds and pods but this may result in uneven maturity. Excessive early damage can delay harvest.

**Harvesting:** Mungbeans has indeterminate flowering habit. This means that they do not have a defined flowering period and will continue to flower as long as they have adequate soil moisture. Consequently, they can have flowers, green pods and black pods present on the plant at the same time. This growth habit can make the harvesting decision difficult. The ideal stage for harvest to maximize yield and quality is when the majority of pods are physiologically mature, and 90% of the pods have turned either yellow or black. At this stage, the crop should be considered ready for desiccation and harvest. The key point when desiccating mungbeans is the use of a robust rate of glyphosate and allowing sufficient time for the crop to dry down before commencing harvest. There is a tendency to harvest too soon after desiccation. The rate of dry-down of the crop will depend on: choice of desiccant, rate used, temperature and moisture conditions. Depending on used product for desiccation as it can be seen in table 1 the waiting time for maximum dry down of leaf and stem moisture, vary from 5 – 6 days to 7 – 16 days. Mungbeans at about 12% moisture can then be stored in regular grain bins previously fumigated to control bean weevils. If mungbeans are higher in moisture then 12% they can be dried slightly by moving unheated air though thin layers until they are near the 12% value. Because they will be sprouted and eaten direct, care should be taken to keep all possible contaminants away from the storage area.

Table 1

<b>Products for desiccating mungbeans</b> (processing after - Mung bean management guide – 2 <sup>nd</sup> edition)				
Active ingrdient	Example trade name	Rate (L/ha)	Days to maximum dessication	Withholding period (WHP)
Diquat	Reglone	2.0-3.0	5-6	0
Glyphosate	Roundop Power Max	various	7-16	7

**Production and performance** - Mungbean production in Australia varies between 30.000 and 60.000 tons per year. Nearly all (95%) of the Australian mungbean crop is bagged, containerized and exported. All stages of crop production and processing have to comply with strict hygiene practices to ensure the crop meets the highest standards for food safety and hygiene. Yield potential in Australia depending on system culture is dry land double crop 0.25–1.25 t/ha, dry land winter fallow 0.75–2.0 t/ha, in condition of irrigation 1.25–2.75 t/ha. Grading losses will usually reduce marketable yields by 5–20%.

### CONCLUSIONS

Our bibliographical study relives the high potential of *Phaseolus aureus* species for cultivation in North East part of Moldova area. The placement of our experimental lands assures the mungbeans requirements for:

Temperature - mungbeans are a warm season crop requiring 90–120 days of frost-free conditions from planting to maturity. If we choose the planting time to be May, we obtain a proper period for mungbean cultivation. The period is similar with the one for *Phaseolus vulgaris* traditionally cultivated species in our area.

Soil - we can assure relatively light soils for *Phaseolus aureus* culture.

Studying the climate condition regarding rainfall, the adequate rainfall can be assured from flowering to late pod fill in order to obtain a good yield. If the possibility of drought appears, the lack of the water can be substituted by our irrigation system.

Comparing with other culture practices, we should use the same cultural practices as for green bush beans, except the harvest moment and technologies.

Culture of the species *Phaseolus aureus* may contribute to the development and diversification of agricultural production, the range of foodstuffs in general and the development of sustainable agriculture, for which to aim and the Romanian agriculture in the context of European and world agriculture.

For obtaining a proper yield there are some recommendations ask to be respected:

- Use of approved seed or, if using grower-retained seed, test before planting and replace every three years – (it is practically impossible to find the certified material in Romania from autochthon production since there are not any varieties cultivated).

- Avoid paddocks with major variations in soil type or unevenness. Assess weed status of the paddock (broadleaf weed control options are limited). Fertilize according to paddock history (especially after a long fallow) and soil test analysis.

- Be aware of any residual herbicide risks.

- Stay within recommended planting windows.

- Use effective inoculation.

- Monitor disease status in crop and timely insect control, check crops every week during vegetative stages and at least twice weekly from budding through to pod fill.

- Use effective desiccation before harvest.

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# SCREENING OF TOMATOES GERMPLASM CULTIVATED IN ROMANIA IN ECOLOGICAL SYSTEM CULTURE

## PREZENTAREA SORTIMENTULUI DE TOMATE CULTIVATE ÎN SISTEM ECOLOGIC ÎN ROMÂNIA

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**Abstract.** *Tomatoes in various forms, fall within the daily diet of the population being consumed fresh, prepared, canned or dried very well appreciated in all world cuisines. Tomatoes are providing nutrients (carbohydrates, proteins, lipids, organic acids), minerals, vitamins (A, B1, B2, B6, C, PP, E, K) and are one of the most balanced fruit in rational nutrition. In this research paper we discuss aspects regarding type of growth, vigurozity, production potential (t/ha), precocity, plant resistance to pathogens, some fruit characteristics like: shape, color, weigh, lodge number, firmness, storage and split resistance. Our observation and determinations were made on a range variety on tomatoes cultivated in ecological system culture.*

**Key words:** *Lycopersicon esculentum*, biodiversity, organic farming

**Rezumat.** *Tomatele sunt unele dintre cele mai apreciate legume în toate bucătăriile lumii fiind consumate proaspete sau preparate. Tomatele sunt cele mai echilibrate fructe din punct de vedere nutrițional ele furnizând nutrienți (carbohidrați, proteine, lipide, acizi organici), minerale, vitamine (A, B1, B2, B6, C, PP, E, K). În aceasta lucrare sunt prezentate aspecte cu privire la tipul de creștere, vigurozitatea, potențialul de producție, precocitatea, rezistența la atacul patogen, cât și câteva caracteristici precum forma, culoarea și greutatea fructelor, fermitatea, rezistența la păstrare și la crăpare. Observațiile au fost efectuate la o gamă de tomate cultivate în sistem ecologic.*

**Cuvinte cheie:** *Lycopersicon esculentum*, biodiversitate, agricultură ecologică

## INTRODUCTION

Organic agriculture meets increasingly higher organic products. Consumers are convinced that these products contribute directly to improving the health of humans and animals. Prices of products organic are beneficial to producers (1.5 - 3 times), they compensate the fact that production is reduced by 15-30%. By definition, the organic products are not the result of an industrial process and criteria that the consumer does not choose physical characteristics (size, symmetry, color uniformity etc.) Primarily important is biological quality of production.

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## MATERIAL AND METHOD

Due to high demands for healthy food and economic efficiency, ecological culture system has become popular and wanted by beneficiaries of organic horticultural products. The biological material was represented by a number of 28 cultivars of tomatoes. We made observations and measurements regarding morphological and biological characteristics of a range variety of tomatoes. Our observation regards: precocity and production potential (t/ha) of culture, some plant characteristics: type of growth and vigurozity, fruit characteristics: shape, color weight (g) lodge number firmness, split and storage resistance. A very important analyzed issue in condition of ecological farming was plant resistance to pathogens.

## RESULTS AND DISCUSSIONS

In organic farming the use of resistant varieties and local populations to attack of pathogens is required (Calin Maria, 2010). Thus in the VRDS Bacau has been studied a large number of tomatoes cultivars in order to establish best for organic. Studies were focused on field crops and protected areas (Brezeanu P. M).

As we can see in all presented tables and also in figure 1 we have studied a number of 28 varieties and we group them in three different categories: varieties for fresh consumption, varieties for fresh consumption and industrialization, varieties for industrialization. In table 1 all analyzed items can be observed.

By using a genetically diverse biological material it can be created and placed in culture a significant number of varieties and hybrids (Ambăruș Silvea, 1990).

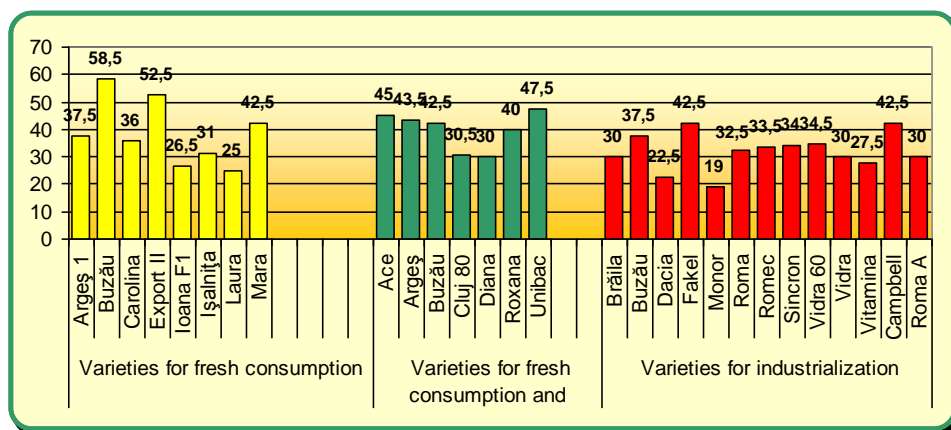


Fig. 1 – Obtained production in ecological system culture

The studied varieties from **the first group** were: early tomatoes: Argeș 1 F<sub>1</sub>, Export II F<sub>1</sub>, Ioana F<sub>1</sub>, Ișalnița 50 and semi late varieties: Buzău 1600, Carolina, Laura, Mara – all presented an indeterminate type of growth. Number of lodges varies from 3 to 4-5 per fruits and the color registered different shades of red. Due to the high content of b carotene fruits of Carolina variety were yellow orange. Fruits of Buzau 1600 and Mara were the fruit with the greatest weight 185

– 260 g. Arges variety developed the fruits with lowest weight, 40-50 g. The very important analyzed item for culture in organic system was the plant resistance to pathogens. Export II F<sub>1</sub> and Mara varieties were most tolerant to specific diseases.

**The second group**, of varieties for fresh consumption and industrialization includes early varieties: Cluj 80, semi late varieties Argeş 428, Roxana, Unibac, and late varieties: Ace Royal, Buzău 22, Diana. Four varieties (Ace Royal, Buzău 22, Roxana, Unibac) were tolerant to specific diseases. The fruits were colored in deep, dark, bright red. The number of seed's loge varies from 2-5 at Cluj 80 to 7-8 at Diana. All varieties presented split and store resistance. Arges 428 developed fruits with weight 200 -300g.

Table 1

Short description of analysed varieties

No	Variety	Fruit characteristics							
		Vigurozity	Shape	Color	Weight (g)	Lodge number	Firmness	Resistance	
								Split	Storage
a. Varieties for fresh consumption									
1	Argeş 1 F <sub>1</sub>	Vigorous growth, size of 110-130 cm	Round flat	Red brick	40-50	4-5	B	R	-
2	Buzău 1600	Plant robust, the size of 90-110 cm	Round globular	Red uniform	190-260	3-4	G	R	-
3	Carolina	Vigorous growth, size of 100-125 cm	Globose, slightly ovoid	Yellow orange	90-100	4-5	G	R	M
4	Export II F <sub>1</sub>	Medium vigurozity, size of 90-100cm	Round, flat globose	Red uniform	70-90	4-5	V G	R	-
5	Ioana F <sub>1</sub>	Vigorous, with great possibilities of shoots	Round flat	Dark red	75-80	4	V G	R	-
6	Işalniţa 50 F <sub>1</sub>	Very vigorous, rich bush	Round globose, with green spot	Deep red	100-110	4-5	G	R	-
7	Laura	Vigorous growth, lush foliage	Globose, with Æ size 5,2 – 7,2 cm	Bright red, smooth	100-110	4	G	R	B

<b>b. Varieties for fresh consumption and industrialization</b>									
1	Mara	Very vigorous, uniform	Round flat, uniform	Dark red	185-230	3-4	G	R	M
2	Ace Royal	Vigorous, with compact bush	Round flat	bright red	80-120	3-4	V G	R	M
3	Argeş 428	Medium vigurocity, size of 80 cm	Round flat	Bright red	200-300	4-5	G	R	M
4	Buzău 22	Medium vigurocity	Spherical, slightly flattened	Deep red, uniform	120-200	3-4	V G	R	M
5	Cluj 80	Very vigorous, size of de 95-125 cm	Large, spherical, size 6 cm	Deep red, smooth	75-80	2-5	G	R	M
6	Diana	Vigorous growth, size of 60/70 cm	Round flat, smooth	Red uniform	120-140	7-8	G	R	M
7	Roxana	Medium vigurocity	Round least flattened	Deep red, uniform	120	4-5	G	R	M
8	Unibac	Medium vigurocity size of 60-70 cm	Flattened ball	Deep Red brick	63-86	4-5	G	R	M
<b>c. Varieties for industrialization</b>									
1	Brăila 405	Very vigorous	Elongate d ovoid	Red spotless	45-50	3-4	V G	R	G
2	Buzău 47	Vigorous growth, size of 60-70 cm	Globular, symmetrical	Red uniform	90-100	5-6	G	R	G
3	Dacia	Semierecte bushes, with 4 -6 shoots	Flattened ball	Deep red,	110-120	3-4	V G	R	M
4	Fakel	Very vigorous	Round flat	Deep red, uniform	60-70	3-4	V G	R	G

5	Monor	Medium vigurocity, leaves little	Round flat to globular	Deep red, glossy	60-70	3-5	V G	L	G
6	Roma VF	Vigorous, semierect port	Elongate d oval	Deep red, uniform	40-70	4	V G	R	G
7	Romec 554 r J	Medium vigurocity size of 60-70 cm	Ovoid, ovoid-square	Bright red, smooth	50-60	3	G	R	G
8	Sincron	Medium vigurocity, lying/repent port	Round flat	Red yellow	50-80	4	G	R	G
9	Vidra 60	Medium vigurocity size of 55-60 cm	Globular, slightly flattened	Red yellow	40-60	2-3	V G	R	G
10	Vidra 533	Erect port, size 50-65 cm	Elongate d pear	Bright Red	60-65	4	V G	R	G
11	Vitamina	Almost erect port, size of 50-60 cm	Globular, slightly flattened	Red uniform	90-100	6-7	G	R	M
12	Campbell 1327	Very vigorous, with compact bushes	Round flat	Deep red, spotless	100-120	4-5	V G	R	M
13	Roma A r	Medium vigurocity, semierect port	Elongate d oval	Deep red,	30-60	4	V G	R	V G

**The third group** studied was the one of tomatoes for industrialization. We took in observation a number of thirteen cultivars with different precocity: 0 – Monor, 1- Brăila 405, Sincron, Vidra 60, Vitamina, 2 - Vidra 533, Roma Ar and 3 – Dacia, Campbell 1327, Romec 554 rJ, Roma VF. All cultivars presented determinate type of growth with a medium to strong vigurocity. Fruits were colored in red spotted or uniform, bright or glossy. Sincron and Vidra 60 presented red yellow fruits. Regarding shape of fruits diffrent types were detected: elongated shape at Brăila 405, Roma A r, Roma VF, Vidra 533, Romec 554 rJ, globular at Buzău 47, Vitamina, Vidra 60, more or less round at Dacia, Fasel, Monor, Sincron, Campbell 1327. The smaller fruits with a lower level of weight (g) were the fruit of Roma Ar 30-60 g. Dacia and Campbell 1327 varieties presented fruits with a higher weight 100-120g per fruit. All fruits presented good and very good firmness. Dacia variety was very sensitive to pathogens attack and

Buzău 47, Fakel, Vitamina, Campbell 1327, Roma A r presented tolerance to pathogen attack.

The experience in organic farming in VRDS Bacau and results presented in this paper confirm that the organic farming is possible (Stoian, 2005).

## CONCLUSIONS

1. The highest yield production in case of group varieties for fresh consumption of was obtained at: Buzău 1600 52-65 t/ha.

2. Export II F<sub>1</sub> and Mara varieties were tolerant to specific diseases.

3. The highest yield production in case of group varieties for fresh consumption and industrialization of was obtained at: Buzău 22: 40-45 t/ha and Unibac 40-55 t/ha

4. The varieties: Ace Royal, Argeş 428, Buzău 22, Cluj 80, Diana Roxana and Unibac were tolerant to specific diseases.

5. Fakel and Campbell 1327 obtained the highest production in case of the industrialization group of tomatoes, 40-45 t/ha.

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# STUDY OF FRUIT QUALITY IN PEPPER CULTIVATED IN CONVENTIONAL AND ORGANIC AGRICULTURE

## STUDIUL CALITĂȚII FRUCTELOR DE ARDEI CULTIVATE ÎN AGRICULTURĂ ECOLOGICĂ ȘI CONVENȚIONALĂ

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**Abstract.** *Research and experimental farming of peppers grown in organic and conventional agriculture have been performed in Vegetable Research and Development Station Bacau, from 2008 to 2010. Fruit composition was analyzed by The Faculty of Horticulture - U.S.A.M.V. Bucharest. Analyses were performed in order to identify the differences that may exist in the composition of vegetables grown in conventional and organic agriculture. The content of soluble solid substances of peppers was higher in organic agriculture. % of glucose was higher in organic farming and % of fructose was higher in conventional agriculture to all cultivars. The content of pepper's ascorbic acid was higher in organic agriculture.*

**Key words:** study, fruit quality, pepper, conventional, organic agriculture

**Rezumat.** *Cercetările și experimentările de cultivare a plantelor de ardei în agricultură ecologică și convențională s-au efectuat la SCDL Bacău, în perioada 2008 – 2010. Determinările privind compoziția fructelor s-au efectuat la USAMV București, Facultatea de Horticultură. Analizele efectuate au relevat diferențe între compoziția legumelor cultivate în agricultură ecologică și agricultură convențională. Astfel substanța uscată solubilă la cultivarele de ardei a fost mai mare în agricultură ecologică. % de glucoză a fost mai mare în agricultură ecologică, iar % de fructoză a fost mai mare în agricultură convențională. Conținutul în acid ascorbic la ardei a fost mai mare în agricultură ecologică.*

**Cuvinte cheie:** calitatea fructelor, ardei, agricultură ecologică, convențională

## INTRODUCTION

The crop technologies can influence the nutritive quality of the pepper fruits (Hallmann and Rembialkowska, 2008). The fresh organic red pepper contains more bioactive compounds than the one grown in conventional agriculture

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(Hallmann and Rembiałkowska, 2007). Sweet pepper (*Capsicum annuum* L.) is rich in ascorbic acid and has an important quantity of carotenoids as beta-carotene, (Haytowitz and Matthews 1984). There is a wide range of pigments in the fruits of pepper plants (Carvajal et al. 1997). In addition the fruits of pepper have flavonoids (Lee et al. 1995) and other phytochemicals (Duke 1992).

In Romania, in the last years we noticed an increase of the surface cultivated with pepper in organic agriculture. As a result, at V.R.D.S. Bacau during 2006-2010 a lot of studies regarding the growth and composition of pepper in organic agriculture have been conducted (Calin and al., 2010).

This study was realized according with the legal communitarian frame from the European Community Regulation no. 834/2007. The purpose of researches is the establishment a differences in quality between organic and conventional agriculture.

## MATERIAL AND METHOD

The researches and experimentation of pepper plants cultivation in ecologic and conventional agriculture were accomplished at VRDS Bacau, during 2008-2010. The determinations regarding the fruit composition were realized at USAMV Bucuresti, Faculty of Horticulture.

The following parameters were determined:

- total dry matter, water, mineral substances (ash),
- mineral elements *K, P, Mg, Ca, Na, Mn, Fe, B, Al, Ba, Cr, Cu, Ni, Pb* and *Zn*,
- total sugars and type of sugars (glucose, fructose, saccharose),
- total soluble proteins,
- soluble dry substance,
- titrable acidity,
- vitamin C (ascorbic acid),
- content in carotene at tomatoes and peppers.

The following methods of analysis were employed:

- gravimetrical methods for total dry substance, water, ash,
- spectrometry ICP-AES, for mineral elements,
- method HPLC for sugars (glucose, fructose, saccharose),
- biurette method for total soluble proteins,
- refractometric method for soluble dry substance,
- method HPLC for vitamin C,
- spectrophotometric method for carotene.

## RESULTS AND DISCUSSIONS

For the determination of food resources and products quality according with the requirements of food and nutrition assurance and EU regulations, at the variants experimented during 2008 and 2010 the following analysis were performed: total dry matter, water, mineral substances (ash), total sugars and type of sugars (glucose, fructose, saccharose), soluble dry substance, titrable acidity, vitamin C (ascorbic acid), content in carotene.

The results obtained are presented in tables 1, 2, 3 and fig. 1.



The content in mineral substances (table 1) varies according with the culture system, type of pepper and utilized cultivar. On observe that the values were higher at the variants from ecologic agriculture. Also, a higher content in mineral substances had the fruits cultivated in organic agriculture.

Table 1

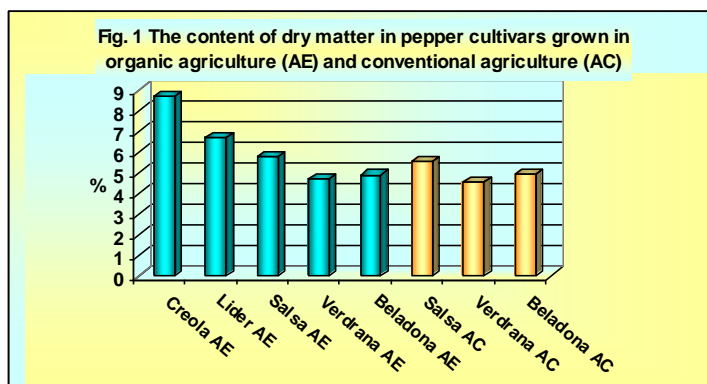
**The biochemical analysis of intensity of respiration, content in water, dry substance, mineral elements and organic substances**

Biochemical analysis in variant	Intensity of respiration	Water	Total dry matter	Mineral substances	Organic substances
	mg CO <sub>2</sub> /kg/h	%	%	%	%
Round pepper in organic agriculture - 2008					
Creola	X	91,27	8,73	0,80	7,93
Lider	x	93,28	6,72	0,44	6,28
Sweet pepper in organic agriculture - 2010					
Salsa	25,70	94,25	5,75	0,47	5,28
Verdrana	22,50	95,29	4,71	0,41	4,30
Beladona	13,90	95,12	4,88	0,43	4,41
Round pepper in conventional agriculture - 2010					
Salsa	18,00	94,45	5,55	0,42	5,13
Verdrana	21,74	95,44	4,56	0,38	4,18
Beladona	20,70	95,09	4,91	0,45	4,46

The dates presented in the previous table show that: the intensity of respiration vary depending on the cultivar, at pepper ranged between 13,9 and 25,7 mg CO<sub>2</sub>/kg product. Depending on the type of culture it was higher at organic peppers: Salsa and Verdana, pleading for the pretability for cultivation in organic agriculture only for certain cultivars. The content in water was different, varying in function of culture system, type of pepper and studied cultivar. Thus, it was higher at sweet pepper cultivated in conventional agriculture (94,45 – 95,44%), comparing with 94,25 - 95,29% at round pepper cultivated in organic agriculture. The round pepper had a smaller content in water (91,27 – 93,28%). The smallest content in water in organic agriculture was determined at Creola variety (91,27%), followed by the variety Lider 93,28%. At sweet pepper the lowest content in water was registered at Salsa cultivar (94,25%), followed by Beladona (95,12%) and Verdana (95,44%).

The dry matter was obtained as a difference, being in a negative proportion with the water content (fig. 1).

The content in organic substances ranged between: 4,18 and 7,93 %, being higher at round pepper (Creola - 7,93%, Lider - 6,28%) and at sweet pepper cultivated in ecologic agriculture (Salsa - 5,28%, Verdrana- 4,30%, Beladona - 4,41%).



The biochemical analysis of dry substances, soluble sugars and titrable acidity is presented in table 2.

Table 2

**The biochemical analysis of dry substances, soluble sugars and titrable acidity**

Biochemical analysis in variant	Dry soluble substance %	Soluble sugars mg/100g			Titrable acidity mg malic acid	Rapport 10 x IR titrable acidity
		Glucose	Fructose	Saccharose		
Round pepper in organic agriculture						
Creola	7,9	1,71	1,49	0,14	0,30	263
Lider	5,2	1,77	1,26	0,21	0,16	325
Sweet pepper in organic agriculture						
Salsa	3,4	1,05	0,85	0,19	0,058	586
Verdrana	3,7	0,74	0,79	0,06	0,096	385
Beladona	3,0	0,85	0,81	0,12	0,083	361
Pepper in conventional agriculture						
Salsa	3,5	0,84	0,73	0,49	0,064	546
Verdrana	3,5	0,90	0,85	0,32	0,083	422
Beladona	3,3	0,81	1,00	0,12	0,077	428

The dates presented show that the dry soluble substance varies between:

- 5,2 and 7,9% at round pepper;
- 3,0 and 3,7% at sweet pepper, being higher in organic agriculture;

% glucose ranged between:

- 1,71 and 1,77 % at round pepper;
- 0,74 and 1,05%, at sweet pepper, being higher in organic agriculture;

% fructoses vary between:

- 0,21 and 0,14%, at round pepper;
- 0,73 and 1,0%, at sweet pepper, being higher in conventional agriculture;

% saccharose was:

- 0,14 and 0,21%, at round pepper;

- 0,06 și 0,49%, at sweet pepper, being higher in conventional agriculture;

Titrate acidity mg malic acid was higher at round pepper and lower at round pepper.

The rapport 10 x IR titrate acidity was lower at round pepper and higher at sweet pepper.

The dates regarding the main antioxidants (table 3) proved that:

- the content in ascorbic acid varies:
  - at round pepper between 83,2 and 116,2 mg/100 g;
  - at sweet pepper between 38,36 and 126,57 mg/100 g, being higher in organic agriculture;
  - the content in carotene varied at round pepper between: 4,69 and 22,43 mg/100g.

Table 3

**The biochemical analysis of ascorbic acid, carotene and chlorophyll**

Biochemical analysis in variant	Ascorbic acid	Carotene	Chlorophyll
	mg/100g	mg/100g	mg/100g
Round pepper in organic agriculture			
Creola	116,2	<b>22,43</b>	-
Lider	83,2	<b>4,69</b>	-
Sweet pepper in organic agriculture			
Salsa	126,57	-	11,16
Verdrana	38,36	-	7,58
Beladona	58,93	-	-
Sweet pepper in conventional agriculture			
Salsa	110,12	-	21,80
Verdrana	61,52	-	-
Beladona	44,51	-	-

## CONCLUSIONS

1. The accomplished analysis revealed differences between the compositions of vegetables cultivated in organic agriculture and conventional agriculture.

2. The intensity of respiration varied upon the cultivar, the values registered being between 13,9 and 25,7 mg CO<sub>2</sub>/kg product, being higher at ecologic pepper: Salsa and Verdana.

3. The water content was different, being higher at sweet pepper in conventional agriculture (94,45 – 95,44%), comparing with 94,25 - 95,29% at sweet pepper cultivated in organic agriculture. The round pepper had a lower content in water (91,27 – 93,28%). The lowest content in water in ecologic agriculture was registered at Creola variety (91,27%), followed by Lider variety 93,28%. At sweet pepper a smaller content in water had the cultivar Salsa (94,25%), followed by Beladona (95,12%) and Verdana (95,44%).

4. The content in mineral substances varied depending on the culture system, type of pepper and cultivar. The values were higher at variants in organic agriculture. Also, a higher content in mineral substances was registered at fruits cultivated in organic agriculture.

5. The content in organic substances ranged between: 4,18 and 7,93 %, being higher at round pepper (Creola - 7,93%, Lider - 6,28%) and sweet pepper cultivated in ecologic agriculture (Salsa - 5,28%, Verdrana- 4,30%, Beladona - 4,41%).

6. The content in ascorbic acid varied also: at round pepper between 83,2 and 116,2 mg/100 g, while at sweet pepper between 38,36 and 126,57 mg/100 g, being higher in organic agriculture;

7. The content in carotene vary at round pepper between: 4,69 and 22,43 mg/100g.

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# RESEARCHES CONCERNING THE QUALITY OF LETTUCE CULTIVATED IN GREENHOUSE AND FERTILIZED WITH NATURAL PRODUCTS

## CERCETĂRI PRIVIND CALITATEA SALATEI CULTIVATĂ ÎN SERĂ ȘI FERTILIZATĂ CU PRODUSE NATURALE

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**Abstract.** *This scientific paper presents the quality of one lettuce assortment, studied in October 2009 - February 2010 period in a biofactorial experiment. The A factor was represented by one assortment of lettuce which was constituted by the next lettuce lines: a<sub>1</sub>-AS 104, a<sub>2</sub>-AS 106, a<sub>3</sub>-AS 107, a<sub>4</sub>-AS 108, a<sub>5</sub>-AS 6119 și a<sub>6</sub>-AS 6123. The B factor was represented by three fertilization graduation with biological products: Elrom, Bionex and Bioplasma. The B factor had a dominant importance over the quality of lettuce yield.*

**Key words:** lettuce, fertilization substances, analysis, nitrate, carbohydrates.

**Rezumat.** *Lucrarea are rolul de a evidenția calitatea unui sortiment de salată, în perioada octombrie 2009 – februarie 2010 studiat în cadrul unei experiențe bifactoriale. Sortimentul de linii de salată a reprezentat factorul A și a fost constituit din următoarele: a<sub>1</sub>-AS 104, a<sub>2</sub>-AS 106, a<sub>3</sub>-AS 107, a<sub>4</sub>-AS 108, a<sub>5</sub>-AS 6119 și a<sub>6</sub>-AS 6123. Factorul B a fost reprezentat de trei graduari de fertilizare cu produse biologice: Elrom, Bionex și Bioplasmă. Factorul B a avut un rol dominant asupra calității recoltei de salată.*

**Cuvinte cheie:** salată, produs de fertilizare, analize, nitrați, glucide.

### INTRODUCTION

The lettuce is cultivated for his leaves wich is most searched by the population and are consumed mostly in fresh condition. Lettuce contains a large specter of minerals while thse apre present in quite reduced amounts (Berar, 1998).

The lettuce alimentary importance is given by the high content of minerals (ca, K, P, Fe), vitamins (C, A, B, , B<sub>2</sub>, PP) and carbohydrates 2-3,5%, proteins 1-1,6%, carotene 1-3 mg/100g fresh product and cellulose. Also lettuce contains organic acids (oxalic, citric lactic) and the latex wich act as sedative, laxative and mineralizing (Indrea D., și colab., 2007).

Between the lettuce constituents, with a unfavorable influence over the consumers health, a special attention must be given to the nitrates. The lettuce nitrate level is influenced by the genetical factors (the cultivar used) and by the ecological (temperature, luminous intensity, humidity of the soil) and

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technological factors (nitrogen fertilization, and fertilizers with gradual release of active substance). By these factors the nitrogen fertilization and the luminous intensity have a major intensity over the lettuce nitrate level (Indrea et al., 2007).

The lettuce young plants, contains more nitrates in coparation with the plants that are avanced in vegetation, causing at he same variety, at 63 days aftes the plantation, a level by 4139 mg NO<sub>3</sub>/kg fresh substance, and at 81 days 3477 mg NO<sub>3</sub>/kg fresh substance. The nitrate larger quantities, is acumulating in plants caused by the aplcation of a large quantities of organic fertilizer wich have a hight level of nitrogen. Acording the soil type, the lettuce level cultivated in the conventional system, was situated between 3537 ppm and 4029 ppm, while in ecollogical sytem being only 1852 ppm (Soare Rodica, Duță Adriana, 2008).

The mobiliden deficiency from the soil can also determinate the excessive acumulation of nitrates in lettuce plants. The C vitamin prevents the transformation of nitrates in nitrites in the plants tissues an human body (Indrea et al., 2007).

## MATERIAL AND METHOD

The biological material used in experience was constitute by six lettuce lines, included in a polyfactor type experience, the set up of the variants being achieved according to subdivided plots method with three repetitions.

The lettuce lines used in experience represented the A factor wich had six graduations: a<sub>1</sub> – AS 104, a<sub>2</sub> – AS 106, a<sub>3</sub> – AS 107, a<sub>4</sub> – AS 108, a<sub>5</sub> – AS 6119 și a<sub>6</sub> – AS. 6123.

The B factor, represented by the biological fertilization preducts, had tree graduations: b<sub>1</sub> – Elrom 1,5 l/ha, b<sub>2</sub> – Bionex 1,5 l/ha, și b<sub>3</sub> – Bioplasma 8,0 l/ha.

The lettuce was cultivated in a Gothic 800 greenhouse type, situated at the Didactic Base of the Banat's University of Agricultural Siences and Veterinary Medicine Timisoara. The culture was achieved acording the general technology of lettuce in grenhouses.

The cuture establishment was made with seedling produced in greenhouse. The seeding operation was efectuated at 16 October 2009, in boxes with nutritive substrate and the procedure of transplanting at 28 October 2009, in nutient plots with a diameter of 5 cm. The caryng works applied during the production of seedlings, was the asiguration of the microclimate optimal conditions and the preventive aplcation of the insecticides and fungicides (Poșta, Ghe., Berar, V., 2008).

The planting operation was efectuate at 27 November 2009. Over the vegetation period was efectuate fertilizations with natural biological products at 10 days intervals.

At consumer plants maturity, have been made quantitative and qualitative deternmnations regarding to the weight of cabbages, that make possible the determination of the production on the unit area and qualitative obseervations.

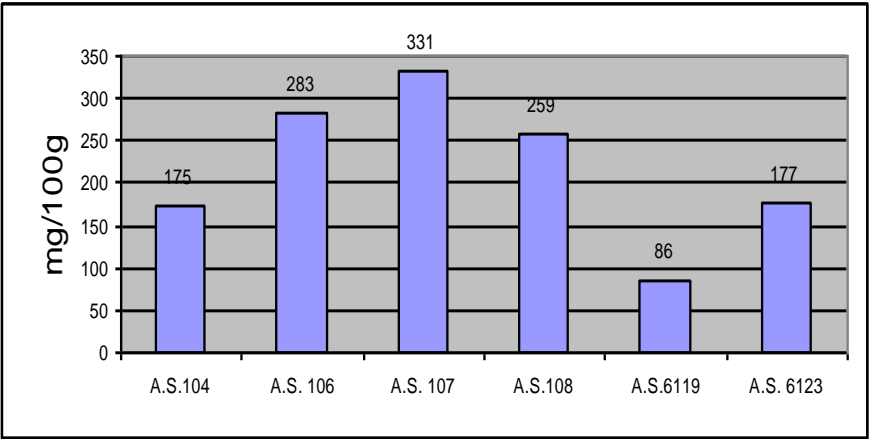
The quantitative observations at the plants harvesting was made at the next dates: 26 January 2010, 01 February 2010 și 08 February 2010.

The qualitative determinatons have referred at nitrate concentrations and the quantity of carbohydrates. These have been made in the research laboratories of the Banat's University of Agricultural Siences and Veterinary Medicine Timisoara (Gergen, I., 2004).

The nitrate concentration and the quantity of carbohydrates were determined by spectrophotometric method using the device SPECORD 205 (Gergen, I., 2004).

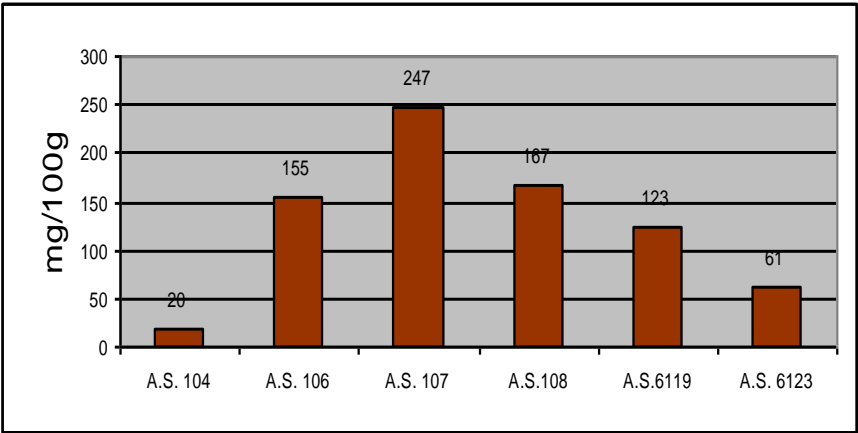
### RESULTS AND DISCUSSIONS

The nitrate concentration level at the six lettuce lines, experimented in October 2009 - February 2010, is presented in figures 1 – 3.



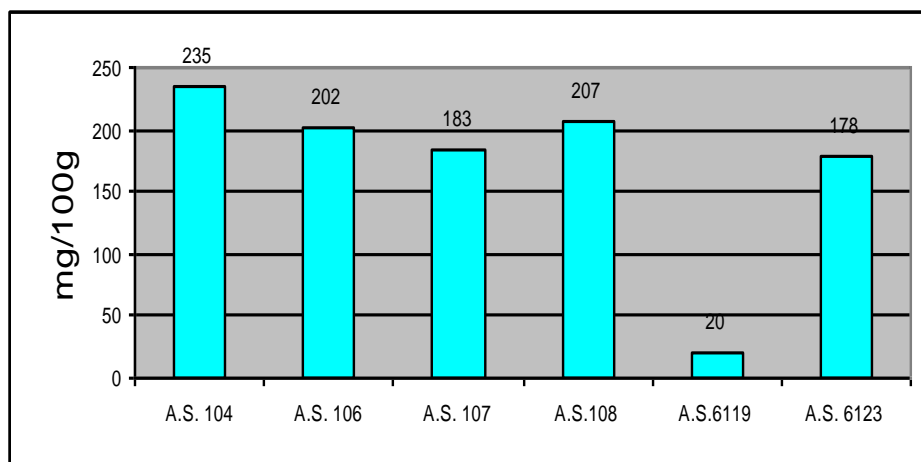
**Fig. 1** - The nitrate concentration at the lettuce fertilized with Elrom

The lowest nitrate concentration of nitrates using the Elrom product was recorded at the lettuce lines AS 6119, As 104 and AS 6123, this oscillating between 86 and 177 mg/100g.



**Fig. 2** - The nitrate concentration at the lettuce fertilized with Bionex

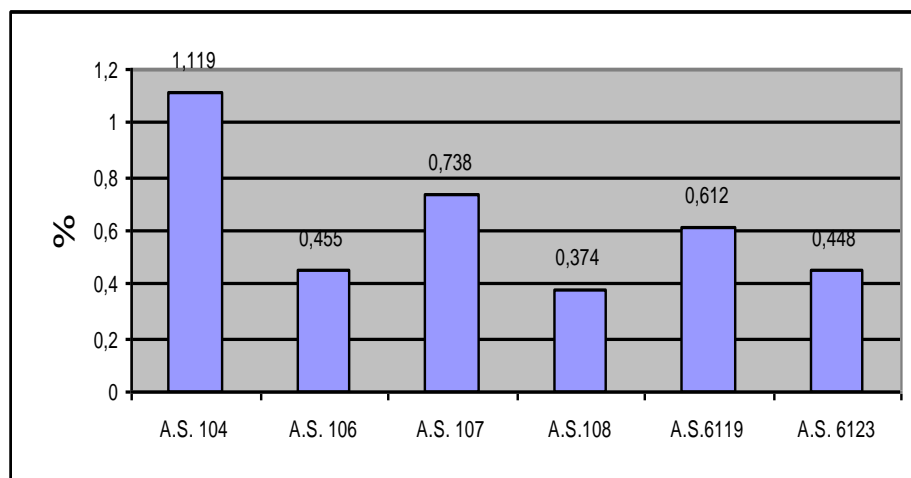
Also at the fertilization with Bionex, the lowest values regarding the nitrate concentration was recorded at the lettuce lines AS 104, AS 6123 and AS 6119 with values between 20 and 123 mg/100g.



**Fig. 3 -** The nitrate concentration at the lettuce fertilized with Bioplasma

When using the Bioplasma product the lowest nitrate level value was recorded at the lettuce line AS 6119 with 20 mg/100g value.

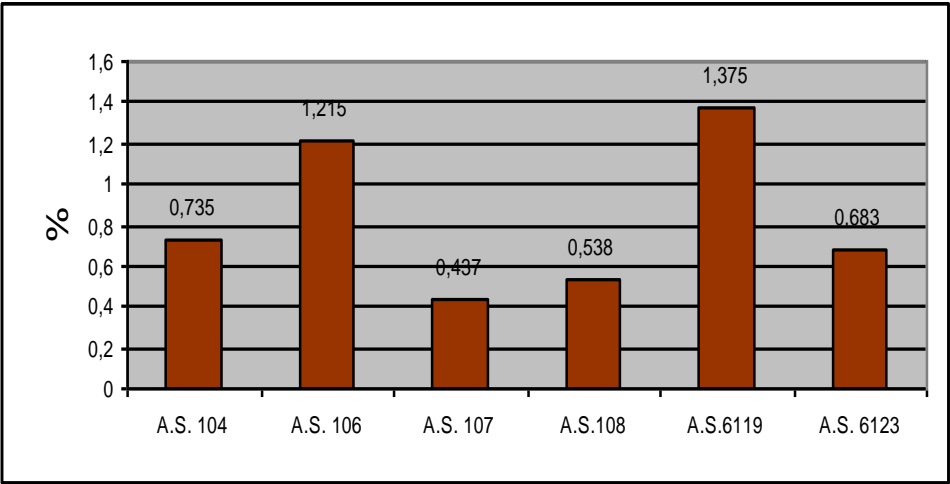
Regarding the quality were made determination over the aspect of the total quantity of carbohydrates. The experimental data are presented in the figures 4– 6.



**Fig. 4 -** The carbohydrate concentration at the lettuce fertilized with Elrom

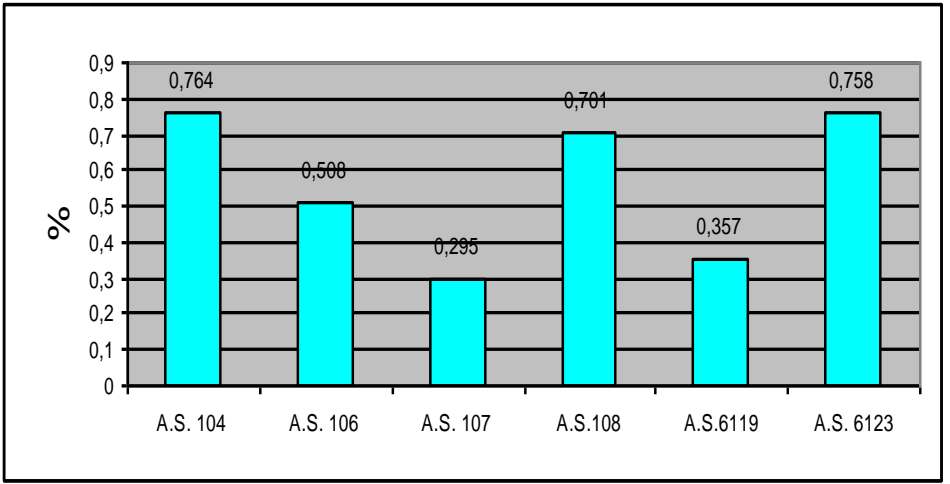
The highest value regarding the quantity of carbohydrates obtained at the lettuce plants fertilize with Elrom product was recorded at the lettuce line AS 104 with a 1,119% value.





**Fig. 5 -** The carbohydrate concentration at the lettuce fertilized with Bionex

In the case of fertilization with Bionex product, the highest values of carbohydrates was recorded at the lettuce lines AS 6119 and AS 106 and the obtained values was 1,375% and 1,215%.



**Fig. 6 -** The carbohydrate concentration at the lettuce fertilized with Bioplasma

Also in the case of fertilization with Bioplasma product, the highest values of carbohydrates were recorded at the lettuce lines AS 104, AS 6123 and AS 108, these oscillating between 0,7645 and 0,701%.

## CONCLUSIONS

1. Using the natural fertilizations substances, considerably reduce the quantity of nitrate level in plants, compared with the conventional systems;

2. The nitrate quantity not exceeded the maximum level accepted by the Romanian legislation which for lettuce cultivated in greenhouses, is 2000 mg/kg. Also the nitrate level don't exceed the maximum level accepted by the European legislation, which admit for lettuce a maximum level of 2500 mg/kg;

3. Using the Bionex product, was recorded the lowest values regarding the nitrate concentration at the six lettuce lines taken in the experience;

4. The lettuce lines AS 6119 and AS 106 recorded the highest values regarding the quantity of carbohydrates, according the fertilization with Bionex product;

5. Using natural fertilizers, represent an important alternative on obtaining lettuce plants with a high alimentary value.

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# COMPARATIV STUDY ON THE HEAVY METALS POLLUTION IN CONVENTIONAL AND ECOLOGICAL VEGETABLE CROPS

## STUDIU COMPARATIV PRIVIND POLUAREA CU UNELE METALE GRELE LA CULTURILE LEGUMICOLE CONVENȚIONALE ȘI ECOLOGICE

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**Abstract.** *The degree of heavy metal pollution has been analyzed in comparison to two types of vegetable crops: conventional and organic. The results show that both types of cultures, the degree of pollution with heavy metals does not exceed the maximum limits. Heavy metal content of organic crops ranged from undetectable to 3.02 µg/kg, and conventional crops, it ranged from faint to 9.34 µg/kg.*

**Key words:** pollution, vegetable crops, heavy metals.

**Rezumat.** *Gradul de poluare cu metale grele a fost analizat comparativ la două tipuri de culturi legumicole: convenționale și ecologice. Rezultatele obținute evidențiază faptul că la ambele tipuri de culturi, gradul de poluare cu metale grele nu depășește limitele maxime admise. Conținutul de metale grele la culturile ecologice a variat de la un nivel nedetectabil la 3,02µg/kg, iar în culturile convenționale, acesta a variat de la slab detectabil la 9,34µg/kg.*

**Cuvinte cheie:** poluare, culturi legumicole, metale grele

## INTRODUCTION

Heavy metal pollution is an issue of great interest to the global population and specifically for those responsible for it. Heavy metal pollution are a major risk factor for agriculture in general, and vegetable growing, in particular.

In the process of food preparation, heavy metals do not decompose, contrary to their concentration per unit mass can increase significantly. Metals, bioaccumulate through the body, stops or blocks the intracellular biochemical processes, or determine mutagenic and carcinogenic processes (Munteanu et al., 2010).

The main purpose of this study is to outline and determine to what extent are polluted with some heavy metals (Cd, Zn, Hg), in two types of vegetable crops, organic and conventional system.

## MATERIAL AND METHOD

Research has been organized in two vegetable farms in Târgu Frumos, which applies to conventional agriculture and the farm "V, Adamachi" from University of

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Agricultural Sciences and Veterinary Medicine Iași (UASVM Iași), ecological certificated in 2008-2009.

Vegetable crops have been established as recommended by literature (Stoian, 2005, Stan and Munteanu, 2001, Stan et al. 2003).

Assessment of heavy metal pollution of vegetable products, was achieved in samples from different organs of vegetables plants.

The organic farm „Adamachi V.” (UASVM Iasi), samples were collected from five species of vegetable: tomatoes (in polytunnels and field crops), cucumbers, eggplants, cabbage and onions. From the Tg. Frumos farms (Maxim and Vavilov), sampling was taken at the following crops: tomatoes, cucumbers, chillies, peppers, cauliflower and celery.

Analyses were performed in the Geochemistry Laboratory of the „Alexandru Ioan Cuza” University, by atomic absorption spectrometry method using a spectrophotometer model Shimadzu 6300 (Bulgariu, 2007).

## RESULTS AND DISCUSSIONS

The results obtained from vegetable crops on heavy metals content of the samples (plant) are shown in tables 1-7. They allow us to see that the values that express the heavy metal content is within the maximum limits (MRL) under the laws in force on the heavy metal content of food.

### a. Results from family farms in Tg. Frumos

Measurements on heavy metal content of vegetable products harvested from Tg. Frumos, from the two family farms AF Maxim Ioan (FM) and AF Vavilov Mihai (FV), are shown in tables 1-6.

Table 1

**Cadmium content in plant collected from conventional farm  
AF Maxim (2008-2009)**

Sample code	Place harvesting	Vegetable samples	Quantity of Cd		Differences from average
			µg/kg	%	
V11	field / polytunnel	tomatoes / Veneția	1.59	101	0.02
V12		tomatoes / Izmir	1.98	126	0.41
V13		tomatoes / Balett	1.68	107	0.11
V14		cucumber / Merengue	1.10	70	-0.46
V15		chili peppers /	2.11	134	0.54
V16		cucumber /Mandi	2.54	162	0.98
V17		cauliflower / leaves	0.11	7	-1.46
V18		celery	1.48	94	-0.09
$\bar{X}$	<b>Average per farm</b>		<b>1.57</b>	100	-

Following tests carried out showed that the content varied from one plant to another product from a family to another. Cadmium content varied from 0.11 µg/kg FM (cauliflower / leaves) to 2.54 µg/kg (cucumber Mandi) (table 1).

As shown in table 2, FM zinc content ranged from 0.17 µg/kg (tomatoes) to 1.88 µg / kg (celery / leaves).

Table 2

**Zinc content in plant samples collected from conventional farm AF Maxim  
(2008-2009)**

sample code	Place harvesting	Vegetable samples	Quantity of Zn		Differences from average
			µg/kg	%	
V11	field / polytunnel	tomatoes / Veneția	0.22	45	-0.27
V12		tomatoes / Izmir	0.18	37	-0.31
V13		tomatoes / Balett	0.17	35	-0.32
V14		cucumber / Merengue	0.22	45	-0.27
V15		chili peppers /	0.23	47	-0.26
V16		cucumber /Mandi	0.21	43	-0.28
V17		cauliflower / leaves	0.86	175	0.37
V18		celery	1.88	384	1.39
$\bar{X}$	<b>Average per farm</b>		<b>0.49</b>	100	-

Mercury content of plant in the FM (table 3) ranged from 0.46µg/kg (tomatoes Balett) to 2.17µg/kg (celery).

Table 3

**The content of Hg in plant samples collected from conventional farm Maxim  
(2008-2009)**

Sample code	Place harvesting	Vegetable samples	Quantity of Hg		Differences from average
			µg/kg	%	
V11	field / polytunnel	tomatoes / Veneția	1.28	125	0.26
V12		tomatoes / Izmir	0.64	63	-0.38
V13		tomatoes / Balett	0.46	45	-0.56
V14		cucumber / Merengue	0.59	58	-0.43
V15		chili peppers /	1,00	98	-0.02
V16		cucumber /Mandi	0.73	72	-0.29
V17		cauliflower / leaves	1.35	132	0.33
V18		celery	2.17	213	1.15
$\bar{X}$	<b>Average per farm</b>		<b>1.02</b>	100	-

Measurements on cadmium in FV (table 4) shows that this metal ranged from undetermined quantity (peppers/Vedrana) in 9.34 µg/kg (sweet/Romantic).

Table 4

**Cadmiu content in plant samples collected from conventional farm Vavilov  
(2008-2009)**

Sample code	Place harvesting	Vegetable samples	Quantity of Cd		Differences from average
			µg/kg	%	
V19	field / polytunnels	pepper Romatica/ fruit	0.16	12	-1.19
V20		pepper Romatica/ leaves	9.34	692	7.99
V21		pepper Whitney/ fruit	0.08	6	-1.27
V22		pepper Whitney/ leaves	0.84	62	-0.51
V23		pepper Vedrana/ fruit	nd	nd	nd
V24		pepper Vedrana/ leaves	0.35	26	-1.00
V25		pepper Fidelio/ fruit	0.10	7	-1.25
V26		pepper Fidelio/ leaves	3.09	229	1.74
V27		cucumber / Amurg/fruit	1.19	88	-0.16
V28		cucumber / Amurg/leaves	0.27	20	-1.08
V29		tomatoes Ballet/fruit	0.79	59	-0.56
V30		tomatoes Ballet/leaves	sld	sld	sld
$\bar{x}$	<b>Average per farm</b>		<b>1.35</b>	<b>100</b>	<b>-</b>

FV zinc content ranged from 0.17 µg/kg (tomato) to 1.82 µg/kg (pepper/Vedrana) (table 5).

Table 5

**Zinc content in plant samples collected from conventional farm Vavilov  
(2008-2009)**

Sample code	Place harvesting	Vegetable samples	Quantity of Zn		Differences from average
			µg/kg	%	
V19	field / polytunnels	pepper Romatica/fruct	0.32	42	-0.45
V20		pepper Romatica/ leaves	1.32	171	0.55
V21		pepper Whitney/fruct	0.38	49	0.39
V22		pepper Whitney/ leaves	1.69	219	0.92
V23		pepper Vedrana/fruct	0.36	47	-0.41
V24		pepper Vedrana/ leaves	1.82	236	1.05
V25		pepper Fidelio/fruct	0.25	32	-0.52
V26		pepper Fidelio/ leaves	1.68	218	0.91
V27		cucumber / Amurg/fruit	0.22	29	-0.55
V28		cucumber/Amurg/leaves	0.54	70	-0.23
V29		tomatoes Ballet/fruit	0.17	22	-0.60
V30		tomatoes Ballet/leaves	0.51	66	-0.26
$\bar{x}$	<b>Average per farm</b>		<b>0.77</b>	<b>100</b>	<b>-</b>

Mercury was detected in vegetal FV limits of 0.61 µg/kg (pepper - Fidelio) at 2.65 µg/kg (tomatoes Ballet) is presented in table 6.

Table 6

**The content of Mercury in plant samples collected from conventional farm Vavilov (2008-2009)**

Sample code	Place harvesting	Vegetable samples	Quantity of Hg		Differences from average
			µg/kg	%	
V19	field / polytunnels	pepper Romatica/ fruit	0.79	57	-0.59
V20		pepper Romatica/ leaves	2.17	157	0.79
V21		pepper Whitney/ fruit	0.78	57	-0.60
V22		pepper Whitney/ leaves	1.56	113	0.18
V23		pepper Vedrana/ fruit	0.98	71	-0.40
V24		pepper Vedrana/ leaves	2.17	157	0.79
V25		pepper Fidelio/ fruit	0.61	44	-0.77
V26		pepper Fidelio/ leaves	1.93	140	0.55
V27		cucumber / Amurg/fruit	0.78	57	-0.60
V28		cucumber/Amurg/leaves	1.48	107	0.10
V29		tomatoes Ballet/fruit	0.82	59	-0.56
V30		tomatoes Ballet/leaves	2.65	185	1.18
$\bar{x}$	Average per farm		1.38	100	-

#### b. Results from organic vegetable farm Adamachi V.

Concentrations of three heavy metals (cadmium, zinc, mercury) in plant samples collected from organic farm “Adamachi V.” is presented in table 7. In the analysis performed cadmium concentration ranged from undetectable (cabbage) to 3.02 mg / kg. Zinc content ranged from 0.26 µg/kg tomatoes to 0.58 µg/kg cabbage. Mercury content was undetectable in all samples analyzed.

Table 7

**The content of heavy metals in plant samples collected from organic Adamachi farm, Iaşi (2008-2009)**

sample code	Vegetable samples	Quantity					Differences from average	
		Cd		Zn		Hg		
		µg/kg	%	µg/kg	%	µg/kg	Cd	Zn
V46	tomatoes	1.67	158	0.35	80	nd	0.61	-0.09
V47	cucumber	3.02	285	0.53	120	nd	1.96	0.09
V48	eggplant	0.44	42	0.49	111	nd	-0.62	0.05
V49	cabbage	nd	nd	0.58	132	nd	nd	0.14
V50	tomatoes	0.76	72	0.26	59	nd	-0.3	-0.18
V51	onion	0.47	44	0.46	105	nd	-0.59	0.02
$\bar{x}$	Average per farm	1.06	100	0.44	100	nd		

The content of cadmium, zinc, and mercury were within the maximum limits allowed by the legislation in force and the European regulations.

## CONCLUSIONS

1. Research has shown that there is great variation in heavy metal content in vegetable products analyzed from the two operating systems.

2. The cadmium content in farm Tg. Frumos, ranged from faint to 9.34 mg/kg zinc content ranged from 0.17 mg/kg to 1.88 mg/kg and the mercury ranged from 0.43 mg/kg to 2.65 mg/kg intensification conditions and high yields these quantities do not represent a potential risk for vegetable crops.

3. The content of heavy metals in organic farm Adamachi of Veterinary Medicine in Iasi were within narrow limits, ranging from undetectable to 3.02 mg/kg, falling within acceptable limits for organic vegetable production.

4. In general we can say that most samples of the vegetable crop in the two systems, is not heavy metal pollution or not a pollution that would have a negative impact on consumer health.

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# RESULTS ON THE EFFECTIVE TROPHICITY OF A VEGETABLE USED SOIL BY THE ECOPEDOLOGICAL MATRIX

## REZULTATE PRIVIND TROFICITATEA EFECTIVĂ A UNUI SOL LEGUMICOL CU AJUTORUL MATRICEI ECOPEDOLOGICE

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**Abstract.** The paper presents the experimental results regarding the ecopedological matrix, the effective trophicity of soil resources of the Experimental Station of plant the Faculty of Horticulture Iasi, in order to estimate the requirements cultivation in organic. System research was carried out by specific working methods, using soil samples taken from the plastic tunnels and open field crops of peppers, aubergines, tomatoes and cucumbers. Development of the diagnosis ecopedological matrix has been made on the following indicators: texture, the consistency of wet soil, soil reaction (pH), base saturation (V), humus, nitrogen (Nt), phosphorus ( $P_{AL}$ ), potassium ( $K_{AL}$ ), air porosity (PA), synthetic biological indicator (ISB), genetic type of soil. Diagnosis obtained revealed the high potential trophicity of soil for organic vegetable growing: 82-84 rating point for tunnel soil and 64-68 points of field soils.

**Key words:** diagnosis, soil, ecology, vegetables

**Rezumat.** Lucrarea prezintă rezultatele experimentale privind matricea diagnozei ecopedologice a troficității efective a resurselor de sol din Stațiunea Didactică Experimentală a Facultății de Horticultură din Iași, cu scopul de a estima cerințele de valorificare a terenului în sistem ecologic. Cercetările s-au realizat, prin metode specifice de lucru, folosindu-se probe de sol prelevate din solar și din câmp deschis, de la culturile de ardei, pătlăgele vinete, tomate și castraveți. Realizarea matricei diagnozei ecopedologice a avut loc pe baza următorilor indicatori pedologici: textura, consistența solului umed, reacția (pH), gradul de saturație în baze (V), humus, azot (Nt), fosfor ( $P_{AL}$ ), potasiu ( $K_{AL}$ ), porozitatea de aerare (PA), indicele sintetic biologic (ISB), tipul genetic de sol. Diagnoza realizată a scos în evidență înalta troficitate potențială a solului pentru cultura legumelor ecologice: 82 – 84 puncte de evaluare pentru solurile din solar și 64 – 68 puncte de evaluare pentru solurile din câmp.

**Cuvinte cheie:** diagnoză, sol, ecologie, legume

## INTRODUCTION

Soil, satisfying quality of living organism and a major habitat for plants and animals, is a dynamic system, open which exchanges reversible of matter, energy

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and information with the environment (Gianfreda, 2005). So, the soil is for most plants agricultural/vegetables as their material support and the most important source of food (Munteanu et al., 2010).

Ecological interpretation of a soil, is defined by two basic characteristics of the soil: the trophic potential and the specific organic food and local area (Bireescu et al., 2002). Effective trophicity soil is the resultant effective action and interrelationships physics-mechanical, chemical and biological considered at the same time, indicators of soil fertility and quality (Chirita, 1974; Bireescu et al., 1999).

The aim of the present research is to determine the soil through sheet trophicity ecopedological matrix of vegetable land USAMV Iassy, the ecological cultivated system. To achieve the proposed goal was set two objectives: determination and analysis of indicators of soil trophicity ecopedological diagnosis and development of effective trophic soil resources (DTEPESR).

## MATERIAL AND METHOD

The research was organized based on soil samples collected from organic vegetable farm field „V. Adamachi” the University of Agricultural Sciences and Veterinary Medicine Iasi (USAMV Iasi). Sampling of soil were made from vegetable crops in the solarium and open, the depth of 0-20 cm. The soil samples were analyzed for the most important factors and pedo-ecological determinants: texture, the consistency of wet soil, soil reaction (pH), base saturation (V), humus, nitrogen (Nt), phosphorus (PAL), potassium (KAL), aeration porosity (AP), synthetic biological indicator (ISB), genetic type of soil. After, analysis of these indicators has been established trophicity ecopedological actual diagnosis of soil resources (DEPTERS-points) by adding grades.

$$\text{DEPTERS} = \sum_{1}^{10} (T_x + \text{PA} + \text{Con} + \text{Biol} + \text{pH} + \text{Hum} + \text{V} + \text{Nt} + \text{P} + \text{K})$$

For comparison of results, reliability was established a quality scale with five steps, then give a basis for the ratings: very good, good, medium, satisfactory and low.

- below 20 points = effective trophicity low soil oligotrophic; rating: low (low soil)
- 21-40 points = effective trophicity less than mediocre, oligo-mesotrophic soil, mark: satisfactory;
- 41-60 points = poor effective trophicity, mesotrophic soil; rating:
- medium - 61-80 points = effective trophicity upper eutrophic soil; rating: good
- 81-100 points = effective trophicity very good soil megatrophic, mark: very good.

The courts that have taken soil samples were cultivated in fields and greenhouses of species: peppers, eggplants, tomatoes and cucumbers.

## RESULTS AND DISCUSSIONS

The results of analysis and evaluation matrix effects through trophic ecopedological diagnosis, ecosystem resources of vegetable organic soil are presented in table 1.

Table 1

**Ecopedological diagnosis of actual trophic matrix of soil resources**

Indicators	Notes	Teaching Experimental Station UASVM						
		polytunnels				open field		
		pepper	aubergines	tomatoes	cucumbers	pepper	aubergines	tomatoes
Texture	value	34,6	33,9	35,1	34,3	39,3	38,1	37,5
	class	IV	IV	IV	IV	IV	IV	IV
	note	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>	<b>6</b>
The consistency of wet soil	value	friable	friable	friable	friable	hard	hard	hard
	class	V	V	V	V	IV	IV	IV
	note	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>6</b>	<b>6</b>	<b>6</b>
Soil pH reaction	value	6,4	6,6	6,8	6,9	7,2	6,7	7,3
	class	IV	V	V	VI	VI	V	V
	note	<b>6</b>	<b>8</b>	<b>8</b>	<b>10</b>	<b>10</b>	<b>8</b>	<b>8</b>
Soil reaction pH	value	91	91	92	90	85	87	86
	class	VI	VI	VI	V	V	V	V
	note	<b>10</b>	<b>10</b>	<b>10</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>
Humus%	value	3,74	3,65	3,71	3,62	3,15	3,26	3,21
	class	V	V	V	V	IV	IV	IV
	note	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>6</b>	<b>6</b>	<b>6</b>
Total nitrogen Nt %	value	0,24	0,29	0,23	0,25	0,17	0,18	0,18
	class	VI	VI	VI	VI	V	V	V
	note	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>8</b>	<b>8</b>	<b>8</b>
Mobile phosphorus ppm	value	72	53	71	48	30	33	27
	class	VI	V	VI	V	IV	IV	IV
	note	<b>10</b>	<b>8</b>	<b>10</b>	<b>8</b>	<b>6</b>	<b>6</b>	<b>6</b>
Assimilable potassium ppm	value	193	241	203	232	158	143	165
	class	V	VI	V	VI	V	IV	IV
	note	<b>8</b>	<b>10</b>	<b>8</b>	<b>10</b>	<b>8</b>	<b>6</b>	<b>6</b>
Aeration porosity PA %	value	21	22	18	19	14	15	15
	class	V	V	IV	IV	III	III	III
	note	<b>8</b>	<b>8</b>	<b>6</b>	<b>6</b>	<b>4</b>	<b>4</b>	<b>4</b>
Indicator Synthetic Biology (ISB%)	value	37	37	36	34	27	28	29
	class	V	V	V	V	IV	IV	IV
	note	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>6</b>	<b>6</b>	<b>6</b>
Genetic type of soil		HorticAntrosol				Chernozem cambic		
DTEPESR *	points	<b>82</b>	<b>84</b>	<b>82</b>	<b>82</b>	<b>68</b>	<b>64</b>	<b>64</b>
	appreciation	very good	very good	very good	very good	good	good	good

\* DTEPESR - Diagnosis of trophic ecopedological effective soil resources

In the analysis of soil samples have been differences in the granting of the polytunnel crop marks, from those in the open.

Regarding to soil texture, the soils samples of polytunnel, as well as those in

the open, both Horticantrisol and for chernozem drafts, notes were given six corresponding (value class IV).

Eight notes (value class V) were awarded for moist soil polytunnel composition, cultivation of peppers, aubergines, tomatoes and cucumbers. In the open field, the culture of peppers, aubergines and tomatoes were given six marks (value class IV).

Regarding to soil reaction (pH), polytunnel samples for crops of peppers, has been given notice six (value class V), the crops of aubergines and tomato were obtained eight notes (value class V), and the cucumbers are notes ten (value class VI). For samples that were collected in open field pepper crops are given ten votes (value class VI), and crops of aubergines and tomato are recorded for eight notes (value class V).

Grades ten (value class VI) for bases saturation (V) of soil from polytunnel, are given crops of peppers, aubergines and tomatoes. Also in polytunnel are registered marks of eight (value class V), for growing cucumbers. The notes were given in open field crops of peppers, aubergines and tomatoes, had eight (value class V).

Humus content of the polytunnel, vegetable crops grown at all correspond to the eight notes (value class V), and open fields for crops are six notes (value class IV) for crops of polytunnel pepper, aubergine and tomatoe.

Amount of total nitrogen content (Nt), recorded in the analyzed samples are given in notes of ten polytunnel (value class VI) for vegetable crop of peppers, aubergines, tomatoes and cucumbers, and open field notes are given eight (value class V), for the crops of in peppers, aubergines and tomatoes.

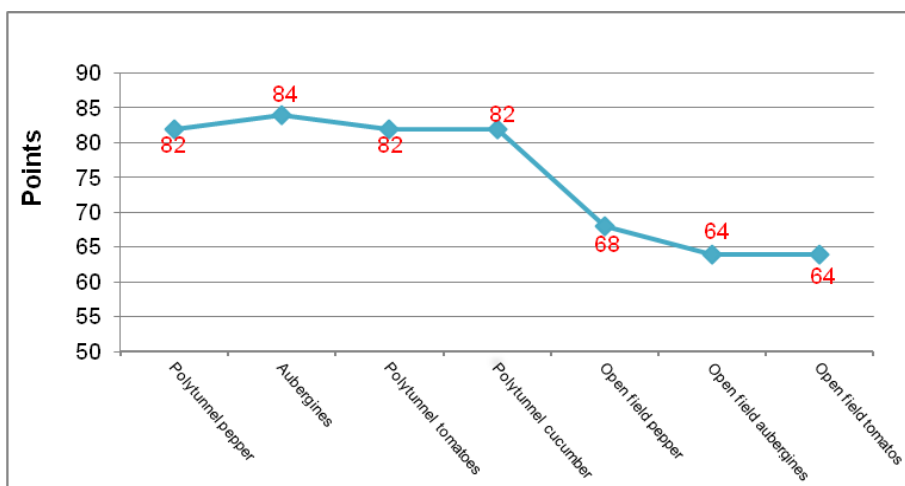
Regarding to mobile phosphorus content ( $P_{AL}$ ) for the crops of pepper are ten (value class VI) for crops of aubergines are granted eight notes (value class V), the tomato crop marks are awarded ten (value class VI) and cucumber notes recorded eight (value class V).

Potassium content ( $K_{AL}$ ) in soil samples collected from polytunnel, for crops of pepper, is held by eight votes (value class V) for crops of aubergine ten (value class VI), for growing tomatoe eight notes (value class V) and crops of cucumber are granted ten (value class VI). Potassium content form samples collected, from pepper crop notes are rated at eight (value class V), and the crop of aubergines and tomato with six grades (grade IV value).

Eight notes (value class IV) are recorded in the polytunnel values of aeration porosity (AP) soil are registered marks of six (value class IV). In the open field to all crops are given four notes (value class III).

Synthetic biological indicator (ISB) from polytunnel crop notes are eight (value class V), while in the open field peppers, aubergines and tomatoes are notes of six (value class IV).

Aggregate amount of notes for the 10 quality indicators for diagnosis ecopedological score indicates the actual trophic soil resources based on qualitative assessment which is very good, average, satisfactory and poor.



**Fig. 1** -Diagnosis of trophic ecopedological effective soil resources

For the cases discussed above situation is shown in figure 1 as follows:

- 84 points value for soil in polytunnel aubergines – very good effective trophicity;
- 82 points value for soil polytunnel cucumbers, peppers and tomato-very good effective trophicity;
- 68 points value for the soil in open field aubergines – good effective trophicity;
- 64 points value for the open ground in crops of peppers and tomatoes – better effective trophicity;
- 68 points value for the open ground in crops of aubergines – good effective trophicity.

## CONCLUSIONS

1. Ecopedological effective diagnosis of trophic soil resources, crop shows that scoring of polytunnel are large (84 points) than those found in open field crops (64 points);
2. Higher levels of the trophic ecopedological actual diagnosis of soil resources indicates a much closer trophicity what natural resources can provide the ground potential;
3. Analysis of soil organic diagnosis, where their characters as intreraction summation of the correlation and ecological factors (climate and soil) of soil food web shows that the fund is high.

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# COMPARATIVE BEHAVIOUR FOR A NEW SWEET PEPPER ASSORTMENT FOR POLYTUNNEL, IN TÂRGU FRUMOS AREA

## STUDIUL COMPARATIV AL UNUI NOU SORTIMENT DE ARDEI GRAS PENTRU SOLAR, ÎN CONDIȚIILE ZONEI TÂRGU FRUMOS

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**Abstract.** *In this paper is presented behaviour of five new sweet pepper cultivars for polytunnels, under production, from a family microfarm in Tg. Frumos area, Iasi county. In the period 2009 - 2010, were conducted observations and biometric measurements for the main agroproductive features ,early and total yield, harvest on dynamics etc. The best results were obtained for early production of cultivars Vedrana F1 (50.4 t / ha), Romatca F1 (44.6t / ha) and Bianca F1 (34.3 t / ha). For total production hybrids was remarked: Vedrana F1 (113.2 t / ha), Romatca F1 (99.4 t / ha) and Belladona F1 (84.2 t / ha).*

**Key words:** assortment, sweet peppers, comparative crop

**Rezumat.** *În lucrarea de față este prezentată comportarea a cinci cultivare noi de ardei gras pentru solarii, în condiții de producție la o microfermă familială din zona Tg. Frumos, județul Iași. În perioada 2009 – 2010, s-au efectuat observații și determinări biometrice pentru principalele însușiri agroproductive: producția timpurie și totală de fructe, dinamica recoltei etc. Cele mai bune rezultate pentru producția timpurie au fost obținute de cultivarele Vedrana F1 (50,4 t/ha), Romatca F1 (44,6 t/ha) și martorul Bianca F1 (34,3 t/ha). Pentru producția totală s-au remarcat hibridii Vedrana F1 (113,2 t/ha), Romatca F1 (99,4 t/ha) și Belladona F1 (84,2 t/ha).*

**Cuvinte cheie:** sortiment, ardei, cultură comparativă

## INTRODUCTION

While promoting organic (biological) vegetable growing, the cultivar is the most important factor of production, which is directly related to the environmental plasticity and consumer preference (Stoleru et al., 2010). Mean while, the cultivar is also an element of biodiversity crops expression, under a permanent change in the assortment of cultivars (Dumitrescu, 1998). The paper present a relatively new variety assortment of sweet peppers for protected crop, consisting of five high production hybrid cultivars.

## MATERIAL AND METHOD

The research was carried out during 2009-2010, at a family association (AF) Vavilov Mihai from Tg. Frumos Iasi county. It was studied a range of five hybrids of

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sweet pepper: Romatca, Fidelio / Belladona, Vedrana, Withney and Bianca as control. The experiment was placed in an individual polytunnels of 600 square meters. The soil preparation and growing space were in accordance with conventional crops appropriate technologies (Munteanu, 2003).

Planting was done during the period 10 April to 15 Aprilie each year, using seedlings produced in pots with a diameter of 10 cm, with 55 days of age. Establishment of crop was based on a scheme of 20 rows in the strip, the plants being conducted with a single stem. Crop density was 27,000 plants / ha, according to the specific technology (Stoican and Lacatus, 1998). Experimental observations and measurements were made to ensure the implementation of biometric general characterization of the range. It were also analyzed early production (assessed on 30 July) and the total production at the end of the growing season. Production data were processed by specific methods (Saulescu and Saulescu, 1967).

## RESULTS AND DISCUSSIONS

A brief characterization of agrobiological sets is shown in table 1. Precocity in the range studied can be said that the Belladona F1 and Romatca are very early F1 and the other three (Bianca F1, Withney and Vedrana F1) are early. In connection with the form of fruit, four fruits are block type and another one is conical (Withney F1).

Color of fruit at consumption maturity is yellow or green with shades open, whose average weight varies from 140 g (Withney F1) to 200 g (Belladona F1 and Vedrana F1). Early production of peppers produced in the conventional system varied from 32.4 t / ha (Withney F1) to 50.4 t / ha (Vedrana F1). Bianca F1 (control) obtained an early production estimated at 34.3 t / ha (table 2.).

Very significant positive differences than the control were obtained by Vedrana F1 (16.1 t / ha). Distinct significant positive differences than the control was obtained by Romatca F1 (10.3 t / ha).

*Table 2*

**Early yield of peppers and significance of differences to control**

Crt. no.	Variant	Early yield t/ha	% to control	Differences to control	Significance
1	Romatca	44,6	130,0	10,3	**
2	Fidelio/ Belladona	32,6	95,1	-1,7	
3	Vedrana	50,4	146,9	16,1	***
4	Withney	32,4	94,5	-1,9	
5	Bianca-Ct	34,3	100	-	

LSD 5% = 2,76;

LSD 1% = 5,64;

LSD 0,1% = 10,87.

The results of total production of pepper in the experience are shown in table 3. Ranged in very broad limits, given the cultural and ecological plasticity of the hybrid. The total production of pepper in 2009 ranged from 82.6 t / ha (Withney F1) to 113.2 t / ha (Vedrana F1), while Bianca control obtained an average yield) of 83.4 t / ha.



Table 1

**Characterization assortment of peppers in comparative crop**

Cultivar	Preco-city	Plant		Fruit characteristics			
		type of growth *	type of growth *	height (cm)	diameter (cm)	color	weight (g / pcs)
0	1	2	3	4	5	6	7
Romatca	very early	120-160	ID	9-10	8-9	light yellow	160-170
Fidelio/Belladona	very early	120-170	ID	9-10	8-9	light yellow	160-200
Vedrana	early	160-170	ID	10-11	8-9	greenish yellow	160-200
Withney	early	110-145	ID	10-11	5-6	light yellow	140-150
Bianca-Ct	early	120-140	ID	8-9	7-8	light yellow	140-170

Referring to the total production, very significant positive differences produced by Vedrana F1 hybrid (29.8 t / ha) and Romatca F1 hybrid (16.0 t / ha), by comparison with the control - Bianca.

Table 3

**Total yield of peppers and significance of differences to control**

Crt. no.	Variant	Total yield t/ha	% to control	Differences to control	Significance
1	Romatca	99,4	119,2	16,0	***
2	Fidelio/Belladona	84,2	100,9	0,8	
3	Vedrana	113,2	135,7	29,8	***
4	Withney	82,6	99,1	-0,8	
5	Bianca-Ct	83,4	100	-	

LSD 5% = 4,92;

LSD 1% = 8,21;

LSD 0,1% = 12,37.

Analyzing the dynamics of the calendar month and aggregate peppers at the end of each month, it is noted that in June, the largest early productions were gotten by Vedrana F1 hybrids (31.4 t / ha), Romatca F1 (29.8 t / ha) and Bianca F1 (23.0 t / ha) (table 4). The same three cultivars achieved high yields in early July; Belladona F1 varied in the variation limits of the control. In June and July, Withney F1 achieved the lowest production of peppers.

Table 4

**Dynamics of peppers yield on months**

Crt. no.	Variant	Calendar months						Total yield t/ha
		May	June	July	August	September	October	
1	Romatca	1,6	29,8	18,2	24,8	19,8	5,2	99,4
2	Fidelio/Belladona	0,8	21,1	16,1	22,6	18,6	5	84,2
3	Vedrana	4	31,4	21,2	28,4	22,8	5,4	113,2
4	Withney	0,9	22,6	14,3	22,6	17,2	5	82,6
5	Bianca-Ct	2,1	23	14,4	21,7	17,2	5	83,4

Table 5

**Dynamics of peppers cumulative yield on months**

Crt. no.	Variant	Calendar months					
		May	June	July	August	September	October
1	Romatca	1,6	31,4	49,6	74,4	94,2	<b>99,4</b>
2	Fidelio/ Belladona	0,8	21,9	38	60,6	79,2	<b>84,2</b>
3	Vedrana	4	35,4	56,6	85	107,8	<b>113,2</b>
4	Withney	0,9	23,5	37,8	60,4	77,6	<b>82,6</b>
5	Bianca-Ct	2,1	25,1	39,5	61,2	78,4	<b>83,4</b>

In August and September hybrids performed relatively constant between 17.2 and 22.8 t / ha. Pepper yield Withney F1 and Romatca F1 achieved relatively constant throughout the growing season from it data presented in table 5. Regarding on cumulative production on the month, can say that the percentage of commercial production ranged from 45.07% (Belladona F1) 50% for Vedrana F1 hybrid.

**CONCLUSIONS**

1. Early peppers production in the range varies between 32.4 t / ha (Withney F1) to 50.4 (Vedrana F1).

2. Higher total yields, compared with control Bianca F1 (89.25 t/ha), have achieved very significant Vedrana F1 hybrids (113.2 t/ha) and Romatca F1 (99.4 t/ha).

3. Maximum amount of yield made in June and July (Romatca F1, Vedrana F1 and Bianca F1), August and September (Belladona F1). VedranaF1 and Romatca F1 cultivars during the growing season achieved constant production in all calendar months.

4. The largest fruits (average 200 g) were obtained from F1 and Vedrana Belladona F1.

5. The average fruit weight, shape, appearance, internal structure and other characteristics varied within normal limits, giving a high value range studied.

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# THE STUDY OF ORGANOCHLORINE PESTICIDE RESIDUES IN SOIL AND VEGETABLES IN DIFFERENT GROWING SYSTEMS

## STUDIUL REZIDUURILOR DE PESTICIDE ORGANOCLORURATE DIN SOL SI LEGUME, IN DIFERITE SISTEME DE CULTIVARE

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**Abstract.** *In this paper are presented the research results obtained in 2010, in SIECOLEG Project regarding the assessment of some organochlorine pesticide residues (20 active substances), from 80 samples soils and 25 samples vegetables from different growing systems (ecological, in conversion and conventional). In all samples analysed the organochlorine pesticide residues were included in admissible limits (Regulation (EC) nr. 396/2005).*

**Key words:** residues, organochlorine pesticides, soil, vegetables.

**Rezumat.** *În lucrarea de față sunt prezentate rezultatele cercetării obținute în anul 2010, în cadrul proiectului 52141/2008 – SIECOLEG, cu privire la evaluarea unor reziduuri de pesticide organoclorurate (20 substanțe active), din 80 probe sol și 25 probe de legume, în diferite sisteme de cultivare (ecologic, în conversie și convențional). În toate probele analizate reziduurile de pesticide organoclorurate s-au încadrat în limitele maxime admise (conform Regulamentului (EC) nr. 396/2005).*

**Cuvinte cheie:** reziduri, pesticide organoclorurate, sol, legume.

## INTRODUCTION

Irrational use of pesticides in agriculture, generally speaking and vegetable growing, in particular, is cause of soil pollution and food pollution with pesticides (Davidescu, 1994, Stoleru, 2007). In most cases, the toxic pesticides exerts its action not only on plant pathogens and pests, but also on the animals and people who are affected due to toxic residues ingested with food (Hura, 2005, 2007, Munteanu, 2010).

It is useful to know the content of pollutants in some soils cultivated with vegetables and then in fresh vegetables in these circumstances.

The goal of our research is to assess risk factors for producers and consumers and to pointed on importance of organic vegetable production in the ecological conditions.

## MATERIAL AND METHOD

During 2010, the organochlorine pesticide residues (20 active substances) were analyzed in 105 samples, of which 85 soil samples and 25 samples of fresh vegetable products (tomatoes, peppers, eggplants, cabbage, onion), in three cultivation systems (organic, in conversion, and conventional), using standard methods.

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Samples of soil (table 1) and plants (table 2) was carried out in certain locations, as follows:

- certified organic land: Bacau Vegetable Research Station - SCL and Iasi University of Agriculture - USAMV;
- land in conversion: Andrieseni (Family Association - FA Rotariu C.)
- conventional land: Roman (AgroFlamanzi), Tg. Frumos (Family Association - FA Maxim I. Family Association - FA Vavilov M.), Matca (Family Association - FA V. Marin).

Table 1

**Number of soil samples analyzed and their codification (2010)**

Land status	Location	No. of samples	Samples codification
<b>Ecological</b>	SCL Bacau	12	S32, S33, S34, S35, ..... S43
	USAMV/ spring	3	S5, S6, S7
	USAMV/ autumn	6	S26, ..... S31
<b>In conversion</b>	Andrieseni Iasi	11	S59, ..... S69
<b>Conventional</b>	Sere Roman/ spring	4	S1, S2, S3, S4
	Sere Roman/ autumn	4	S78, S79, S80, S81
	Tg. Frumos/ spring	7	S8, S9, S10, S11, S12, S13, S14
	Tg. Frumos/ autumn	14	S44, S45, S46, S47, S48, S49, S50, S51, S52, S53, S54, S55, S56, S57, S58
	Matca	11	S15, S16, ..... S25

Determination of pesticide residues was carried out according to standards, as follows: SR EN12393-1, 2, 3:2009 - Fat-free food products. Multiresiduu GC methods for determination of pesticide residues and SR EN 15662/2009 - Foods of plant origin. Determination of pesticide residues by GC-MS and / or LC-MS/MS after extraction / partition with acetonitrile and purified by dispersive method SPE-QuEChERS.

Table 2

**Number of plant samples analyzed in different areas (2010)**

Land status	Location	No. of samples	Samples codification
<b>Ecological</b>	SCL Bacau	4	V9, V10, V11, V12
<b>In conversion</b>	Andrieseni Iasi	7	V19, ..... V25
<b>Conventional</b>	Tg. Frumos	6	V13, ..... V18
	Matca	8	V1, V2, ..... V8

After processing the samples by extraction with organic solvents (acetonitrile, petroleum ether), pesticide residues were analyzed by gas chromatography method using a Shimadzu GC, model 2100, equipped with ECD detector and using autosamples for organochlorine pesticides analysis. Interpretation of results on pesticide residues was carried out in accordance with Regulation (EC) no. 396/2005 on maximum residue limits of pesticides in soil and vegetables.

## RESULTS AND DISCUSSIONS

The results of organochlorine pesticide residues (20 active substances) in soil samples are shown in table 3. Organochlorine pesticide residues were not detected in any sample analyzed in farm USAMV (samples S5, S6, S7).

Table 3

**Contents of organochlorine pesticide residues from soil samples  
In phase I (mg/kg)**

Pesticides (active substances)	Samples codification													
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14
alfa -HCH	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
gama-HCH	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
beta _HCH	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
delta _HCH	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptaclor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Aldrin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptaclor epoxid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Gama clordan	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alfa clordan	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
4, 4' DDE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endosulfan I	0.005	0.01	0.01	nd	nd	nd	nd	0.01	0.004	0.015	nd	0.003	0.002	0.004
Dieldrin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endrin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
4,4' DDD	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endosulfan II	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
4, 4' DDT	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endrin aldehida	0.004	0.005	0.01	0.002	nd	nd	nd	nd	0.001	0.003	nd	0.001	0.001	0.002
Metoxiclor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endosulfan sulfat	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.001	0.001	nd	0.001
Endrin cetona	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

nd – nedetectabil

Table 4

**Contents of organochlorine pesticide residues from soil samples  
in phase II (mg/kg)**

Pesticides (active substances)	Samples codification																
	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31
alfa -HCH	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
gama-HCH	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
beta _HCH	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
delta _HCH	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptaclor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Aldrin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Heptaclor epoxid	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Gama clordan	nd	nd	nd	nd	0.001	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Alfa clordan	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
4, 4' DDE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endosulfan I	0.001	0.002	0.01	0.005	0.03	0.01	0.01	0.03	0.002	0.005	0.005	nd	nd	nd	nd	nd	nd
Dieldrin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endrin	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
4,4' DDD	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endosulfan II	nd	nd	nd	nd	0.002	nd	0.001	0	nd	nd	nd	nd	nd	nd	nd	nd	nd
4, 4' DDT	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endrin aldehida	nd	nd	nd	0.002	0.02	0.01	0.01	0.02	nd	0.004	0.002	nd	nd	nd	nd	nd	nd
Metoxiclor	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endosulfan sulfat	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Endrin cetona	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

In the soil samples collected from conventional form from Roman (samples S1, S2, S3) and polytunnels to Tg.Frumos (S8, S9, S10, S11, S12, S13, S14) residues of Endosulfan I and Endrin aldehyde were detected and in samples S11, S12 and S14 residues fo Endosulfan sulfate were detected.

The results on organochlorine pesticide residues (20 active substances) from soil samples collected in August, are presented in table 4.

Organochlorine pesticide was not detected in any sample analyzed at the farm USAMV (samples S26 - S31).

In the soil samples collected from conventional vegetable farms in Tg. Frumos (sample S15 - S25) residues of Endosulfan I, Endosulfan II (samples S19, S21) and Endrin aldehyde (S14, S15, S21, S22, S25 and S4) at low concentrations were detected.

Results of organochlorine pesticide residues in vegetables, harvested in 2010, are presented in tables 5 and 6. The active substances that have not been detected in vegetable products are not listed in tables 5 and 6.

Table 5 presents the results of the content of organochlorine pesticide residues from conventional farms analyzing 20 organochlorine pesticide active substances, the same as in soil samples.

The content of pesticide residues was not detected in all samples analyzed. In samples from the Matca and Tg. Frumos were detected residues of Endosulfan I (V6) and 4.4 DDT (V7), but within acceptable limits (<0.01 mg / kg). In samples from Tg. Frumos (V13) were found pesticide residues in all samples analyzed, but permissible limits, under 0.01 mg / kg.

Table 5

**Contents of organochlorine pesticide residues in fresh vegetable products harvested from conventional farms, 2010 (mg / kg)**

Species / cultivar	Pesticides (active substances)						
	Samples	Heptaclor epoxid	Alfa clordan	Endo-sulfan I	4, 4' DDT	Endrin aldehida	Endrin cetona
Tomatoes/Galina	V1	nd	nd	nd	nd	nd	nd
Tomatoes/Winona	V2	nd	nd	nd	nd	nd	nd
Peppers/California	V3	nd	nd	nd	nd	nd	nd
Peppers/Fidelio	V4	nd	nd	nd	nd	nd	nd
Tomatoes/Magnus	V5	nd	nd	nd	nd	nd	nd
Cucumbers/Merengue	V6	nd	nd	0.001	nd	nd	nd
Tomatoes/Magnus	V7	nd	nd	nd	0.002	nd	nd
Cucumbers/Mirabelle	V8	nd	nd	nd	nd	nd	nd
Tomatoes/Calioppe	V13	nd	nd	nd	nd	nd	nd
Cucumbers/Merengue	V14	nd	nd	0.002	nd	nd	nd
Peppers/Maradona	V15	nd	nd	0.001	nd	nd	nd
Tomatoes/Belladona	V16	0.006	nd	0.001	nd	0.002	nd
Cucumbers/Merengue	V17	nd	nd	0.001	nd	0.001	nd

In table 6 organochlorine pesticide residues in vegetables from organic (V9 - V12) and conversion farms (V19 - V25) are presented. The content of these pesticide residues have been detected in all samples analyzed. Endosulfan I residues were detected (V20 and V22) and Endrin aldehyde (V19, V20, V22, V23), but within acceptable limits (<0,001 mg / kg).

The dates presented in tables 3, 4, 5 and 6 resulting positive correlation that exists between organochlorine pesticide residues in soil and those in fresh vegetables.

Table 6

**Contents of organochlorine pesticide residues in vegetable samples  
collected from organic farms in conversion, in 2010 (mg / kg)**

Species / cultivar	Pesticides (active substances)						
	Samples	Heptaclor epoxid	Alfa clordan	Endo- sulfan I	4, 4' DDT	Endrin aldehida	Endrin cetona
Tomatoes/Siriona	V9	nd	nd	nd	nd	nd	nd
Tomatoes/Rio grande	V10	nd	nd	nd	nd	nd	nd
Peppers/Siret	V11	nd	nd	nd	nd	nd	nd
Eggplant/Epic	V12	nd	nd	nd	nd	nd	nd
Peppers/Belladona	V19	nd	nd	nd	nd	0.001	nd
Tomatoes/Primadona	V20	nd	nd	0.001	nd	0.001	nd
Eggplant/Aragon	V21	nd	nd	nd	nd	nd	nd
Cucumbers/Merengue	V22	nd	nd	0.001	nd	0.001	nd
Onion/Stuttgart	V23	nd	nd	nd	nd	0.001	nd
Green beans/Saxa	V24	nd	nd	nd	nd	nd	nd
Cabbage/Gloria	V25	nd	nd	nd	nd	nd	nd

## CONCLUSIONS

1. Organochlorine pesticide residues: HCH-total, total DDT, Aldrin, Dieldrin, Endosulfan etc., were undetectable or in small amounts, which fall within the maximum allowed (CMA 0.01 mg / kg) in organic vegetable farms or conversion process.

2. In the conventional farms Roman, Tg. Frumos and Matca a number of organochlorine pesticide residues in most soil samples analyzed were found.

3. In most of the analyzed samples of soil and plant products grown on soils that, during 2010, the contents of the main chemical contaminants analyzed by modern techniques were not detected or were in the maximum permitted under EU and national regulation.

4. The dates presented in the paper highlight the positive correlation that exists between organoclorurarte pesticide residues in soil and fresh vegetables.

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# NEW ACHIEVEMENTS REGARDING SWEET PEPPER BREEDING (*CAPSICUM ANNUUM* L.) OBTAINED AT V.R.D.S. BUZĂU

## NOI REALIZĂRI ÎN AMELIORAREA ARDEIULUI GRAS (*CAPSICUM ANNUUM* L.) OBȚINUTE LA S.C.D.L. BUZĂU

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**Abstract.** *In the Plant Breeding Laboratory from Vegetable Research and Development Station (S.C.D.L.) Buzău researches to obtain new valuable genotypes of sweet pepper in order to correspond to the requirements of the farmers started in 1990. Until now, there were obtained and homologated 3 varieties of sweet pepper and other 2 lines (L<sub>3</sub> and L<sub>5</sub>) will be soon homologated.*

**Key words:** sweet pepper, genotype, germplasm collection, breeding

**Rezumat.** *În Laboratorul de Ameliorare din cadrul Stațiunii de Cercetare - Dezvoltare pentru Legumicultură (S.C.D.L.) Buzău au fost efectuate, încă din anul 1990, cercetări privind obținerea de noi genotipuri valoroase la ardeiul gras care să corespundă cerințelor cultivatorilor autohtoni. Până în prezent au fost obținute și omologate trei soiuri la această specie și alte două linii (L<sub>3</sub> și L<sub>5</sub>) sunt în curs de omologare.*

**Cuvinte cheie:** ardei gras, genotipuri, colecție de germoplasmă, ameliorare

### INTRODUCTION

The vegetable areas from Romania offers favorable conditions for the sweet pepper crop in open field, solarium and greenhouse (Ciofu R. 2003).

Despite these opportunities, the surfaces cultivated with this species started to decrease from year to year (M.A.D.R.). The main cause of this decrease is represented by the small number of Romanian creations which registers visible fluctuations in what it concerns productivity and quality from a year to other. Taking advantage of these market niches the foreign firms brought a lot of varieties and new hybrids with expensive prices. All of them were insufficiently tested or even not tested at all in the environmental conditions of our country and did not always get to a desirable result.

The attempt to introduce foreign creations in culture proved the fact that the varieties import is a temporary solution. These new varieties cannot maintain the same parameters like in the origin country.

The different development of the foreign varieties leads to the conclusion that their introduction in culture must be made carefully, taking into consideration

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the ecological plasticity and also the necessity of the breeding works in order to create a proper variety.

In these circumstances, the Vegetable Research – Development Station (V.R.D.S.) Buzău, by the Plant Breeding Laboratory, started 1990 the researches in order to obtain new sweet pepper genotypes. Until now there were obtained and homologated 3 varieties and other 2 lines ( $L_3$  și  $L_5$ ) will soon be homologated.

The researches made until now had as a main purpose the evaluation, the conservation and the capitalization of the germplasm base that exists in our institution.

## **MATERIAL AND METHOD**

The initial breeding material that was collected over 20 years in the germplasm base of our institution was undergone to an intensive selection process. The valuable genotypes were promoted in the evaluation field (Leonte C., 1996).

During the breeding works there were taken into consideration the value of some qualitative and quantitative indexes according to the main purpose of the research (Drăcea, 1972).

During the experience there was used as a control variant the variety called “Superior Yellow” (“Galben Superior”). This variety detains the supremacy in our country for over 5 decades (Luncă Lucia, 1974).

There were used the following experimental variants:

- $V_{1Mt}$  – Superior Yellow variety;
- $V_2$  – sweet pepper line  $L_3$ ;
- $V_3$  sweet pepper line  $L_5$ .

The methods used were the following:

- individual selection repeated in the local populations (Vînătoru C., 2008);
- the selection in advanced homozygote populations (Crăciun T., 1981);
- the verification of the agronomic value of the perspective lines in comparative cultures (Andronicescu D., 1971);
- the supervision in comparative cultures for the attack of pathogens.

## **RESULTS AND DISCUSSIONS**

The researches dignified the following partial and final positive results:

- there was evaluated the germplasm base detained by our institution;
- there was conserved and enriched the germplasm base which detains 24 lines in an advanced homozygote stadium;
- there were made and completed the observation papers;
- there were stock taken and supervised the useful characteristics detained by each line, the amplitude of their transmission in lineage and the genetic stability;
- there were obtained the lines  $L_3$  and  $L_5$  which were studied in comparative cultures for 3 years, demonstrating superiority in what it concerns the phenotypical expression in comparison the control variant and the other studied lines (table 1).

Table 1

**The morpho- physiological characterization of the control variant and the new created lines L<sub>3</sub> and L<sub>5</sub>**

No.	Specification	Experimental variant		
		V <sub>1Mt</sub>	V <sub>2</sub>	V <sub>3</sub>
1	Plants height (cm)	45 - 50	55 - 60	65 - 70
2	Characteristics foliage	Light green rich	Dark green mean	Black green rich
3	Fruits characteristics	Tronconic 3 – 4 lobes	Prismatic 3 facet	Tronconic 3 – 4 lobes
4	Fruits color at the technical maturity	Light yellow	Yellow green	Gold yellow
5	Fruits color at the physiological maturity	Red	Red	Red
6	Fruits length (cm)	9,5	12,2	11,4
7	Fruits mean diameter (cm)	4,8	4,6	6,1
8	Fruits mean weight	71,2±2,3	105±2,6	131±2,8
9	Number of fruits/plant	5 – 6	8 – 9	6 – 7
10	Pericarp thickness (mm)	5,6±0,08	6,8±0,06	7,1±0,05
11	Receptacle weight (g)	12,8	13,6	10,4
12	Seeds weight/fruit (g)	2,2	2,4	2,0
13	Number of seeds/fruit	212	230	195
14	Early yield (t/ha)	25 - 28	30 - 35	20 - 27
Yield quality – nutritive value				
15	Ascorbic acid (mg/100g)	112	116	110
16	Dry substance (%)	6,22	6,18	5,75
17	Sugar (%)	2,06	2,72	2,07

\* Yield until the 30<sup>th</sup> of July

The lines obtained and the control variants are presented in the following paragraphs.

**Superior yellow variety.** It is mean early, 115 – 118 days since the coming up until the first harvest in the V.R.D.S. Buzău conditions (table 2).

Table 2

**Phenophase duration in the VRDS Buzău conditions (days)**

Phonological data	Experimental variant		
	V <sub>1Mt</sub>	V <sub>2</sub>	V <sub>3</sub>
Emergence – flourish	68 – 71	65 – 70	70 – 75
Flourish – harvest	47	40	45
Emergence – harvest	115 – 118	105 – 110	115 – 120

Plants dimensions are approximately 45 – 50 cm, with mean vigor ramifications, great foliage with mean leafs colored light green. The fruit has a tronconic shape, with a smooth surface with 3 – 4 lobes easy apical marked, the pericarp, with a 4 – 6 mm thickness. It has a light yellow color at the consume maturity and red at the physiological maturity. It has a voluminous epidermis with a specific luster. It is recommended for conservation and it has a remarkable commercial aspect.

**Line L<sub>3</sub>.** The plant is vigorous, with an erect port, 55 – 60 cm height; the foliage is dark green colored, mean coverer for the fruit with a prismatic shape (fig. 1).



**Fig. 1** – Culture aspect of the line L<sub>3</sub>

The fruit has a mean weight of 105 g and a thick pericarp 6,8 mm (fig. 2).



**Fig. 2** – Longitudinal section through a physiological mature fruit of L<sub>3</sub>

At the consume maturity the fruit is green yellow, and at the physiological maturity is intense red (fig. 3).



**Fig. 3** – The evolution of the fruits belonging to L<sub>3</sub> at the technological maturity and at the physiological maturity

It ensures a 45 – 50 t yield/hectare, with over 80% fruits STAS qual. I. Until the 30<sup>th</sup> of July it ensures 30 – 35% from the total yield (table 3). L<sub>3</sub> has the best comportment (tolerant) against the *Verticilium dahliae*, but also against the other pathogenic agents. L<sub>3</sub> is remarkable for its great commercial aspect and also for its valuable organoleptic qualities.

**Table 3**

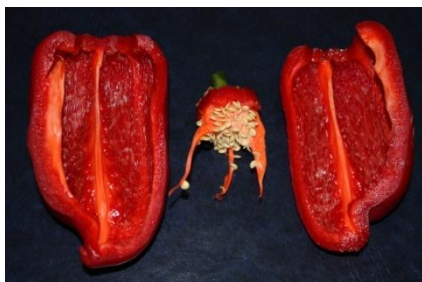
**Mean yield potential (2008 – 2010)**

Experimental variant	Yield		Difference t/ha	Signification	
	t/ha	%		Reported to error	Reported to the V x A interaction
V <sub>2</sub>	48,56	153,7	17	xxx	xxx
V <sub>3</sub>	41,6	132,2	10,23	xxx	xx
V <sub>1Mt</sub>	31,52	100	–	–	–

Pt E DL 5% = 2,76 t/ha  
DL 1% = 3,69 t/ha  
DL 0,1% = 4,82 t/ha

Pt V x A DL 5% = 4,79 t/ha  
DL 1% = 6,49 t/ha  
DL 0,1% = 8,47 t/ha

**Line L<sub>5</sub>** is a high plant, approximately 65 – 70 cm height, with a great foliage, great coverer for the fruit with a tronconic shape. The fruit is voluminous with 3 – 4 edges, easy marked longitudinal. The pericarp has a 7,1mm thickness, gold yellow colored, at the physiological maturity the color becomes dark red (fig. 4).



**a**



**b**

**Fig. 4** – Longitudinal section (a) and the fruits evolution (b) belonging to L<sub>5</sub> since the technological maturity to the physiological maturity

The mean weight of the fruit is 131g. It is a mean early variety; it needs 115 –120 days since the emergence until the first harvest. It has a great yield capacity (41,6 t/ha), with over 10 t/ha more than the yield registered at the control variant. It is recommended especially for the fresh consume for its equilibrated taste and tenderness, but also for conserved products.

## CONCLUSIONS

1. The green pepper variety called Superior Yellow maintain itself performing, but it can be successfully concurred with 2 new creations obtained at VRDS Buzău – lines L<sub>3</sub> and L<sub>5</sub>.

2. L<sub>3</sub> is productive (48,56 t/ha), it presents a 105 g/fruit and is recommended for open field and protected spaces culture.

3. L<sub>5</sub> is productive (41,6 t/ha) and presents a 131 g/fruit.

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# INFLUENCE OF SOME ECOLOGICAL PRODUCTS ON ANATOMO-MORPHOLOGICAL CHANGES IN GRAFTING COALESCENCE AT PEAR AND PLUM FRUIT TREES

## EFFECTUL UNOR PREPARATE ECOLOGICE ASUPRA MODIFICĂRILOR ANATOMO-MORFOLOGICE ÎN PROCESUL DE PRINDERE LA ALTOIRE LA SPECIILE PĂR ȘI PRUN

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**Abstract:** *The aim of this paper to evidence the effect of some ecological products on grafting success and anatomo - morphological changes which appear during the coalescence of grafting partners. The experiences were made in didactical farm field belonging U.S.A.M.V. Iasi, in 2008-2010. Rootstocks of pear (Pyrus sativa and Cydonia oblonga) and plum (Prunus domestica and Prunus cerasifera) were grafted with cultivars having different graft compatibility degrees. During the grafting process, an ecological product P2 (offered by I.C.D.B "Bios" Cluj) was applied above and below the grafting union area. After three weeks, on the treated variants, microscopically sections through the grafted point showed a stimulation of calusogenesis processes and a better tissue differentiation.*

**Key words:** ecological products, incompatibility, grafting, conductive vassels

**Rezumat:** *În lucrarea de față ne propunem să evidențiem rolul unor preparate ecologice asupra procesului de prindere la altoire și modificările de ordin anatomo - morfologic ce apar în procesul de sudare și vascularizare a celor doi parteneri. Experiențele au fost efectuate în cadrul fermei didactice a U.S.A.M.V. Iași, în perioada 2008-2010. Portaltui din speciile păr (Pyrus sativa și Cydonia oblonga) și prun (Prunus domestica și Prunus cerasifera) au fost altoiți cu soiuri ce prezintă diferite grade de compatibilitate la altoire. În timpul altoirii a fost efectuat un tratament cu produsul ecologic P2 furnizat de I.C.D.B. " Bios" Cluj. Secțiunile microscopice prin punctul de altoire au demonstrat stimularea procesului de calusogeneză și de diferențiere a vaselor conducătoare sub acțiunea tratamentului cu produsul P1.*

**Cuvinte cheie:** preparate ecologice, incompatibilitate, altoire, vase conducătoare

## INTRODUCTION

In ecological fruit tree growing the accent is put on substances witch are used as biostimulators to improve root growth and due to this increase the

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crop as well as increasing featuring degree at some cultivars. Beside that some substances have a healing effect and are used in orchards for a faster healing of trees after winter or mechanical lesions or after annual pruning.

Because grafting is one of the most important method of fruit tree planting material producing, one of research direction in this field is diminution as much as possible of incompatibility phenomenon between some cultivars and their rootstocks used for their characteristics and adaptability for a specific climatic area.

In this direction many researches were made, in the aim of determination of incompatibility causes (Herrero, 1951; Mosse, 1962), and for diminution of this effect by creating of new compatible cultivars or by grafting on intermediary compatible rootstock.

This paper is part of a grater study which has as aim the elaboration of some ecological products for increasing graft compatibility and a further better development of plants. In these studies two ecological products P1 and P2 were tested, and the best results were obtained when P2 product was used. For this reason we tried to test influence of product P2 on grafting success and anatomo-morphological changes which may appear in grafting area at some pear and plum varieties with different compatibility degrees.

## **MATERIAL AND METHOD**

Experiments were organized in didactical farm of USAMV Iasi. Biological material was represent by pear rootstock (*Cydonia oblonga* and *Pyrus sativa*) and plum rootstock (*Prunus domestica* and *Prunus cerasifera*) which were grafted with pear cultivars Cure and Compessee de Paris and plum cultivars Stanley and Tuleu gras. As control we used cultivars grafted on *Pyrus sativa* and *Cydonia oblonga* (compatible variants). Grafting were made in August and immediately after grafting a treatment with P2 product offered by ICDB Bios.

Samples were collected at 4 weeks after grafting and for anatomical section semiautomat microtome SLEE MAINZ CUT 6062 and optic microscope MOTIC B SERIES were used. Observations were made using 4x and 10x objective and images were capture with Motic Image Plus soft.

## **RESULTS AND DISCUSSIONS**

The union of the vascular elements of stock and scion following grafting is thought to be the critical event in the formation of a compatible graft (Yeoman, 1984). The differentiation of connecting vascular tissue is preceded by a proliferation of parenchymatous callus from both components of the graft. Callus formation takes approximately 2-3 weeks and after that a new cambial tissue will differentiate which will generate a new xylem and a new phloem, vascularisation being complete after approximately 6-8 weeks (Soule, 1971; Moore, 1981; 1982;1983).

If partners are incompatible, parenchymatous cells will from the two surfaces generates cambium and felogen which will form suber and will



isolate scion and rootstock leading on grafting failure. Between these two extreme cases (compatibility and incompatibility) there are multiple situations in which initially a coalescence process take place, but, in time, the new fruit tree will manifest a low compatibility degree with various symptoms: presence of undifferentiated cell tissue on suture line of the two partners, contortion of vascular tissue, discontinuity of wood and bark, appearance of woody bridges between the partners etc.

For analysing redifferentiation capacity of parenchymatous tissue samples for anatomo-morphological observations were take at 4 weeks after grafting, this moment being the one when, at compatible combinations, the neoformations of vascular tissues must start, or in case of incompatible combinations it can be observed the suberification of the cambial tissue or other disturbances of vessels formation

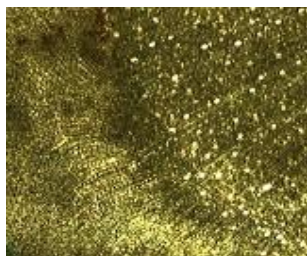
When pear cultivar were grafted on *Pyrus sativa*, a very intense cell proliferation has been observed, parenchymatous cell tissue occupied the entire space between rootstock and scion without tissue suberification, so that water and mineral substances could be uptake without difficulty.

In both variants (compatible and incompatible scions grafted on *Pyrus sativa*) callus has been formed on entire surface of cut tissues, fact which suggest that application of P2 product did not have a visible influence on cell proliferation process, but it has been observed that vessels neoformation process was quicker.

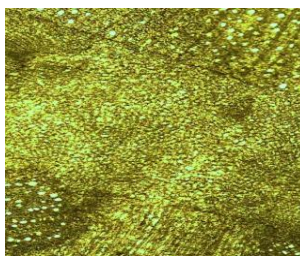
At 4 weeks after grafting on treated variant it can be observe xylemic vessel formation, but on untreated variant this process wasn't started yet.

When grafting was made on *Cydonia oblonga*, at 4 weeks after grafting it could be observe parenchymatous tissue formation but without starting of cell differentiation process. At untreated variants of variety Comptesse de Paris grafted on *Cydonia oblonga*, woody vessels of the scion and rootstock were separated by a brown parenchymatous suberyfied tissue which block water and nutritive substances circulation, leading to formation of some necrotic zones in grafting point. Treatment application led to a diminution of suberification degree so that on treated variant new formed callus is more homogenous and necrosis was observed only in isolated points. Neoformation of conductive vessels was not observed at these variants (fig.1).

At plum varieties observations evidenced a quicker formation of the callus, so that at only 2 weeks after grafting space between those two partners was completely occupied by callus consistent, whereas, on pear trees callus consistence was still friable. As well as pear cultivars, it has been observed that on variants grafted on *Prunus sativa* treated with P2 redifferentiation process has already start, new conductive vessels being observed, in contrast with untreated variants at which redifferentiation didn't start yet (fig. 2).



a) Cure / *Pyrus sativa* (treated)



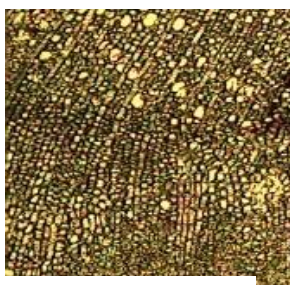
b) Cure / *Pyrus sativa* (untreated)



c) Comptesse de Paris / *Pyrus sativa* (treated)



d) Comptesse de Paris / *Pyrus sativa* (untreated)



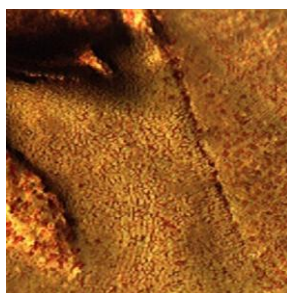
e) Cure/ *Cydonia oblonga* (treated)



f) Cure/ *Cydonia oblonga* (untreated)



g) Comptesse de Paris/ *Cydonia oblonga* (treated)

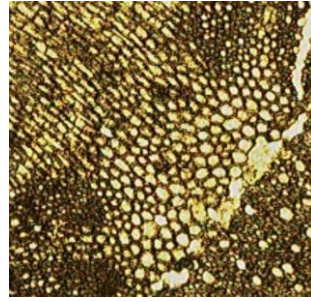


h) Comptesse de Paris/ *Cydonia oblonga* (untreated)

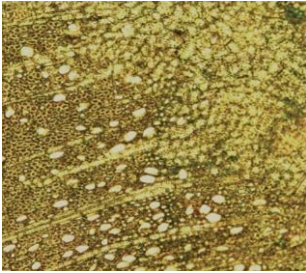
**Fig. 1 (a-h)** – Anatomical sections through grafted point at pear



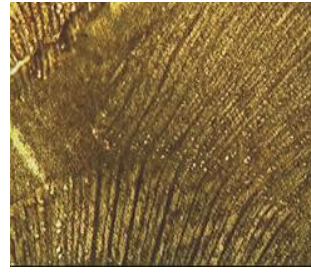
a) Stanley / *Prunus Sativa*  
(treated)



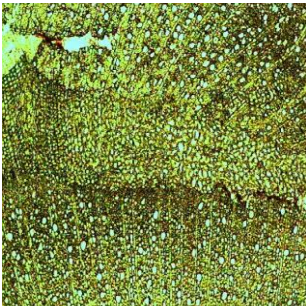
b) Stanley / *Prunus Sativa*  
(untreated)



c) Tuleu gras / *Prunus sativa*  
(treated)



d) Tuleu gras / *Prunus sativa*  
(untreated)



e) Stanley/*Prunus cerasifera*  
(treated)



f) Stanley/*Prunus cerasifera*  
(untreated)



g) Tuleu gras / *Prunus cerasifera*  
(treated)



h) Tuleu gras / *Prunus cerasifera*  
(untreated)

**Fig. 2 (a-h)** - Anatomical sections through grafted point at plum

In case of grafting on *Prunus cerasifera* incompatibility symptoms were remarked both at incompatible variety Tuleu gras and Stanley. On Tuleu gras/*Prunus cerasifera* it was observed a suberification of parenchymatous tissues of both rootstock and scion with a pregnant tendency of isolation of the partners whereas at Stanley a fine line of suber only at rootstock level. (fig. 2)

Under the influence of P2 treatment frequency of these modifications has diminuend so that in case of Stanley variety anatomical sections showed only deviations of conductive vessels without any other abnormal aspects which may suggest difficulties in vascularisation processes on suture line.

In case of Tuleu gras cultivar, suberification was partially, being observed homogenous parenchyma which assure partners adherence and water and mineral supply fact which permits a satisfy vascularisation of grafted area.

## CONCLUSIONS

1. At pear specie, after application of treatment with P2 product it has been observed a diminution of suberification degree of dedifferentiated tissues

2. At plum varieties grafted on *Prunus sativa* it has been observed an acceleration of conductive vessels formation after product P2 was applied. When grafting was made on *Prunus cerasifera* tissues suberification was observed in a lower proportion on the treated variants in opposite with those untreated.

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# ASPECTS REGARDING GRAFTING INCOMPATIBILITY ON SOME CULTIVARS OF PLUM

## ASPECTE PRIVIND INCOMPATIBILITATEA LA ALTOIRE LA UNELE SOIURI DE PRUN

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**Abstract.** *The mechanism of the incompatibility to grafting is considered to be a result of the mutual influence between scion and rootstock. In order to emphasize the early incompatibility phenomenon, both different biochemical and physiological processes have been studied on the level of the grafting area, as well as different compounds and mineral substances that are transported through the joining area. We performed biochemical analyses regarding the accumulation of nitrogen, soluble glucides and content of gross protein in the grafted combinations. The results showed differences regarding the transport of nitrogen and soluble glucides on the level of the grafting area. Thus, the compatibility between the scion and the rootstock is essential for the production and the use of the carbohydrates and nitrogen reserves which reflects the strength of the plant and the economic efficiency.*

**Key words:** graft, incompatibility, nitrogen total, soluble sugars

**Rezumat.** *Mecanismul incompatibilității altoirii este considerat un rezultat al influenței reciproce dintre altoi și portaltoi. Pentru evidențierea fenomenului de incompatibilitate timpurie au fost studiate atât diferite procese biochimice și fiziologice de la nivelul zonei de altoire, cât și diferiți compuși și substanțe minerele ce sunt transportate prin zona de uniune. S-au efectuat analize biochimice privind acumularea azotului, a glucidelor solubile și a conținutului de proteină brută la combinațiile altoite. Rezultatele au scos în evidență diferențe privind transportul azotului și a glucidelor solubile la nivelul zonei de altoire. Astfel, compatibilitatea dintre altoi și portaltoi sunt esențiale pentru producerea și utilizarea rezervelor de carbohidrați și azot fapt ce reflectă vigroarea plantei și randamentul economic.*

**Cuvinte cheie:** altoire, incompatibilitate, azot total, glucide solubile

## INTRODUCTION

One of the biggest obstacles in producing trees is represented by the incompatibility of grafting. That could be the result of the genetic, physiological or anatomical aspects (Hartmann et al, 1997). The time necessary for the apparition of the symptoms of incompatibility is usually very long, so that in some cases years could pass by without the tree manifesting any visible symptom. Moreover, the anatomical symptoms manifested in early stages of the trees are not always

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clearly associated with the phenomenon of incompatibility (Andrews and Marguez, 1993). The reserves of carbohydrates play an important role in the metabolism, development, increase of resistance to freezing, defence and prevention of the mortality of the woody plants. The capacity of mobilization at the level of the deposit organs depends, among other factors, of the mechanisms to deposit (Wolswinkel, 1985) and the launch of carbohydrates, the metabolism of storing in the area of depositing (Daie, 1985). In case of using the combination of grafted peach tree on plum grafting carrier, the availability of the carbon in the roots and the assimilation of nitrogen by the graft present a very important role in the incompatibility of the grafting (Yano et al., 2002). The studies done by Moing and Gaudillere (1992), underline the importance of the content of carbohydrates and nitrogen for maintaining the vigour of the tree. Even though it is clear that the phenomenon of incompatibility is determined by the genetic differences of the two partners, the intimate mechanism by which takes place the phenomenon of rejection has not been clarified till date. A few hypotheses have been presented, explaining the causes of the appearance of this phenomenon, but none of them is not fully proved and supported by relevant experimental proves. Thus, the elaboration of some sure methods of early identification of the incompatible combinations is a modality to eliminate the economic loss in the tree practice.

## **MATERIAL AND METHOD**

The experiment was located in the experimental field of the University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad" of Iasi from S.D.E. [Didactical Experimental Station] "V. Adamachi". The biologic material used is represented by four types of plum (Stanley, Centenary, Tuleu timpuriu, Gras ameliorat) grafted on graft carriers *Prunus cerasifera* and P. F. Renclocl green.

Studies were done during the vegetation period of 2010, the planted material being in the second year of vegetation. In order to realize the biochemical analyses, the tests were harvested at 2 cm above the grafting point, in the area of the grafting point, from 2 cm under the grafting point. Biochemical studies were done regarding the contents of the soluble carbohydrates (by means of Schoorl method), total nitrogen and brute protein (by means of the Kjeldahl procedure) at the level of the grafting area.

## **RESULTS AND DISCUSSIONS**

The incompatibility is due to the lack of differentiation at the level of the grafting point of the tissues of callus in phloem and xylem tissues, aspects presented in the studies done by Moore (1983). These phenomena can provoke lack of combination between graft carriers and graft, which leads to the lack of graft lignifications with the graft carrier.

The distribution of the carbohydrates in the young plus trees implies the production of carbohydrates in the photosynthetic organs, the following translocation by phloem at the level of the organs of growth and deposit. In case of young plum trees, the content of carbohydrates is influenced by the graft carrier used, but this thing depends on the type of carbohydrates and the vegetation season (Gaudillere et al., 1992).

Providing minerals from the root to the trunk interacts with the assimilation and repartition of the carbon, which can influence the proportion of biomass between root and trunk. The proportion root/trunk is modified by environment factors, such as water and the availability of the minerals (McDonald et al., 1986). In order to establish the influence of the phenomenon of incompatibility on re-establishing the vascular continuity between the two grafted partners, it was determined the content of soluble carbohydrates and total nitrogen at the level of the grafting point. The reserves of carbohydrates play an important role in the metabolism, development, increase of resistance to freezing, defence, postpone and prevention of the mortality of the woody plants.

The results of the studies done with varieties of plum show a bigger accumulation of carbohydrates at the level of the grafting point, both in the variety grafted on *Prunus cerasifera* and in the variety grafted on *P.F.Renclod green*. On comparing the results obtained in the two varieties, it is underlined the degree of remaking the continuity of the vessels according to the compatibility between the partners and the age of the trees. In the case of the compatible variety, the resemblance from the anatomic point of view is underlined by the close values of content of soluble carbohydrates obtained at the level of the grafting point and graft carrier (table 1).

This is underlined by the close values of the content of carbohydrates at the level of the grafting point and graft carrier, both in the variety grafted on the graft carrier *P.F.Renclod green* and in the variety Stanley/*Prunus cerasifera*, combination known as being compatible.

The influence of the phenomenon of incompatibility determined in the incompatible combinations the accumulation of some larger quantity of soluble carbohydrates at the level of the grafting point comparing with the compatible variety. The largest average content of soluble carbohydrates at the level of the grafting area was underlined in the variety Tuleu timpuriu (39.04 mg/g s.u), followed by the variety Gras ameliorat (38.13 mg/g s.u). The lowest average value of the content of soluble carbohydrates at the level of the grafting area was noticed in the variety Stanley, being of 36.11 mg/g s.u.

In the incompatible varieties grafted on *Prunus cerasifera*, in the graft, the average content of soluble carbohydrates was bigger than in the graft carrier, but lower than in the grafting area. This fact suggests that, in the area of combining the two partners, there are some barriers in the anatomic structure, which hinders the transportation of the photo-assimilated towards the graft carrier.

Since in both varieties it was noticed retention of the content of soluble carbohydrates at the level of the grafting point, we can consider that the transport of the soluble carbohydrates towards the root is perturbed not only by incompatibility, but also by the grafting, which determines the retention of soluble carbohydrates at the level of the joint area.

The results regarding the content in total nitrogen underline a higher quantity of total nitrogen at the variety grafted on the graft carrier *P.F. Renclod green* comparing with the results obtained in the varieties grafted on the graft

carrier *Prunus cerasifera*. The highest quantity of total nitrogen was accumulated at the level of the grafting point and in the graft carrier. At the level of the graft, the maximum content was 0.63g/100g s.u. at the variety grafted on the graft carrier a *P.F. Renclod green*, respectively 0.42 g/100g s.u. at the variety grafted on *Prunus cerasifera* (table 2). In the graft, at the variety grafted on *Prunus cerasifera*, the content of total nitrogen had lower values comparing with the variety grafted on *P.F. Renclod green*, the values being between 0.57 g/100g s.u. at the variety Centenary and 0.58 g/100g s.u. at the variety Gras ameliorat.

As for the variety grafted on *P.F. Renclod green*, the highest value was underlined in the varieties Stanley with 0.58 g/100g s.u., and the lowest value by the variety Tuleu timpuriu with 0.37 g/100g s.u.

The values obtained in the trees in the second year of vegetation underlines, in the case of the compatible variety grafted on *P.F. Renclod green*, some content of total nitrogen in the graft close to the one in the graft carrier (table 2), however lower than in the grafting point.

Table 1

**Sugar content average values on Stanley,Centemar, Gras ameliorat, Tuleu Timpuriu plum cultivars**

Scion/rootstock	2 cm above union (mg/g DW)	on the union (mg/g DW)	2 cm below union (mg/g DW)
<b>Centemar/<i>Prunus cerasifera</i></b>	30,46	37,56	28,34
<b>Tuleu timpuriu/<i>Prunus cerasifera</i></b>	32,48	39,04	29,34
<b>Gras ameliorat/<i>Prunus cerasifera</i></b>	31,79	38,13	28,97
<b>Stanley/<i>Prunus cerasifera</i></b>	34,66	36,11	35,46
<b>Centemar/<i>P.F. Renclod verde</i></b>	25,67	29,11	30,11
<b>Tuleu timpuriu/<i>P.F. Renclod verde</i></b>	24,67	25,33	25,56
<b>Gras ameliorat/<i>P.F. Renclod verde</i></b>	27,17	27,26	27,81
<b>Stanley/<i>P.F. Renclod verde</i></b>	26,13	27,66	28,47

DW – dry weight

Table 2

**Nitrogen content average values on Stanley,Centemar, Gras ameliorat, Tuleu Timpuriu plum cultivars**

Scion/rootstock	2 cm above union (g/100 g DW)	on the union (g/100 g DW)	2 cm below union (g/100 g DW)
<b>Centemar/<i>Prunus cerasifera</i></b>	0,38	0,41	0,39
<b>Tuleu timpuriu/<i>Prunus cerasifera</i></b>	0,37	0,43	0,44
<b>Gras ameliorat/<i>Prunus cerasifera</i></b>	0,39	0,41	0,40
<b>Stanley/<i>Prunus cerasifera</i></b>	0,58	0,65	0,67
<b>Centemar/<i>P.F. Renclod verde</i></b>	0,57	0,63	0,66
<b>Tuleu timpuriu/<i>P.F. Renclod verde</i></b>	0,58	0,64	0,69
<b>Gras ameliorat/<i>P.F. Renclod verde</i></b>	0,59	0,65	0,68
<b>Stanley/<i>P.F. Renclod verde</i></b>	0,37	0,41	0,42

DW – dry weight



In the case of the variety grafted on *Prunus cerasifera*, the difference between the content of total nitrogen in the graft, graft carrier and grafting point is much higher, which underlines a remake not exactly appropriate of the timber vessels.

Determining the content of brute protein underlines a higher quantity of protein in the varieties grafted on *P.F. Renclod green* compared with the ones grafted on the graft carrier *Prunus cerasifera* (table 3). At the level of the graft, it was noticed a lower content of brute protein than in the point of graft and graft carrier. At the level of the grafting area, the maximum content of brute protein at the varieties grafted on *Prunus cerasifera*, was 4.06g/100g.s.u. variety Stanley. In the case of the variety grafted on *P.F. Renclod green*, the maximum value of the content of brute protein in the first year of vegetation was 4.06g/100g s.u.

Table 3

**Crude protein content average values on Stanley,Centenar, Gras ameliorat,  
Tuleu Timpuriu plum cultivars**

Scion/rootstock	2 cm above union (g/100 g DW)	on the union (g/100 g DW)	2 cm below union (g/100 g DW)
<b>Centenar/<i>Prunus cerasifera</i></b>	2,38	2,56	2,44
<b>Tuleu timpuriu/<i>Prunus cerasifera</i></b>	2,31	2,69	2,75
<b>Gras ameliorat/<i>Prunus cerasifera</i></b>	2,44	2,56	2,50
<b>Stanley/<i>Prunus cerasifera</i></b>	3,63	4,06	4,19
<b>Centenar/ <i>P.F.Renclod verde</i></b>	3,56	3,94	4,13
<b>Tuleu timpuriu/ <i>P.F.Renclod verde</i></b>	3,63	4,00	4,31
<b>Gras ameliorat/ <i>P.F.Renclod verde</i></b>	3,69	4,06	4,25
<b>Stanley/ <i>P.F.Renclod verde</i></b>	2,31	2,56	2,63

DW – dry weight

## CONCLUSIONS

1. The biochemical studies done in the varieties of plum grafted on the two graft carriers, underline the influence of the phenomenon of incompatibility on remaking the vascular continuity among the grafted partners.

2 .The differences regarding the contents of soluble carbohydrates between the two varieties suggest the existence of some structural anomalies at the level of the conductive tissues in the case of the incompatible variety. These anomalies determine the retention both of soluble carbohydrates and proteins, which are synthesized in the aerial part of the trees.

3. The influence of the phenomenon of incompatibility was also underlined in the case of the circulation of nitrogen in the content of total nitrogen higher at the level of grafting point, which underlines the fact that, at the level of the xylem vessels, there are some modifications of structure.

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# INTENSIVE APPLE PLANTATION PRODUCTIVITY IN FUNCTION OF FOLIAR FERTILIZATION APPLICATION

## PRODUCTIVITATEA PLANTAȚILOR INTENSIVE DE MĂR ÎN FUNCȚIE DE APLICAREA FERTILIZĂRILOR FOLIARE

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**Abstract.** An investigation of development systems in apple foliar fertilization was performed by means of stationary research methods and fields. As study material of apple trees have served trees of three apple varieties Golden Delicious, Idared and Florina 8 years old grafted on rootstock M26. The planting system is 4x2 meters. In orchard was used foliar fertilization based on Urea46% N in different concentration of 0,4% to 1,2% of deferent stages of fruit development, Polyfeed ( $N_{19}P_{19}K_{19}$ ) at a 0,1% concentration and  $CaCl_2$  (0,5%, 0,7%). The Golden Delicious variety harvest increased from 25.5 t/ha in 2008 up to 31.1 t/ha in 2009, Idared is the variety who yields are from 18,3 t/ha in 2009 in control variant up to 29.1 t/ha in 2010 in variant 4. The Florina crop varieties ranged from 23.1 t/ha in 2008 up to 34.9 t/ha in 2010.

**Key words:** apple, concentration, variety, urea

**Rezumat.** Investigațiile cu privire la elaborarea sistemelor de fertilizare foliară la măr s-au efectuat prin intermediul metodelor de cercetare staționare și câmp. Ca material de studiu au servit pomii de măr în vârstă de 8 ani din soiurile Golden Delicious, Idared și Florina, altoite pe portaltoiul M 26. Distanța de plantare 4x2 m. Ca fertilizant foliar s-a folosit uree 46% s.a. în concentrație de la 0,4 % până la 1,2 %, în diferite faze de dezvoltare a fructelor, Polyfeed ( $N_{19}P_{19}K_{19}$ ) în concentrație de 0,1% și  $CaCl_2$  (0,5% 0,7%). La soiul Golden Delicious producția a crescut de la 25,5 t/ha în anul 2008 până la 31,1 t/ha în anul 2009. La soiul Idared producția a crescut de la 18,3 t/ha în anul 2009, în varianta martor, până la 29,1 t/ha în anul 2010 în varianta 4. La soiul Florina producția a variat de la 23,1 t/ha în anul 2008 până la 34,9 t/ha în anul 2010.

**Cuvinte cheie:** măr, concentrație, soi, uree

## INTRODUCTION

Along with the high productivity of the plantation a great attention should be given special attention to fruit quality because, it affects fruit production efficiency. Fruit quality depends on many factors, but primarily determined by the variety of biological features (Kudravec R. P., 1987, Sasnauskas A. et. al. 2006).

By a proper diet, made by fertigation or foliar normalization of load bearing fruit after binding, and interventions in green shoots growing on creating a balance between enjoyment and trees bud differentiation that leads to consistent and high quality production (Roșca C., Diaconiuc V 2005).

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## MATERIAL AND METHOD

The investigations were conducted during the years 2008- 2010 in the apple orchard business 'Zubresti' SA, district Sraseni planted with trees grafted 1 year of age. Plantations establishment was carried out in spring 2003 with fruit varieties Golden Delicious, Idared and Florina grafted on M26 rootstock. Distance 4x2 m planting trees. Trees are driven by narrow crown zone located from north to south.

The investigations on the development of the foliar fertilization in apple are made stationary through research methods, field and laboratory. The variants are located in four repetitions each randomized trees in 32 variants. Agro-technical measures in the orchard is made in accordance with ago- technical guidance in force. Soil is maintained as field work by conducting an annual plowing in winter and as needed 3-5 cultivations. Urea 46% breast was in different concentrations on fruit development stages. Solutions consumption is 1.000 liters per hectare (table 1).

Table 1

**Scheme of experience**

Foliar fertilization performance period	Nutrient concentration %			
	V1 (control)	V2	V3	V4
Urea 46% active substance				
After flowering (75% of flowers have fallen)	Water	0.4	0.5	0.6
When fruits have the size of a peanut (fruit diameter reached 10-12 mm)	Water	0.7	0.8	0.9
When fruits have the size of a walnut (the fruit had reached 25-30 mmin diameter)	Water	1.0	1.1	1.2
Polyfeed (N19:P19:K19)				
When fruits are ripe state (20-30 July)	Water	0.1	0.1	0.1
Calcium chloride (CaCl <sub>2</sub> )				
With 20-30 days before harvesting the fruit	Water	0.5	0,6	0,7

## RESULT AND DISCUSSIONS

In 2008 the fruit number of Golden Delicious variety per tree was from 109 to 192 in control variant until the variant 4, average fruit weigh from 98 g up to 136 g. The number and weight of fruit in variant 2 and 3 is between 116 and 150 fruit and 116 g and 127 g per fruit in variant 3. Fruit crop in 2008 was biggest high in variant 3 (23.8 t/ha) followed by variant 4 (23.5 t/ha) and variant 2 (19.9 t/ha). The lowest recorded harvest in control variant to 15.9 t/ha. In 2009 the fruit number of the Golden Delicious variety was higher than in 2008 year but the difference between the variant were also high. Thus, the lowest number of fruit was recorded in control variant (173 fruit) that took on average 109 grams, and the largest number of fruit was recorded in variant 4 with 230 fruits per tree with an average weight of 136 g. In variant 2 were 180 fruits with weighing 119 g and 198 fruit in variant 3 weight129 g. In the 2009 yield per hectare Golden Delicious variety is in strict accordance with the number of fruit per tree and their average weight. Thus, in control variant was 23.6 t/ha, and in fourth variant to 31.1 t. In 2010 the Golden Delicious variety fruit harvest was quantify less than in 2009 year but higher than in 2008 year. In control variant was obtained the lowest

number of fruits (100) and the largest amount in variant 4 (1721). The average weight of fruit in 2010 year was with small difference between the variant 2 where the average weight was 114 grams. The fruit crop per hectare in 2010 year where with great difference, between the variants average. Thus, in control variant the yield was 17.0 tons. The biggest harvest was recorded in variant 4 to 28.6 t/ha.

Table 2

**Fruit production by variety and concentration of foliar applied fertilizers (Urea 46%)**  
**(Rootstock M26, Distance of panting 4x2, S.A. „Zubrești“, 2008 - 2010)**

variant	Number of fruit per tree			weight average 1 fruit g			t/ha		
	year 2008	year 2009	year 2010	year 2008	year 2009	year 2010	year 2008	year 2009	year 2010
<b>Golden Delicious</b>									
V1	109	173	100	98	109	134	15,9	23,6	17,0
V2	116	180	152	127	119	114	19,9	26,8	21,8
V3	150	198	169	116	129	133	23,8	29,4	25,8
V4	192	230	171	136	136	134	23,5	31,1	28,6
DL,5%	-	-	-	-	-	-	0,25	0,24	0,28
<b>Florina</b>									
V1	162	168	178	104	124	125	23,1	26,7	27,8
V2	172	170	184	113	134	142	24,0	28,2	32,6
V3	183	173	190	137	125	141	29,7	26,8	33,5
V4	197	178	205	141	135	117	29,9	30,2	34,9
DL, 5%	-	-	-	-	-	-	2,14	1,95	3,71
<b>Idared</b>									
V1	170	110	155	100	133	99,3	21,9	18,3	19,3
V2	173	117	170	121	143	113	25,9	20,9	24,1
V3	175	130	186	120	144	108	27,2	23,4	25,2
V4	180	148	195	132	136	119	28,1	25,1	29,1
DL, 5%	-	-	-	-	-	-	1,87	2,7	2,85

The Florina variety in 2008 year, the fruit number in control variant was (162) and highest in variant 4 with 197 fruits that have registered an average weight of 141 g. The smaller fruits were in control variant with 104 g. In the remaining variants had a ranging number from 172 fruits of tree, average fruit weight of 113 g in variant 2, and 183 fruit per tree with an average weight of 137 g in variant three. In 2009 year the number of fruit in control variant was 168 fruits per tree and their average weight of 124 g. Under variant two the number of fruit was 170 pieces per tree with a weight of 125 g. In 2010 year the number of fruits was lowest in control variant 178 fruits with an average weight of 125 g. The highest number of fruits was recorded in variant 4 with 205 fruit and an average weight of 117 g/ fruit. The highest index of fruit number and weight was observed in variant 3 with a 190 fruit number and an average weight of 141 g where the dose applied was 0.5%; 0.8%;1.1% of Urea 46%N. The average weight of fruit was higher in variant 2 with 142 g of fruit where the number was 184 pieces/ tree. The quantities fruit of the Florina variety in 2008 years was the smallest amount in control variant (162

fruit) with a total harvest of 23.1 t/ha and the largest amount of fruit per hectare was recording in variant 4 with 29.9 t/ha. In 2010 year the amount of fruit of Florina variety was a tree growing in comparison with those previous years of study was in growing (2008- 2009) and recorded the largest amount of fruit per tree and per hectare in variant 4 where concentration of foliar applied fertilizers (Urea 46%N) were 0.6%; 0.9%; 1.2% and amounted to 34.9 t/ha.

In 2008 year t5o the Idared variety the fruit number is between values of 170 in control variant and 180 in variant 4. The fruit mass was 100 g in control variant which has not been applied foliar fertilization based of nitrogen on Urea 46% higher breast and fruit were obtained in variant 4 with 132 g. In third year (2010) were recorded 155 fruit in control variant with an average weight of 99.3 g of fruit. Under variant two the number of fruit was 170 with an average weight of 108 g. The largest number of fruit was in variant 4 where was 195 fruits with an average weight of 119 g. The yields per hectare are in sequence with the number of fruits as well as their average weight. Following foliar fertilization the harvest applied per hectare yield is higher than the control variant and recorded a harvest of over 20 tons per hectare where the largest quantities of fruits were recorded in variant 4 where the concentrations o fertilizer was 0.6%; 0.9%; and 1.2%.

## CONCLUSIONS

1. Following foliar fertilization the harvest applied per hectare yield is higher than the control variant and recorded a harvest of over 20 tons per hectare where the largest quantities of fruits were recorded in variant 4 where the concentrations o fertilizer was 0.6%; 0.9%; and 1.2%.

2. In 2010 year the amount of fruit of Florina variety was a tree growing in comparison with those previous years of study was in growing (2008- 2009) and recorded the largest amount of fruit per tree and per hectare in variant 4 where concentration of foliar applied fertilizers (Urea 46%N) were 0.6%; 0.9%; 1.2% and amounted to 34.9 t/ha.

3. In the 2009 yield per hectare Golden Delicious variety is in strict accordance with the number of fruit per tree and their average weight. Thus, in control variant was 23.6 t/ha, and in fourth variant to 31.1 t.

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# STUDIES ON THE DIURNAL CHANGES IN PHOTOSYNTHETIC PROCESS AT SOME *FRAGARIA* *VESCA* CULTIVARS

## STUDII ASUPRA MODIFICĂRILOR DIURNE ALE PROCESULUI DE FOTOSINTEZA LA UNELE SOIURI DE *FRAGARIA VESCA*

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**Abstract.** *The aim of this paper is to study diurnal variations of photosynthetic process at two strawberry cultivars (Magic and Real). Monitoring reaction of those two genotypes in different light conditions was made by determination of photosynthesis rate, stomatal conductivity, transpiration rate and intracellular CO<sub>2</sub> amount, using portable photosynthesis system LCi. The results showed modification of photosynthesis rate, during one day, as a bimodal curve with two peaks. Diurnal variation of stomatal conductivity was proportional with transpiration rate, respecting the same model as photosynthetic rate.*

**Key words:** diurnal variation, photosynthesis, transpiration rate, stomatal conductivity, *Fragaria vesca*.

**Rezumat:** *Scopul acestei lucrări este studierea variațiilor diurne ale procesului de fotosinteză la două soiuri de căpșun (Magic și Real). Monitorizarea reacției celor două genotipuri în condiții diferite de lumină s-a realizat prin determinarea ratei fotosintezei, a conductivității stomatale, a ratei transpirației și a cantității de CO<sub>2</sub> intercelular cu ajutorul sistemului de fotosinteză portabil LCi. Rezultatele au arătat modificări ale ratei fotosintezei, pe parcursul unei zile, sub forma unei curbe bimodale cu 2 pic-uri. Variațiile diurne ale conductivității stomatale au fost direct proporționale cu rata transpirației, respectând același model detectat în cazul ratei fotosintezei.*

**Cuvinte cheie:** variație diurnă, rata fotosintezei, rata transpirației, conductivitatea stomatală, *Fragaria vesca*

## INTRODUCTION

One aspect of optimizing crop productivity in the greenhouse is to find optimal conditions for whole-plant photosynthesis. Individual leaf photosynthesis measurements are generally not good estimates for whole-plant photosynthesis. (Berry J.A., 1982). Leaf photosynthesis can be highly variable due to such factors as leaf age, chlorophyll content (Mohua Yang, 2008), leaf shading, or biotic and abiotic stresses whereas whole-plant productivity is influenced greatly by canopy complexity and growth (Miller et al., 1996). For this reason we studied diurnal variations of photosynthetic process at two strawberry cultivars (Magic and Real).

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## MATERIAL AND METHOD

Biological material was represented by two strawberry varieties Real and Magic, planted in pots and maintained in greenhouse for 3 months. Determinations were made in April for 3 consecutive days with a similar environment conditions with photosynthetic system measure LCI (product by ADC Bioscientific Ltd UK), at every hour between 7-16 and photosynthetic rate, evapotranspiration rate and stomatal conductivity were measured.

Photosynthetic regulation mechanisms were studied by measuring chlorophyll fluorescence with portable fluorometer Handy PEA by excitation of leaves reaction centres with a red light flash at  $3000 \mu\text{mol m}^{-2} \text{s}^{-1}$ ; values were recorded at every 10 microseconds during the first 2 milliseconds and after that, at every millisecond until 1 second. Samples were dark adapted for 30 minutes.

Fluorescence at 50 microseconds was considered  $F_0$ , values from 2 ms represents fluorescence at J step and those from 30 ms represents fluorescence at I step. Maximal fluorescence  $F_m$  (P) represents values at which all the reaction centres are closed. Based on  $F_0$  and  $F_m$  maximal efficiency of PS II ( $F_v/F_m$ ) was calculated.

JIP-test: was used for determination of some parameters as: absorbance per reaction centre (ABS/RC), trapped energy per reaction centre (TRo/RC), electron transfer per reaction centre (ETo/RC), dissipation per reaction centre (Di/RC) and density of active centre per RC.

In the same time, a protocol with preillumination of the reaction centres was applied. Light intensity before excitation was  $250 \mu\text{mol m}^{-2} \text{s}^{-1}$  and after that 15 saturated pulses were applied at each 10 seconds; before the last pulse preillumination was turned off. Based on the fluorescence values efficiency of PS II was calculated, quantity of energy light used in photochemistry (qP) and quantity of dissipated energy.

## RESULTS AND DISCUSSIONS

Determinations evidenced similar modifications for both varieties and particular modifications too, for each cultivar. The first category included intensification of electron transport accompanied by an increasing of photosynthesis transpiration and stomatal conductivity in parallel with increasing of light intensity. For both of the cultivars maximal values of photosynthetic rate were obtained at 11 o'clock (fig.1-5).

The second category includes differences regarding capacity of water utilisation. Magic cultivar recorded a similar but oscillatory evolution of photosynthetic rate, evapotranspiration rate and stomatal conductivity, whereas at Real cultivar photosynthetic rate and stomatal conductivity have a similar variation with a stable kinetic, which determine a better regulation of evapotranspiration. Furthermore, analysing A/E ratio, it can be observed that at Real cultivar efficiency of water using was better than Magic (values of A/E at Real are higher than Magic). Similar results were obtained by Xu K., Guo Y.P., (2005) in their experiences with strawberries.



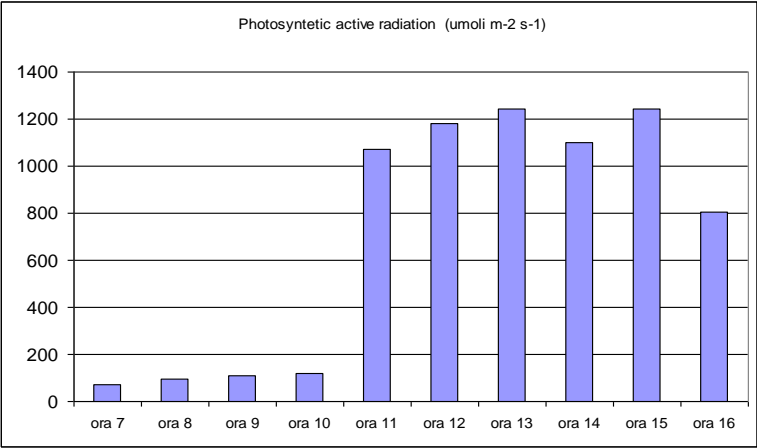


Fig. 1 - Photosynthetic active radiation

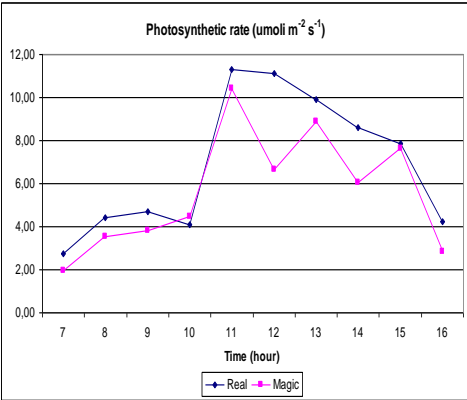


Fig. 2 - Photosynthetic rate

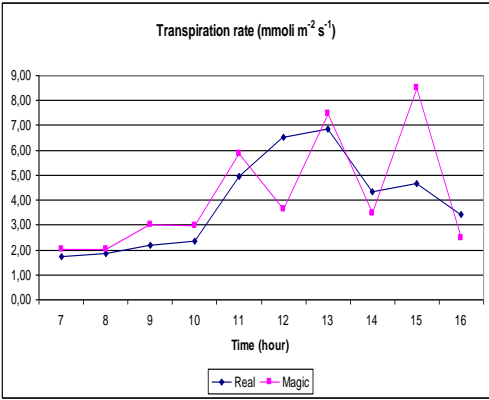


Fig. 3 - Transpiration rate

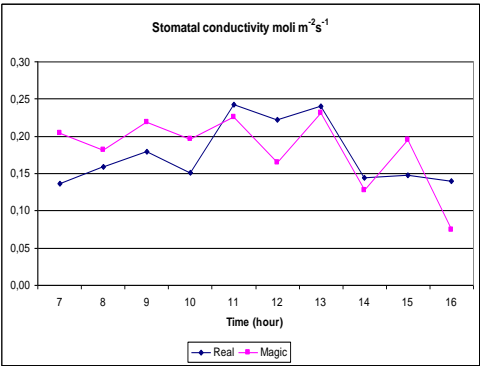


Fig. 4 - Stomatal conductivity

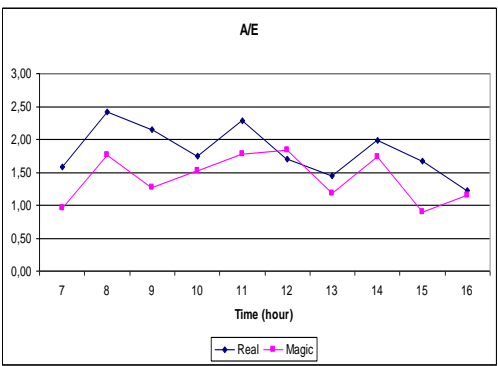
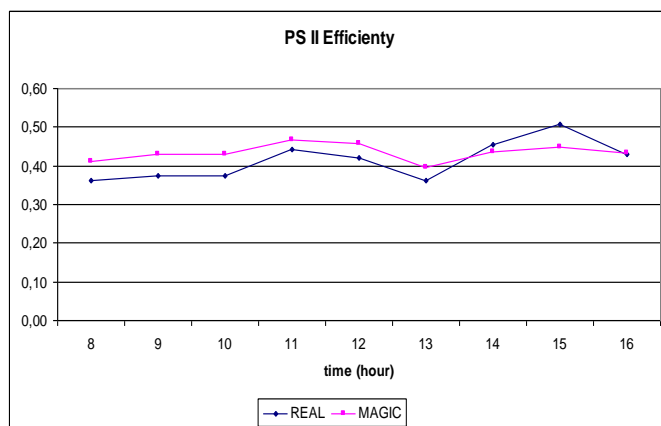


Fig. 5 - Ratio between photosynthetic rate and transpiration rate

Light-driven photosynthetic electron transport provides reducing power for photosynthetic carbon reduction and photorespiratory carbon oxidation. Both these processes are associated with the activity of ribulose 1,5 bisphosphate carboxylase/oxygenase (Rubisco).

Electron transport may also provide a source for alternative electron sinks, such as nitrate reduction and direct reduction of O<sub>2</sub> in the Mehler reaction. Genty et al. first found a linear relationship between quantum yield for CO<sub>2</sub> assimilation and the product of photochemical quenching (qP) and the efficiency of excitation capture (F'v/F'm) by open photosystem II (PSII) centres under non-photorespiratory conditions (Genty et al., 1989). This provides the basis for using  $qP \times F'v/F'm$  (PSII quantum efficiency) to monitor changes in quantum yield of non-cyclic electron transport in vivo. The quantitative relationship between PSII quantum efficiency and quantum yield for CO<sub>2</sub> assimilation, developed under non-photorespiratory conditions, has subsequently been used as a calibration curve to estimate the rate of noncyclic electron transport associated with Rubisco and partitioning of electron flow between CO<sub>2</sub> assimilation and photorespiration under photorespiratory conditions (Cornic and Briantais, 1991; Cornic and Ghashghaie, 1991; Ghashghaie and Cornic, 1994; Habash et al., 1995).

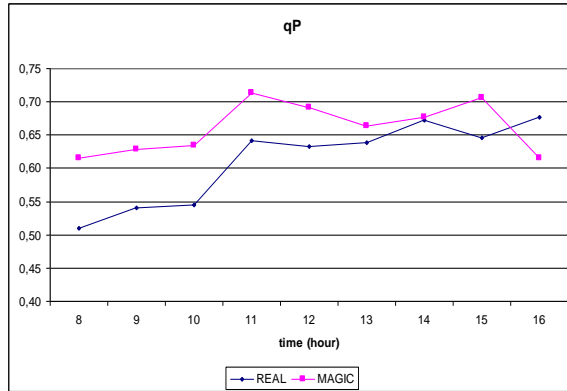
PS II efficiency was similar in both cultivars (fig.6) with some differences regarding capacity of using energy for photochemical reactions. This process is named photochemical quenching (qP) and is a measure of open reaction centres.



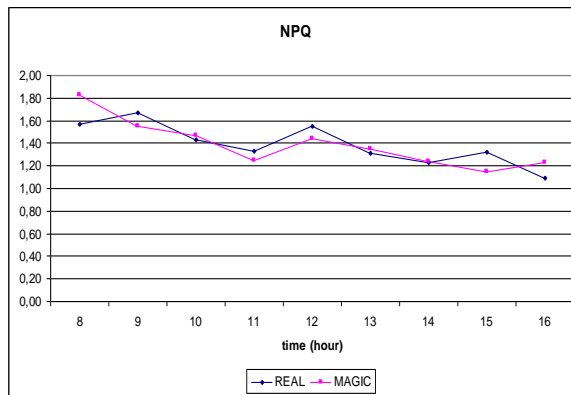
**Fig. 6 - Photosystem II efficiency**

The opposite process is named non-photochemical quenching (NPQ) which represents dissipated energy as heat. qP at Real recorded an increasing at 11 o'clock as a consequence of increasing the number of reactive centres open at this moment (fig.7).

However values of NPQ decreased relatively constant between 7 and 16 o'clock, at both of the cultivars (fig.8). This thing may suggest that Real cultivar adapts at light energy excess by increasing of number of active centres and not by increasing of light dissipation rate.

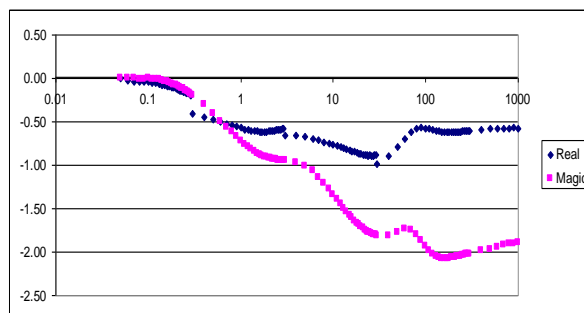


**Fig. 7 - Photochemical quenching**

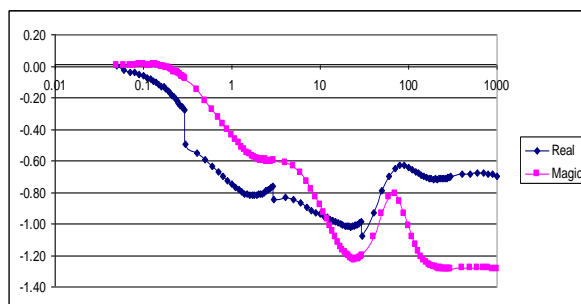


**Fig. 8 - Non-Photochemical quenching**

Fluorescence transitions studies made at 11 and 16 o'clock made in evidence genotypical differences in response at diurnal variations of light intensity, Real cultivar recording higher values of  $F_m$  than Magic (fig. 9 și 10) which demonstrates that OJIP analysis can reveal genotypical differences in those cases when other parameters are not sensitive enough to detect it.



**Fig. 9 -  $\Delta F$  at 11 o'clock**



**Fig. 10 -  $\Delta F$  at 16 o'clock**

## CONCLUSIONS

1. At Magic cultivar photosynthetic rate, stomatal conductivity presents a similar but oscillatory evolution, but, at Real cultivar photosynthetic rate and stomatal conductivity have a similar evolution with a stabile kinetic.

2. Real adapts at light energy excess by increasing of number of active centres and not by increasing of light dissipation rate.

3. OJIP analysis can reveal genotypical differences in those cases when other parameters are not sensitive enough to detect it.

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# PRODUCTIVITY OF APPLE TREES IN V-SYSTEM ORCHARD

## PRODUCTIVITATEA POMILOR DE MĂR ÎN STRUCTURA PLANTAȚIEI CU CORONAMENTUL ÎN DOUĂ PLANURI OBLICE (V)

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**Abstract.** A trial was established in the spring of 2004, one-year-old scab-resistant apple cultivars grafted on dwarfing M.9 rootstock, were planted in the Experimental Station "Criuleni" in central Republic of Moldova. Apple trees of the cultivar Generos and Florina were trained different crown, with trees leaned to 40° from vertical, each in an alternate direction down the row ("V" system). The experiment was designed as a randomized block with three replicates. Each plot consisted of ten trees. The site was drip irrigated. The higher value indices was obtained in the variant were trees was formation on V-palmette and angle of approximately 40° from vertical.

**Key words:** scab-resistant, crown, cultivars, apple, rootstock.

**Rezumat.** Lotul experimental a fost înființat în centrul Republicii Moldova la Stațiunea Didactică Experimentală „Criuleni” în primăvara anului 2004, cu pomi de măr în vârstă de un an, soiurile au o rezistență genetică la rapăn și sunt altoite pe portaltoiul de vigoare slabă M9. Pomii de soiurile Generos și Florina au fost conduși după diferite forme de coroană, fiind înclinați la 40° față de verticală în direcția intervalelor dintre rânduri formând un gard fructifer în formă de „V”. Cea mai mare valoare a indicatorilor de creștere și productivitate la unitatea de suprafață a fost obținută în varianta unde pomii sunt conduși după forma de coroană palmeta liber aplatizată, unghiul de înclinare al pomilor de la verticală fiind de circa 40°.

**Cuvinte cheie:** imun la boli, coroană, soiuri, măr, portaltoi

## INTRODUCTION

In modern fruit growing, much attention has been given to controlling the balance between tree growth and fruit production in high-density plantings. Although dwarfing rootstocks are of prime importance for controlling the growth, cultural techniques as pruning and orchard design also have an influence on tree development (Babuc V. 2000). The planting system in an apple orchard is crucial for yield, fruit quality and profitability. The best way to increase early yield is to enhance planting. But these super spindle plantings have high investment costs and could not fulfil requirements with regard to sufficient yield and fruit quality. The new solution are open forms. The most popular V-shaped systems, recommended for fruit production, are V-system orchard (Cimpoieș Gh. 2000; Robinson, 2005). The open forms with slender elements allow optimum light interception and generate good yields with high fruit quality (Mika et al., 2000;

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Buler et al., 2004). The lower investment costs for the open systems with 2, 3 or 4 branch elements (Tatura) due to a reduced number of trees per hectare are advantageous as compared with the current spindle system in single rows. The somewhat higher costs for the support scaffold frame are a minor disadvantage (Buler Z., Mika A., 2004).

The aim of the present study was to compare the growth and yield of some tree training systems in an apple orchard in the central Republic of Moldova.

## **MATERIAL AND METHOD**

The experiment was conducted at the Experimental Station "Criuleni" in central Republic of Moldova. Apples trees of the cultivars Generos and Florina grafted on dwarfing M.9 rootstock, was planted in spring 2004. The trees rows were aligned north-south.

The experiment was designed as a randomized block with three replicates. Each plot consisted of ten trees. The site was drip irrigated.

The experiment plots was divided in five variants:

- 1 variant (control) - one-line with vertical accommodation of trees and their formation as spindle. The scheme of planting 4 x 1,5 m (1666 trees per ha);

- 2 variant - two-plane V - figurative with formation of trees as a spindle and their inclination under a corner 40° in the opposite sides. The scheme of planting 4,5 x 1 m (2222 trees per ha);

- 3 variant - two-plane V - figurative with formation of trees as palmet system (central lider) and their inclination under a corner 40° in the opposite sides. The scheme of planting 4,5 x 1 m. (2222 trees per ha);

- 4 variant - two-plane V - figurative with formation of trees as palmet system (central lider), two trees in one place and an inclination in the opposite sides under a corner 40°. The scheme of planting 4,5 x 1 m (4444 trees per ha);

- 5 variant - two-plane V - figurative with formation of trees on system Tatura.

The scheme of planting 4,5 x 1 m (2222 trees per ha).

## **RESULT AND DISCUSSIONS**

The length and number of branches included in the annual aggregate length of their overall growth potential and is building upon the trees later. Annual branches mostly evolving new branches bearing young, physiologically active and productive. It supersedes these three branches spread over the years have exploited four years and have largely exhausted (Gh. Cimpoieş 2000).

Up to the seventh year after planting, vegetative growth, yield were affected by cultivar and plant density. Although 'Florina' trees grew stronger than 'Generos'. Trunk growth was negatively related to plant density (table 1). In 2009, when the trees came into bearing, there is a significant decrease in the amount of average annual increases both in variety and variety Florina as general for all variants studied.

This is because much of the nutrients consumed the fruit bud differentiation, growth and ripening of fruit, etc. Whatever the form of trunk diameter for the variety Florina crown was higher than the trees of the genus Generos.

Table 1

**The growth indices and trunk diameter an apple-tree, Rootstock M9**

Variants	Annual average length of shoots, cm		Annual length of shoots, m		Trunk diameter, cm	
	2009	2010	2009	2010	2009	2010
Generos variety						
Variant1 (c)	24	47	15,12	20,9	6,4	6,9
Variant2	23	51	16,72	39,5	4,8	5,1
Variant3	30	49	17,10	26,7	5,0	5,1
Variant4	24	48	13,20	15,8	4,3	4,7
Variant5	29	47	16,30	26,2	5,3	5,8
Florina variety						
Variant1 (c)	31	39	47,95	42,1	6,6	6,9
Variant2	34	41	30,22	50,5	4,8	5,6
Variant3	30	42	40,58	49,9	5,4	6,1
Variant4	27	37	22,7	28,1	5,0	6
Variant5	35	37	33,03	44,1	5,5	6,3

Table 2

**Productivity of apple trees in the V-system orchard. Rootstock M9**

Variants	Fruit production, q / ha			Cumulative yield, 2008-2010 q / ha	Average yield, 2008-2010 q / ha	In % of control, %
	2008	2009	2010			
Generos variety						
Variant1 (c)	190	161	380	731	244	100
Variant2	262	189	404	855	285	117
Variant3	227	208	477	912	304	125
Variant4	277	118	413	808	269	110
Variant5	246	195	142	583	194	80
Florina variety						
Variant1 (c)	178	229	296	703	234	100
Variant2	162	232	318	712	237	101
Variant3	186	281	320	738	246	104
Variant4	238	313	274	825	275	116
Variant5	161	254	240	678	226	97

Analysis of fruit production (table 2) in the last three years of research, it was found that the highest values recorded in the canopy of solitary plantations in two oblique planes. Within this structure of the plantation, led by palmet system, tapering due to spatial position, were allowed to obtain higher yields of fruit. Slightly lower production was led by Tatura fruit trees, because the crown imposed as a large number of cuts.

The variety Generos most production was obtained in variant 3, where trees are led by palmet system (central lider) trees were being inclined at 40°. Ear to the

variety Florina highest values were obtained in variant 4 where), two trees in one place and an inclination in the opposite sides under a corner  $40^0$ .

## CONCLUSIONS

1. In the variants studied, more effective is the canopy structure in two oblique planes, led the palmet system. Small area of nutrition and vegetative macrostructure oblique position helped establish the balance between growth and fructification.

2. Tatura in planting trees after cutting the canopy solitary tapering in two planes, due to the higher cut in the first years after planting, reduced production during the study. As a result, production of fruit plantation in this structure is less effective.

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# STUDY OF THE AGRICULTURAL TECHNOLOGIES IMPACT UPON THE QUALITY INDEX OF JONATHAN APPLES IN CONDITIONS OF TIMISOARA

## STUDIUL INFLUENȚEI TEHNOLOGIILOR AGRICOLE ASUPRA INDICILOR CALITATIVI AI FRUCTELOR DE MĂR LA SOIUL JONATHAN IN CONDIȚIILE TIMIȘOAREI

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**Abstract.** *In this paper we studied the impact of the soil maintenance systems upon Jonathan apples' quality and production, cultivated in the western part of Romania. We studied and experimented less pollutant soil maintenance systems, mainly by using plants as green fertilizers. There were eight experimental variants: V1 – black field (2 manual hoeing + 2 mechanical hoeing) – control, V2 – seeding and incorporation in the soil with green manure (white clover), V3 – seeding and incorporation in the soil with green manure (bird's-foot trefoil), V4 – seeding with grass mixture 1 (2 manual hoeing), V5 - seeding with grass mixture 2 (2 manual hoeing), V6 - seeding with grass mixture + mulching, V7 - seeding with grass mixture + Roundup 360 SL (3 l/ha), V8 – mixed field, Roundup 360 SL (3 l/ha) + mechanical hoeing. At the same time, there were determined the physical features of apples (average weight, average diameter and average height) the refractometer dry substance and the sugars content, the total acidity (malic acid), the total minerals, the spectrophotometry vitamin C content and the microelements (Fe, Mn, Zn, Cu) through atomic absorption spectrophotometry (AAS), as well as the production obtained. In conclusion, the experimental variants where we used green manure (Trifolium repens or Lotus corniculatus) gave the highest productions, higher weight of fruits and higher content of sugars and minerals.*

**Key words:** Jonathan, apples, soil maintaining systems, quality

**Rezumat.** *In această lucrare a fost studiată influența sistemelor de întreținere a solului asupra calității și producției de măr, soiul Jonathan, cultivat în zona de vest a României. Prin aceste cercetări s-a urmărit întreținerea unei plantații de meri, într-un mod cât mai puțin poluant în ceea ce privește sistemul de întreținere a solului, prin folosirea îndeosebi de plante pentru îngrășăminte verzi. S-au stabilit 8 variante experimentale: V1 – ogor negru (2 prașile manuale + 2 prașile mecanice) – martor, V2 – înierbare și încorporare cu plante pt. îngrășământ verde (trifoi alb), V3 – înierbare și încorporare cu plante pt. îngrășământ verde (ghizdei), V4 – înierbare cu amestec de graminee 1 (2 prașile manuale), V5 – înierbare cu amestec de graminee 2 (2 prașile manuale), V6 – înierbare cu amestec de graminee și mulcire pe rândul de pomi, V7 – ogor erbicidat înierbare pe interval cu amestec de graminee + erbicidare pe rând cu Roundup 360 SL (3 l/ha), V8 – ogor*

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*combinat erbicidare pe rând Roundup 360 SL (3 l/ha) + prașile mecanice pe intervale. Experimental s-au determinat proprietățile fizice ale merelor (masă medie, diametru, înălțime), substanța uscată și conținutul în zaharuri prin metoda refractometrică, aciditatea exprimată în acid malic, substanțele minerale totale, conținutul de vitamina C spectrofotometric și microelementele (Fe, Mn, Zn, Cu) prin spectrofotometrie de absorbție atomică (SAA), precum și producția. În concluzie, variantele experimentale ce au folosit îngrășământul verde (ghizdei sau trifoi alb) au condus la producții ridicate, o masă a fructelor mai mare și un conținut în zaharuri și substanțe minerale sporit.*

**Cuvinte cheie:** Jonathan, mere, sisteme de întreținere a solului, calitate

## INTRODUCTION

In Romania apple tree culture occupied the II<sup>nd</sup> place concerning its cultivation and it represented 30% of the total orchards surface. In the European Union, Romania produces 3.6% of the total apple production. Rich in vitamins A, B1, B2 and C, but also in other nutrients, such as magnesium, phosphorus, iron and potassium, the apples have many good properties for human health (Baciu A., 2005; Grădinariu G. et al., 1998; Iordănescu Olimpia, 2008).

In this paper we studied the impact of the soil maintenance systems upon Jonathan apples' quality and production, cultivated in the western part of Romania. We studied and experimented. By this research we studied and experimented the maintenance of an apple orchard in a less pollutant soil maintenance systems (Blosma J., 2000; Lăzureanu, A., 2002; Iordănescu Olimpia Alina, Micu Roxana Elena, 2010), mainly by using plants as green fertilizers (Petre Gh., Petre Valeria, 2008).

## MATERIAL AND METHOD

The researches were done in the didactic orchard of Fruit Culture department from the Faculty of Horticulture and Forestry in Timișoara, the biological material being represented by Jonathan apple tree variety. The trees were grafted on MM106, the crown system being Palm Spindelbusch, while the trees were planted in 1997, being in full production.

By this research we proposed improving some technological links of apple culture in conditions of the western part of Romania and they belong to a Research project IDEI.

The experimental variants were: V1 – 2 manual hoes + 2 mechanical hoes – control variant, V2 - *Trifolium repens* on the interval, V3 – *Lotus corniculatus* on the interval, V4 - cover crops on the interval mixture 1 (2 manual hoes), V5 - cover crops on the interval mixture 2 (2 manual hoes), V6 - cover crops on the interval, mixed grass, and mulching, V7 - Roundup 360 SL (3 l/ha), cover crops on the interval, V8 - Roundup 360 SL (3 l/ha) + mechanical hoes on the interval. Each variant had 10 trees planted at the distance of 2 m on the row and 4 m between the rows. Experimentally, there were determined the physical features of apples (average weight, diameter and height) and the chemical features (dry substance and the content of sugars by refractometric method, the acidity – g/l malic acid, minerals, the content of vitamin C by spectrophotometry), but also the microelements content of apples (Fe, Mn, Zn, Cu) by atomical absorption spectrophotometry.

## RESULTS AND DISCUSSIONS

The results obtained concerning the physical features of Jonathan fruits in the two years of experiment are presented in tables 1 and 2.

In 2008, the biggest fruits were obtained in those variants where we used green manure, respectively variants  $V_2$  and  $V_3$ , followed by the variants where there were used grass cover crops and the control variant (table 1).

In 2009, the fruits had very close side indexes in the studied variants, but among them we remark the variants with plants used as green manure, the same as previous year (table 2).

Without question, the size of fruits is a parameter depending on the variety and less on other factors, but out of our researches we observed that in the variants where plants for green manure were used, the physical features of fruits were better comparative with the other studied variants.

Table 1

**Physical features of Jonathan apples in 2008**

Variant	Big diameter (cm)	Small diameter (cm)	Height (cm)	Size index
$V_1$ - 2 manual hoes + 2 mechanical hoes – control variant	8,1	7,9	7,0	7,66
$V_2$ - <i>Trifolium repens</i> on the interval	8,1	8,1	7,2	7,80
$V_3$ - <i>Lotus corniculatus</i> on the interval	8,0	7,9	7,3	7,73
$V_4$ - cover crops on the interval mixture 1 (2 manual hoes)	8,0	8,0	7,1	7,70
$V_5$ - cover crops on the interval mixture 2 (2 manual hoes)	7,9	7,8	7,3	7,66
$V_6$ - cover crops on the interval, mixed grass, and mulching	8,0	7,8	6,8	7,53
$V_7$ - Roundup 360 SL (3 l/ha), cover crops on the interval	8,0	7,8	6,9	7,56
$V_8$ - Roundup 360 SL (3 l/ha) + mechanical hoes on the interval	7,8	7,7	7,0	7,50

Table 2

**Physical features of Jonathan apples in 2009**

Variant	Big diameter (cm)	Small diameter (cm)	Height (cm)	Size index
$V_1$ - 2 manual hoes + 2 mechanical hoes – control variant	7,9	7,5	7,0	7,47
$V_2$ - <i>Trifolium repens</i> on the interval	8,1	7,9	7,6	7,87
$V_3$ - <i>Lotus corniculatus</i> on the interval	8,0	8,0	7,6	7,87
$V_4$ - cover crops on the interval mixture 1 (2 manual hoes)	8,0	8,0	7,1	7,70
$V_5$ - cover crops on the interval mixture 2 (2 manual hoes)	8,0	7,9	7,4	7,77
$V_6$ - cover crops on the interval, mixed grass, and mulching	8,0	8,0	7,2	7,73
$V_7$ - Roundup 360 SL (3 l/ha), cover crops on the interval	8,0	7,8	7,0	7,60
$V_8$ - Roundup 360 SL (3 l/ha) + mechanical hoes on the interval	7,9	7,9	7,6	7,80

The results obtained concerning the chemical features of Jonathan apples in the two studied years are presented in tables 3 and 4.

Table 3

**The chemical features of Jonathan apples in 2008**

Varianta	Minerals (%)	Vitamin C (mg/100 g fruit)	Dry substance (%)	Sugar (%)	Acidity (g/l malic acid)
V <sub>1</sub> - 2 manual hoes + 2 mechanical hoes – control variant	12,8	11,10	0,210	7,21	0,12
V <sub>2</sub> - <i>Trifolium repens</i> on the interval	13,9	12,27	0,193	7,40	0,19
V <sub>3</sub> - <i>Lotus corniculatus</i> on the interval	13,1	11,42	0,195	7,56	0,16
V <sub>4</sub> - cover crops on the interval mixture 1 (2 manual hoes)	12,9	11,21	0,173	7,15	0,14
V <sub>5</sub> - cover crops on the interval mixture 2 (2 manual hoes)	12,6	10,89	0,131	7,30	0,13
V <sub>6</sub> - cover crops on the interval, mixed grass, and mulching	12,8	11,10	0,156	7,15	0,17
V <sub>7</sub> - Roundup 360 SL (3 l/ha), cover crops on the interval	13,7	12,06	0,193	7,30	0,21
V <sub>8</sub> - Roundup 360 SL (3 l/ha) + mechanical hoes on the interval	12,7	10,99	0,210	7,51	0,15

In general, in apples, the content of sugars varies between 7.59% and 16.40% for 100 g of fruit. Out of table 3 we can see that in the climatic conditions of 2008 in Timisoara, the sugars content varied between 10.89% for variant V<sub>5</sub> - cover crops on the interval mixture 2 (2 manual hoes) and 12.27% in variant V<sub>2</sub> - *Trifolium repens* on the interval, all of the other variants having middle values.

The content of vitamin C in apples is normally of 1-47 mg/100g fresh fruit (mg %), while in our experiment the values varying between 7.15 mg/100 g fresh fruit in variants V<sub>4</sub> and V<sub>6</sub> till 7.56 mg/100g fresh fruit in V<sub>3</sub> - *Lotus corniculatus* on the interval.

Table 4

**The chemical features of Jonathan apples in 2009**

Varianta	Minerals (%)	Vitamin C (mg/100 g fruit)	Dry substance (%)	Sugar (%)	Acidity (g/l malic acid)
V <sub>1</sub> - 2 manual hoes + 2 mechanical hoes – control variant	12,7	11,00	0,193	7,19	0,14
V <sub>2</sub> - <i>Trifolium repens</i> on the interval	13,0	11,32	0,173	7,56	0,13
V <sub>3</sub> - <i>Lotus corniculatus</i> on the interval	13,2	11,53	0,182	7,37	0,17
V <sub>4</sub> - cover crops on the interval mixture 1 (2 manual hoes)	12,5	10,79	0,139	7,01	0,17
V <sub>5</sub> - cover crops on the interval mixture 2 (2 manual hoes)	12,2	10,47	0,171	6,98	0,21
V <sub>6</sub> - cover crops on the interval, mixed grass, and mulching	13,2	11,53	0,143	7,72	0,16
V <sub>7</sub> - Roundup 360 SL (3 l/ha), cover crops on the interval	12,7	11,00	0,216	7,24	0,18
V <sub>8</sub> - Roundup 360 SL (3 l/ha) + mechanical hoes on the interval	12,4	10,68	0,190	7,21	0,14

In 2009, the content of sugars had lower values than in the past year due to the climatic conditions in the period of apples' growth and maturation. Concerning variants' impact upon sugars content in fruits, we observed that in those variants where plants for green manure were used there were registered the higher values, while the lowest values were obtained in the apples of those variants where we used grass cover crops.

The content of vitamin C in 2009 was also lower than in 2008, the values varying between 6.98 mg/100 g fresh fruit in V<sub>5</sub> - cover crops on the interval mixture 2 (2 manual hoes) and 7.72 mg/100 g fresh fruit in V<sub>6</sub> - cover crops on the interval, mixed grass, and mulching on the tree row.

The results obtained concerning the metal content in Jonathan apples in the two studied years are being presented in tables 5 and 6.

Table 5

**Metals content in Jonathan apples in 2008**

Varianta	Fe ppm	Mn ppm	Zn ppm	Cu ppm
V <sub>1</sub> - 2 manual hoes + 2 mechanical hoes – control variant	5.33	0.73	1.83	1.83
V <sub>2</sub> - <i>Trifolium repens</i> on the interval	5.33	0.86	2.00	2.16
V <sub>3</sub> - <i>Lotus corniculatus</i> on the interval	6.83	1.00	1.83	2.50
V <sub>4</sub> - cover crops on the interval mixture 1 (2 manual hoes)	7.00	0.71	2.50	3.33
V <sub>5</sub> - cover crops on the interval mixture 2 (2 manual hoes)	7.50	0.98	1.66	1.83
V <sub>6</sub> - cover crops on the interval, mixed grass, and mulching	7.66	1.01	2.16	2.83
V <sub>7</sub> - Roundup 360 SL (3 l/ha), cover crops on the interval	7.00	0.85	3.00	3.16
V <sub>8</sub> - Roundup 360 SL (3 l/ha) + mechanical hoes on the interval	6.33	0.86	1.66	2.33

Table 6

**Metals content in Jonathan apples in 2009**

Varianta	Fe ppm	Mn ppm	Zn ppm	Cu ppm
V <sub>1</sub> - 2 manual hoes + 2 mechanical hoes – control variant	6.00	0.71	2.00	1.66
V <sub>2</sub> - <i>Trifolium repens</i> on the interval	5.33	0.85	2.16	2.16
V <sub>3</sub> - <i>Lotus corniculatus</i> on the interval	6.33	0.91	2.50	2.00
V <sub>4</sub> - cover crops on the interval mixture 1 (2 manual hoes)	6.83	0.86	1.83	2.50
V <sub>5</sub> - cover crops on the interval mixture 2 (2 manual hoes)	7.50	1.00	1.66	1.50
V <sub>6</sub> - cover crops on the interval, mixed grass, and mulching	7.00	0.81	2.16	2.16
V <sub>7</sub> - Roundup 360 SL (3 l/ha), cover crops on the interval	7.66	0.88	3.00	2.50
V <sub>8</sub> - Roundup 360 SL (3 l/ha) + mechanical hoes on the interval	8.00	0.85	3.16	3.00

The content of Zinc and Copper in both years, for all the experimental variants was under the maximum admissible limit 5.0 mg/kg, limit determined for the ecological culture of apple trees (Government Decision no. 189/2002).

In 2008, the zinc had the lowest values in V<sub>5</sub> - cover crops on the interval mixture 2 (2 manual hoes) and in V<sub>8</sub> - Roundup 360 SL (3 l/ha) + mechanical hoes on the interval. The highest content of zinc was determined in the apples of variant V<sub>7</sub>

and V<sub>4</sub>. Cooper's dynamic in fruits was almost similar to the one of zinc element, the highest value being observed in V<sub>4</sub>, while the lowest value was observed in the control variant and V<sub>5</sub> - cover crops on the interval mixture 2 (2 manual hoes).

In 2009, for zinc and also for copper V<sub>5</sub> - cover crops on the interval mixture 2 (2 manual hoes) had the lowest values. The highest content of these elements were registered in variants V<sub>7</sub> and V<sub>8</sub>, which are the variants where we used herbicides.

The highest content of iron and manganese, in 2008, was obtained in the apples of V<sub>6</sub> - cover crops on the interval, mixed grass, and mulching (7.66 ppm), while in 2009 the highest content of iron was determined in the apples of variant V<sub>8</sub> - Roundup 360 SL (3 l/ha) + mechanical hoes on the interval and of manganese in the apples of variant V<sub>5</sub> - cover crops on the interval mixture 2 (2 manual hoes).

## CONCLUSIONS

1. The experimental variants where we used plants for green manure, such as *Trifolium repens* and *Lotus corniculatus*, gave higher quality fruits (a higher content of sugars and minerals), than in variant V<sub>8</sub> - Roundup 360 SL (3 l/ha) + mechanical hoes on the interval.

2. The content of microelements for all studied variants was under the maximum admissible limit for the ecological culture of apple trees

3. The use of plants for green manure, but also of some other soil maintaining systems in apple orchards is favorable for obtaining good quality fruits.

4. The use of recommended doses and reducing the number of treatments with herbicides in apple orchards have favorable effects for obtaining apples at the standards required by the European Community.

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# RASPBERRY FLOWERS TO ORGANOGENESIS IN CLIMATIC CONDITIONS FROM NORTHEASTERN ROMANIA

## ORGANOGENEZA FLORALĂ LA ZMEUR ÎN CONDIȚIILE CLIMATICE DIN NE-UL ROMÂNIEI

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**Abstract.** *Research on the dormant bud so f raspberry fruit focused on determining the period of transition from vegetative to reproductive phase and development of floral elements in climatic conditions from north eastern Romania in years 2008, 2009, 2010. The results show remark able differences from year to year reflecting the cumulative action of climatic factors and hereditary varieties.*

**Key words:** raspberry, bud, organogenesis

**Rezumat.** *Cercetările privind repausul vegetativ la mugurii de rod de zmeur au vizat stabilirea perioadei de tranziție de la faza vegetativă la cea reproductivă, precum și evoluția dezvoltării elementelor florale în condițiile ecologice din NE-ul României în anii 2008, 2009, 2010. Rezultatele obținute demonstrează diferențe remarcabile de la un an la altul, ceea ce reflectă acțiunea cumulativă a factorilor climatici și ereditari ai soiurilor.*

**Cuvinte cheie:** zmeur, mugure, organogeneză

## INTRODUCTION

Phenophase flowering is preceded by differentiation of flower buds which includes two stages: floral induction and morphological differentiation. In the first stage, called by some authors (Ağaoğlu, 1999, quoted by Eydurán S. P. and Ağaoğlu Y. S., 2011) and "physiological differentiation phase") to create the conditions needed to change the direction of development of vegetative buds, from the formative stage at the flower buds (Istrate M., 2007). In the second phase floral elements are developed. Beginning, evolution of floral organogenesis process is different for each variety. The time of growth and development of flower buds is unevenly, with different intensities, depending on climatic conditions (egg temperature), species and agriculture measures applied (Mănescu C. et al, 1989). Floral induction can take place or not, before endodormancy, while the growth of floral elements may continue throughout the rest period (Takeda and Wisniewski, 1989). Floral organogenesis knowledge is very important for to identify of varieties with better adaptability to a certain area of culture and also for the application of agriculture measures before the onset of differentiation stage.

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## MATERIAL AND METHOD

**Plant material:** In this study we investigated Veten and Willamette raspberry varieties, planting of Fruit Research Station of UASVM Iasi. We collected 10-20 axillary buds (at 3-4 weeks intervals from August to April during the years 2008-2009 and 2009-2010) from the top of the floricanes branches with the same length, and were fixed and stored in FAA. The buds were sectioned with manual microtome. Necrosis buds were not taken into account. Bud stages of development were established by analyzing the stereomicroscope MOTIC and described by Mathers and Wood and M. Robertson, 1957 (quoted by S. Peral Atila Ağaoğlu and Y. Sabit, 2006):

Table 1

Stage development of *Rubus idaeus* L. bud

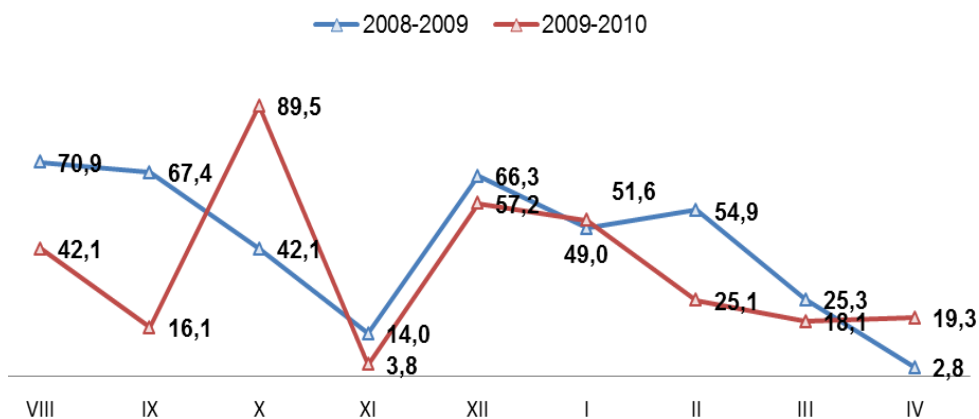
Stage	Description
1	There is no division in growing cone. Primer bud is in vegetative bud phase, growing cone is surrounded by leaf formations
2	inflorescence axis
3	broadened apex with sepal primordia;
4	three-lobed sepal primordia;
5	petal primordia;
6	dome-shaped receptacle;
7	stamen primordia
8	pistil primordia on bottom-half of receptacle
9	pistil primordia cover most of receptacle;
10	anther sacs on stamen and stylar and stigmatic tissues on pistil primordia, respectively.

**Daily climate data** were taken from the Research and Development Station for Viticulture and Vinification from Iasi (lat. 47°2' N), near of Fruit Research Station of U.S.A.M.V. Iasi, Romania.

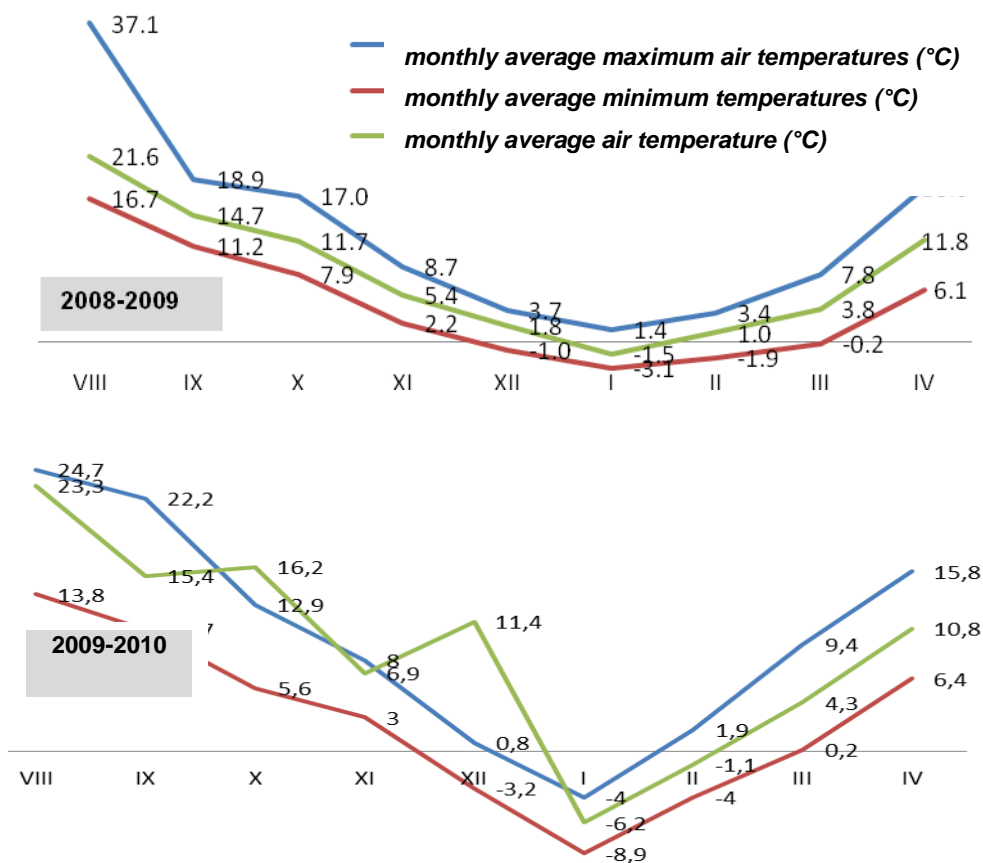
## RESULTS AND DISCUSSIONS

**Climatic conditions.** Average monthly maximum and minimum air temperature and rainfall (mm) recorded at the nearest weather station (Research and Development Station for Viticulture and Vinification), are shown in figure 1. and 2. The data obtained in 2008 reveals a high temperature in August (37.1°C, monthly average maximum, 20.3°C, monthly average) and precipitation over the normal limit (70.9 mm to 40.4 mm). The second decade of March delimits heat unit accumulation (base 5°C).





**Fig. 1** - Average monthly of precipitation (mm) recorded in lassy between August 2008 – April 2009 and August 2009 – April 2010



**Fig. 2** - Average air temperature (°C) recorded in lassy between August 2008 – April 2009 and August 2009 – April 2010

Veten and Willamette are two raspberries varieties which fructifying on two years branches (*floricane*) in summer. Buds formed on the first year branches are vegetative. In the second year this buds turn into generative bud (flower buds).

Analysis of sectioned buds showed differences between the two varieties in terms of floral organogenesis (table 2).

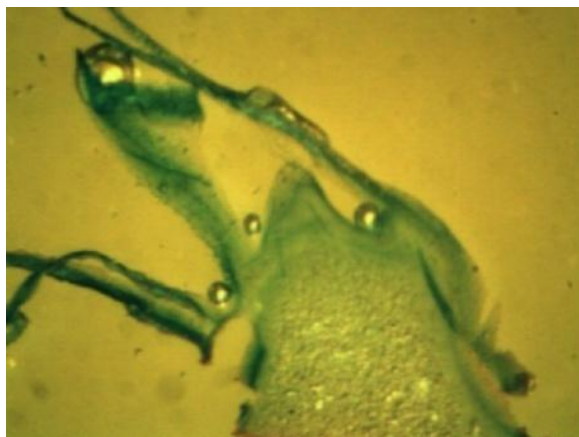
Table 2

**Bud developmental stages for Willamette and Veten in climatic conditions from north-eastern Romania between August 2008 – April 2009 and August 2009 – April 2010**

Variety	Bud developmental stages								
2008-2009									
	1 Aug.	26 Sep.	10 Oct.	29 Oct.	25 Nov.	19 Dec.	27 Jan..	26 Feb.	15 Mar.
Willamette	1.0 <sup>a</sup>	1.0 <sup>a</sup>	1.8 <sup>a</sup>	3.8 <sup>a</sup>	5.1 <sup>a</sup>	6.0 <sup>a</sup>	7.7 <sup>b</sup>	7.6 <sup>a</sup>	9.5 <sup>a</sup>
Veten	1.0 <sup>a</sup>	1.0 <sup>a</sup>	1.1 <sup>b</sup>	3.3 <sup>a</sup>	5.0 <sup>a</sup>	5.6 <sup>b</sup>	7.4 <sup>a</sup>	7.5 <sup>a</sup>	9.1 <sup>a</sup>
2009-2010									
	1 Aug.	28 Sep.	10 Oct.	29 Oct.	30 Nov.	29 Dec.	2 Feb.	28 Feb.	15 Mar.
Willamette	1.0 <sup>a</sup>	1.0 <sup>a</sup>	1.6 <sup>a</sup>	3.2 <sup>a</sup>	5.4 <sup>b</sup>	5.9 <sup>b</sup>	6.3 <sup>a</sup>	7.8 <sup>a</sup>	9.6 <sup>a</sup>
Veten	1.0 <sup>a</sup>	1.0 <sup>a</sup>	1.3 <sup>a</sup>	3.0 <sup>a</sup>	5.2 <sup>a</sup>	5.7 <sup>a</sup>	6.0 <sup>a</sup>	7.6 <sup>a</sup>	9.2 <sup>a</sup>

\*Mean separation within columns by Duncan’s multiple range test,  $P\leq0.05$ . See Table 1 for key descriptors of bud developmental stages.

In 2008, during August and September the both of raspberries varieties (Willamette and Veten) are still in vegetative stage (Stage 1). The primary terminal apex is still protected of the leaf primordia and some lateral apex. Floral induction process begins during the first half of October through the swelling and elongation of the terminal apex. (Stage 2, figure 3).



**Fig. 3 - Stage 2: growing cone**

In the ending of October, on the elongated apex appear the first floral primordia, usually five sepals primordia (Stage 3).

Petal primordia (Stage 4) of the terminal flower primordia by the differentiation between sepals primordia, in November later. Also there is increase in size of receptacles. That same month, until ending, flowers primordia axillary are bazipetal differentiated. It should be noted that by this time of floral organogenesis, the average air temperature has not dropped below 5°C. During the winter there is a very slow growth of inflorescence axis.

Stamen primordia (Stage 7) develop at the bottom of sepal primordia in January, followed by the differentiation of anther.

In March, on the receptacle which becomes tronconical, occurs in an acropetal and spiral sense, differentiate on of carpel primordia.

The results of this study demonstrate that the climatic factors have an effect on the rate at which the differentiation of floral organs occurred in buds.

Low temperatures in December 2009 (monthly average temperature was - 6.2°C) and January 2010 may be considered causes of falls in the value rate of development of buds. It should also be noted that low temperatures during this period are accompanied by low level of precipitation. The important role of temperature in the process of organogenesis is highlighted by the fact that in February 2010 there was a greater number of buds in the stage 8 of development, compared with 2009.

## CONCLUSIONS

1. Floral organogenesis process at the two varieties of raspberry occurred on dates very close. These studies about of raspberry flowers to organogenesis in climatic conditions from north-eastern Romania indicate that

temperature plays a major role in determining the extent of bud differentiation during winter.

2. Analysis of the effect of low temperatures during the dormancy period and the increase of temperature at early spring on the development of raspberry buds could lead to the development of climate models useful for predicting low chilling requirement to obtain an optimal crop.

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# ESTABLISHMENT MODE AND TIME OF CUTTING OF LAVENDER PLANTS FOR REGENERATION TO OBTAIN THE BEST FEATURES OF DECORATIVE AND VOLATILE OIL PRODUCTION

## STABILIREA MODULUI ȘI A EPOCHI DE TĂIERE PENTRU REGENERAREA PLANTELOR DE LAVANDĂ ÎN VEDEREA ÎMBUNĂTĂȚIRII CARACTERISTICILOR DECORATIVE ȘI PRODUCȚIEI DE ULEI VOLATIL

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**Abstract.** *In the technology of growing lavender, cutting shrubs to regenerate plants can influence inflorescence height, decorative capacity and production of oil. For this reason, the experimental versions exposed for this research study, present researches undertaken in order to determine the optimal timing for such operations and the height used for reaching efficiency both for those who want to use this species for ornamental purposes and for those who seeks a high production of oil. In this respect, observations and measurements were made in the inflorescence and the amount of volatile oil dosages. Statistical interpretation of data obtained show the superiority of regeneration cuts made in November or March, compared with those in July.*

**Key words:** *Lavandula angustifolia*, inflorescence, length, mass, vertical, volatile oil

**Rezumat.** *În tehnologia de cultivare a lavandei, tăierea tufelor pentru regenerarea plantelor poate influența major înălțimea inflorescențelor, capacitatea decorativă și producția de ulei volatil. Din acest motiv, variantele experimentale ale studiului de față expun cercetări cu privire la stabilirea momentului optim de efectuare a acestei operații precum și înălțimea la care se efectuează pentru a obține eficiența atât pentru cei ce doresc folosirea acestei specii în scop ornamental cât și pentru cei ce urmăresc obținerea unei producții ridicate de ulei volatil. În acest sens, s-au efectuat observații și măsurători la nivelul inflorescențelor și dozaje a cantității de ulei volatil. Interpretarea statistică a datelor obținute demonstrează superioritatea tăierilor de regenerare efectuate în lunile noiembrie sau martie, comparativ cu cele efectuate în iulie.*

**Cuvinte cheie:** *Lavandula angustifolia*, inflorescență, lungime, masă, verticile, ulei volatil

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## INTRODUCTION

*Lavandula angustifolia* Mill. has as primary usage in ancient times, due to scent baths pleasant flavor that gives to the water, and its soothing, antiseptic and healing of wounds action (Pârvu, 2004).

Subsequent writings show that the species can be considered one of the best tonic herbs for the nervous system, the infusion of flowers can even combat depression and melancholia. Flowers chase moth, having a repellent effect and being a good perfume for the clothes as well. For medicinal purposes are exploited the soothing, carminative, analgesic, antiseptic, diuretic properties etc. (Munteanu, 2007). The efficiency of oil production in recent years has increased from 2.3 to 2.6% (Hassiotis et al., 2010). Spectrum of uses of the species does not stop here, the flower being a valued ornamental and honey plant. In green spaces, *Lavandula angustifolia* Mill. can be planted either alone or in groups, in combination with other medium-sized perennial flower species, in rounds rebate, on lawns or even in street ware.

Technology introduction and definition of culture have been made in our country since 1950 near Brasov (Evdochia Coiciu, 1962) and in 1955, Traian Savulescu has made the first works to study the variability (Pârvu, 2004). The species is perennial and can stay in the same place more than 20 years if plants are properly maintained. Otherwise, the plantations can be damaged easily because of irrational exploitation. This study was done in order to highlight the extent to which the applied cut at *Lavandula angustifolia*, in certain times and at different heights, affect the ornamental value and quantity of essential oil gained.

## MATERIAL AND METHOD

Biological material with whom have been created the experimental versions belongs to Codreanca variety. The seeds were provided by the National Institute of Research and Development for Potato and Sugar Beet - Laboratory of Medicinal Plants, Brasov. From the seeds, was produced in 2005 seedlings that was used to establish experimental plots. The experiment was polifactorial and was organized by randomized block method (Ardeleanu, 2006). The two variables used in the experiment were the moment when were done the cuts of regeneration and the height at which they were made.

Planting scheme had distances of 100 cm between rows and 50 cm on the rows, resulting in a density of 20,000 plants / ha (Piroșca, 2000). The flowers collection began in the second year of culture, as stated by Păun (1995). After the fourth harvest, in 2009 cuts were applied to bush regeneration in several ways, depending on how the experimental field was organized. In the first experimental variant the regeneration cuts were made in July, immediately after harvest. The next experimental version the cuts have been applied in autumn, in November. In the third variant, cuts were applied in March the next year. In the fourth variant there were no regeneration cuttings. During the growing season that followed, there have been made observations and measurements of vertical inflorescence number, inflorescence length.

At collection moment, there has been weighed, separately on variants, the inflorescence mass harvested and then passed to the determination of volatile oil.

The first three experimental variants was introduced the second variable, cutting height from the ground. This was done at heights of 3 cm and 10 cm respectively.

For extraction of volatile oil were used fresh blossoms. The technique used was the steam being caught using a laboratory-type facilities Neo - Clevenger (Jitianu and Georgescu, 1999).

The data were recorded in a table and were subject to interpretation by statistical analysis of variance in the number of vertical inflorescence, inflorescence length, inflorescence mass harvested and the amount of volatile oil obtained (Ardeleanu and Sestraş, 1996).

## RESULTS AND DISCUSSIONS

The values of experimental measurements mentioned above can be discussed based on the use of plants of *Lavandula angustifolia* Mill. If the aim of regeneration after the cutting is an aesthetic one, then of course we would be interested in the performances in terms of number of flower blossom or its length. At these plants, the flowers are grouped in vertical inflorescence (Pârvu, 2004), which is directly proportional, from a numerical point of view, with the inflorescence length. As such table 1, which shows the performance achieved by our experimental variations in the number of vertical, shows the version where the number of vertical of the inflorescence was the highest, respectively 8, was the one where the regeneration of the cut was made at 3 cm, in November. The following, is one made in March, with a value of 6 vertical inflorescence.

Table 1

**Influence of cutting height and time for regeneration of plants of *Lavandula angustifolia* Mill. on the number of vertical blossom**

No	Cutting height	Age (months)	Number of vertical / Flowering			
			Pcs.	%	Difference	Significance
1	Cut at 3 cm	July	3	100	0	-
		November	8	266,67	5	***
		March	6	200	3	*
2	Cut at 10 cm	July	3	100	0	-
		November	4	133,33	1	-
		March	4	133,33	1	-
3	Uncut (Mt)	-	3	100		-
4	DL 5%				2,44	
	DL 1%				3,39	
	DL 0,1%				4,91	

The lowest values were recorded in cases where the regeneration cuts were made at a height of 10 cm or were made immediately after harvest in July or were not made at all. Among these cases the differences were small, the values ranging between 3 and 4 vertical inflorescence.

Inflorescence length is another factor through which the aesthetic value of plants of *Lavandula angustifolia* Mill. can be put into relief. Performances were

recorded in all the variants where regeneration cutting was performed at 3 cm, in November (table 2).

Table 2

**Influence of cutting height and time for regeneration of plants of *Lavandula angustifolia* Mill. on the length of inflorescence**

No	Cutting height	Age (months)	Inflorescence length (cm)			
			Length	%	Difference	Significance
1	Cut at 3 cm	July	3,1	110,71	0,3	-
		November	7,2	257,14	4,4	***
		March	5,7	203,57	2,9	*
2	Cut at 10 cm	July	2,5	89,29	-0,3	-
		November	4,2	150	1,4	-
		March	4,5	160,71	1,7	-
3	Uncut (Mt)	-	2,8	100		
4	DL 5%				2,31	
	DL 1%				3,21	
	DL 0,1%				4,66	

As in the case of analyzing the number of vertical blossom, the next version, in descending order of values, is the one where the cut was short and was made in March. It is highlighted positive influence of the number of vertical on the length of inflorescence, with clear implications for decorative effects in plants.

In tables 3 and 4 there are the results of parameters related to the productive capacity of the plant at all experimental variants. The flowers harvested in July, were weighed immediately.

Table 3

**Influence of cutting height and time for regeneration of plants of *Lavandula angustifolia* Mill. on the mass of inflorescences**

No	Cutting height	Age (months)	Inflorescence mass (t / ha)			
			Production	%	Difference	Significance
1	Cut at 3 cm	July	0,95	141,79	0,28	-
		November	3,83	571,64	3,16	***
		March	3,21	479,10	2,54	**
2	Cut at 10 cm	July	0,45	67,16	-0,22	-
		November	1,36	202,99	0,69	-
		March	1,65	246,27	0,98	-
3	Uncut (Mt)	-	0,67	100		
4	DL 5%				1,62	
	DL 1%				2,26	
	DL 0,1%				3,27	

The largest amount of flowers were collected from variants where the regenerating cuttings were short, to 3 cm and done in the months of rest, in November and March. Through apical dominance, the most vigorous shoots are formed from the terminal and closest shoots. The cuts made have eliminated this phenomenon, prompting the vegetation of basal shoots. From the data obtained,



abundant growth is highlighted, and the emergence of more flowers for short cuts. Thus, at the version cut to 10 cm and the witness, were obtained the lowest values for all parameters. This indicates that the shoots placed in terminal and superior position shoots generate lower growth than the other variants.

Table 4

**Influence of cutting height and time for regeneration of plants of *Lavandula angustifolia* Mill. on the quantity of volatile oil**

No	Cutting height	Age (months)	Oil quantity (l / ha)			
			Production	%	Difference	Significance
1	Cut at 3 cm	July	7,1	151,07	2,4	-
		November	33,72	717,45	29,02	***
		March	29,66	631,06	24,96	**
2	Cut at 10 cm	July	3,36	71,489	-1,34	-
		November	11,96	254,47	7,26	-
		March	12,99	276,38	8,29	-
3	Uncut (Mt)	-	4,7	100		
4	DL 5%				12,84	
	DL 1%				17,85	
	DL 0,1%				25,85	

The amount of oil is directly proportional to the mass of fresh flowers harvested.

An interesting aspect is the influence and timing of making cuts, the regeneration cuts described in the experiment conducted in November and March had the best results. Perhaps this is because in winter the concentration of cellular juice is higher, leading to a slight wound healing, loss through drying is less. This can be confirmed that the variant in which the cuts were made at 3 cm, but in July, results were lower in all parameters studied. They are smaller than the values obtained for variants in which cuts were made at 10 cm, but in the cold season, or were not executed.

## CONCLUSIONS

1. Version witness, which had no cutting, recorded the worst results in terms of vertical inflorescence number, inflorescence length, inflorescence mass and the quantity of oil.

2. Regeneration cuttings carried out immediately after harvest have negative effects, the results are very close to the witness version.

3. The variant which consistently showed significant differences, compared with positive control, was the version where the cuts were made at 3 cm in November.

4. The experiment demonstrates that regeneration cuts occur in physiological balance, positively affecting both vegetative growth and floral induction.

5. Regeneration cuttings may have a role in regulating metabolic processes which have biochemical implications in plastic and circulation of the hormone and thus influenced the quantity of oil accumulated in the flowers.

6. Both for decorative purposes and for collection of flowers, it is recommended that the regeneration cutting process is made at 3 cm, in November.

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# SCREENING THE INFLUENCE OF TEMPERATURE AS STRESS FACTOR IN THE ORIENTATION OF MORPHOGENETIC REACTION OF *BRASSICA OLERACEA* ANTHERS CULTIVATED *IN VITRO*

## STUDII PRIVIND INFLUENȚA TEMPERATURII CA FACTOR DE STRES DETERMINANT ÎN ORIENTAREA REACȚIEI MORFOGENETICE A ANTERELOR DE *BRASSICA OLERACEA* CULTIVATE *IN VITRO*

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**Abstract.** Anther culture has become a powerful tool for the rapid production of haploid and inbred lines used for obtaining hybrid cultivars and it has reduced significantly the time required for breeding new cultivars by at least 2 to 3 years. Androgenesis results in homozygous progeny from a heterozygous parent in a single generation and provides excellent material for research, plant breeding and plant transformation. There are many factors that influence the effectiveness of anther culture and these factors may also interact. Some of major factors are genotype, donor plant growth conditions, anther pretreatment, time of their flowering, microsporogenesis phase, cultivation media composition, temperature shock and environment conditions. The aim of the present work was to assess the influence of temperature as stress factor in the orientation of morphogenetic reaction of *Brassica oleracea* anthers cultivated *in vitro* toward the obtaining of haploid plants.

**Key words:** haploids, embryo, callus, cabbage, shoots

**Rezumat.** Cultura de antere a devenit un instrument puternic de producere a plantelor haploide utilizabile pentru obținerea de plante haploide, reducând semnificativ timpul necesar pentru crearea de noi cultivare. Androgeneza presupune realizarea unor plante homozigote pornind de la un părinte heterozigot, într-o singură generație, oferind astfel un material excelent pentru cercetarea fundamentală dar și pentru ameliorarea și transformarea genetică a plantelor. Factorii care influențează orientarea reacției morfofenetice a anterelor sunt multipli, iar eficacitatea androgenezei depinde și de interacțiunea dintre acești factori. Principalii determinanți sunt genotipul, condițiile de creștere a plantelor donor, pre-tratamentul anterelor, timpul de înflorire, faza de microsporogeneză, compoziția mediului de cultură, aplicarea unor șocuri termice și condițiile de creștere. Scopul prezentului studiu a fost determinarea influenței temperaturii, ca factor de stress în orientarea reacției morfofenetice a anterelor de *Brassica oleracea* cultivate *in vitro*.

**Cuvinte cheie:** haploizi, embrion, calus, varza, lăstari

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## INTRODUCTION

The haploid plants derived from anther culture have been used to produce homozygous diploids, in many plant species due to the fact that using this technique we can accelerate breeding programs. For *Brassica* spp. haploid plants production through anther culture proved to be an important goal for tissue culture scientist all over the world. Traditionally, plant breeders usually achieve isogene lines, utilized as parent lines for F1 hybrid production by using the self-pollination, which is a highly time consuming process. Using tissue culture technique, more precisely anther culture, homozygous plant can be produced within a year as compared to the long inbreeding method, which might take 8-10 years. Therefore, *in vitro* techniques are considered to be alternative tools of conventional method of *Brassica* improvement.

The regeneration of haploid plants from anther culture depends on a wide range of factors, from which we underline: the genotype, culture media, physiological status of donor plant, anther wall factor, stage of pollen development, and effect of temperature and light.

In the last two decades, remarkable progress in anther culture technology has been made in all major *Brassica* species, but most of them are concentrated on oilseed rape (*Brassica napus*) (Palmer et al. 1996). Comprehensive utilization of this doubled-haploid production system has been involved in *Brassica* breeding programmes as well as in gene transfer, biochemical and physiological studies, and other manipulations (Palmer et al. 1996). However, all these applications largely depend upon efficient protocols that are specific for each species and sometime even for each genotype.

As mentioned before, there are various factors influencing anther culture success and among them is also temperature regarded as stress treatments (Dunwell, 1983). Among these stress factors in *Brassica* anther culture, many authors reported the importance of a short heat shock treatment that is basically required to stimulate anther development toward direct organogenesis and embryogenesis.

In spite of its critical role in other species, the cold pretreatment is less frequently used in *Brassica* species. Moreover, the significance of cold pretreatment in *Brassica* anther embryogenesis seems contradictory in previous studies. Some authors reported effective results from cold pretreatment of flower buds or inflorescences in *Brassica* sp. (Lichter 1982), while others underlined negative effects in *B. napus* (Dunwell et al. 1983) and *B. rapa* (Munshi 1996).

These contradictory results regarding the influence of cold pretreatment over the morphogenetic reaction of anther cultivated *in vitro* may lead to misunderstanding of its role and may conduct to an inappropriate application in *Brassica* anther culture.

Our study focused toward the evaluation of low temperature effect, regarded as stress pretreatment, applied to flower buds before inoculation to culture media combined with heat shock applied to anthers immediately after inoculation.

## MATERIAL AND METHOD

The plant material utilized in this research is represented by two varieties BC 145 and BC 321 that belongs to Vegetable Research and Development Station

Bacau, Romania. Donor plants were grown in controlled conditions, in greenhouses, with a proper regime of watering, fertilization and pest control.

The explants, represented by buds measured 3.0 – 3.4 mm in length and a ratio of petal length to anther length (0.5–0.75) (Gu et al., 2004, cited by Wedzony, 2007). These buds contained anthers with microspores at late uninucleate to binucleate stage (observed using 1% aceto-carmin under microscope). Part of the selected buds with microspore were wrapped with polythene bag and kept at 4°C for 2 days (variant V1), 4 days (variant V2) and 7 days (variants V3). The control variant is represented by fresh buds with no temperature stress (V0). The abnormal anthers of the bud were discarded and those at the appropriate size and age were used in the culture.

The explants were washed thoroughly under running tap water for 30 min and treated with a surfactant, Tween 20 (10 drops per 100ml of sterilized distilled water). Later these explants were surface sterilized with 0.1% mercuric chloride (w/v) for 15 min and repeatedly washed using sterilized distilled water. Under aseptic conditions, anthers were removed from the sterilized buds using a fine Tweezers (forceps) and inoculated on sterile tubes with culture media containing MS macro and microsalts (Murashige Skoog, 1962) supplemented with vitamins MS, 1962 and the following hormonal formula - BA- 8.8  $\mu$ M +2.7  $\mu$ M NAA. The hormonal formula utilised was determined to be the most effective in different prior experiments.

The cultures were incubated at 33°C temperature for one week in complete dark. After that the cultures were transfer in culture chambers with controlled light, humidity and temperature control at 25°C, a 16-h photoperiod, and 5000 lx light intensity. Fifty anthers of each genotype were inoculated into each treatment.

Four to five weeks after inoculation of anthers, they were removed aseptically from the culture tubes on a sterilized glass plate inside the laminar airflow cabinet and were placed again on freshly prepared sterilized medium containing appropriate hormonal supplements for plant regeneration. Sub culture was done in the MS media containing different combinations and concentrations of BA and NAA. The sub cultured culture tubes were again incubated at 25°C with 16 hrs photoperiod for 5-7 days. Repeated sub cultures were done at an interval of 15 days and incubated under the same temperature as mentioned previously. After shoot initiation, more light intensity was used for shoot elongation. The culture vessels showing signs of contamination were discarded. Day to day observation was carried out to note the responses.

In the course of the experiments the number of anthers producing callus and embryoids were recorded. The number of embryoids with cotyledons and roots developed in tubes were marked also.

The frequency of both type of reaction and the frequency of reacted anthers were calculated in percentage to the *in vitro* set initial explants. The frequency of the regenerated microplants was presented in percentage both to the total number of anthers and to the number of obtained direct embryoids from the respective genotype.

## RESULTS AND DISCUSSIONS

Low temperature stress is one of the most important but least studied abiotic stresses affecting plant development in tissue culture. The reproductive stage is the most susceptible stage for temperature stress in most crops in which temperature response has been studied (Paulsen 1994; Angadi et al. 2000).

The results obtained in our experimentations and presented in the present paper sustain this theory. The application of low temperatures, regarded as stress factor,

before the inoculation of the anthers on the growth media had significant influence over the induction and orientation of the explant morphogenetic reaction.

The reaction of the anthers at both genotypes utilized in the present paper ranged between direct embryogenesis and organogenesis and induction of callusogenesis. Regarding the callusogenesis, the temperature influenced the type and consistence of callus. We identified three callus morphotypes that were normally developed at the end of each subculture period: a friable white callus with no buds – fig. 1, a green-yellowish callus with no or scarce buds, and a hard green callus – fig. 2 covered with patches of buds and leafy structures that eventually developed into elongated shoots. White friable calluses were identified mainly on the variant V1 and V0, and even if subcultured on new fresh media it did not show reversion to green callus. The hard green calluses with buds were found to be developed from the anthers that were treated with a shock temperature of  $+4^{\circ}\text{C}$  for 4 days. While at variant V3 the callus structures were more yellowish colored than the previous one and proved to have a low capacity to develop shoots.



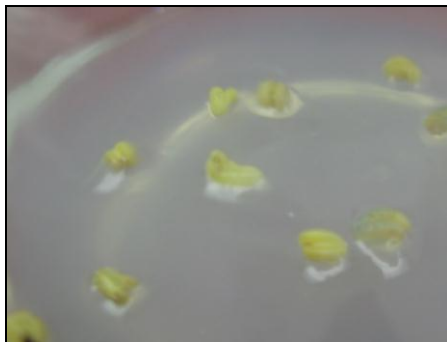
**Fig. 1** - Friable white callus with no buds developed from anthers with no temperature stress (V0 - control)

Both genotypes of *Brassica* utilized in our experiments are responsive to cultivation in vitro. The anthers after incubation at  $33^{\circ}$ , in dark conditions started to increase in size – fig. 3, becoming globular-shaped. On their surfaces started to appear small meristematic centers that evolved in fully developed plants or in plantlets without a root system. After four to five weeks from the inoculation times, the cultures were transferred on freshly prepared sterilized medium containing MS media with BA and NAA.



**Fig. 2** – Hard green callus generated from anthers that were treated with a shock temperature of  $+4^{\circ}\text{C}$  for 4 days – variant V2.

On these media, incubated at 25°C with 16 hours photoperiod, the cultures continue to develop as more shoots arise at the base of the first appeared plantlet. The best morphogenetic reaction quantified as the percentage of reactive anthers comparing with the total number of explants placed in culture, as well as regenerated plants.



**Fig. 3** – Anthers on induction media after stress treatment

The interpretation of results obtained after the development of the experiment underline the fact that anthers respond well to a short stress treatment at +4°C for 4 days.



**Fig. 5** – Small meristematic clusters formed at the base of the initial plantlet

This temperature pre-treatment of flower buds increased frequencies of organogenesis upto 34.17% and 43.32% at genotype BC 145 and genotype BC 321 respectively in MS-medium supplemented with BA- 8.8  $\mu\text{M}$  +2.7  $\mu\text{M}$  NAA.

After the first plantlets appeared, they were removed aseptically from the culture tubes on a sterilized glass plate inside the laminar airflow cabinet and were placed again on freshly prepared sterilized medium containing the same hormonal supplements. Gradually, at the basis of each new plantlet, both on the surface and inside the medium started to appear small meristematic centers - fig. 4 that evolved in embryoids and fully formed plants. Rooted plants were hardened by maintaining a high humidity (90% RH) during first week of hardening, which resulted in more than 80% survival of plantlets.

## CONCLUSIONS

1. The purpose of the study was the accomplishment of a screening regarding the influence of temperature utilised as stress factor in the orientation of morphogenetic reaction of *Brassica oleracea* anthers cultivated *in vitro*.

2. The results obtained showed that the application of low temperatures +4°C, before the inoculation of anthers on growth media had significant influence over the induction and orientation of the explant morphogenetic reaction.

3. The reaction of the anthers at both genotypes utilized in the present paper ranged between direct embryogenesis and organogenesis and induction of callusogenesis.

4. From the three variant tested, the variant V2, meaning +4°C for 4 days increased frequencies of organogenesis upto 34.17% and 43.32% at genotype BC 145 and genotype BC 321 respectively in MS-medium supplemented with BA-8.8 µM +2.7 µM NAA.

5. The development of a standardized *in vitro* haploid production protocol for Brassica spp. will help in the production of homozygous inbred lines for use in development of synthetics or hybrid varieties.

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# STUDY ON THE PRECOCITY INDEXES DURING THE ANNUAL GROWTH CYCLE OF GRAPEVINE, IN BLAJ WINE-GROWING CENTER, TÂRNAVE VINEYARD

## STUDIU ASUPRA INDICILOR DE PRECOCITATE AI CICLULUI VEGETIV ÎN CENTRUL VITICOL BLAJ, PODGORIA TÂRNAVE

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**Abstract.** *In the experience placed at SCDDV Blaj has been pursued the unfolding of the main phenophases at the grape varieties: Astra, Blasius, Selena and Fetească regală, in climate conditions of the years 2009 and 2010. Precocity index of the vegetation cycle was calculated using Barbeau's formula (1998). In the two years, to the varieties: Astra, Blasius and Selena the vegetation start was earlier than at Fetească regală, variety enshrined in Târnavă Vineyard. It was established a close link between the vegetation phases and the amount of useful temperatures. Precocity of vegetation cycle was influenced by the flowering moment. On average, in 2010 it was found a precocity of vegetative cycle ( $iPcy = 100.00$ ) compared to 2009 ( $iPcy = 99.98$ ), although the climatic condition in 2009 were more favourable for vine culture than 2010. Between precocity indexes of veraison and precocity of vegetative cycle was established in 2009 a significant positive correlation ( $r = 0.98^*$ ) and a negative nesemnificativă correlation in 2010 ( $r = -0.93$ ).*

**Key words:** grapevine, precocity index of the annul cycle, floraison, veraison

**Rezumat.** *În experiența amplasată la S.C.D.D.V Blaj s-a urmărit desfășurarea principalelor fenofaze la soiurile: Astra, Blasius, Selena și Fetească regală, în condițiile climatice ale anilor 2009 și 2010. Folosind formula lui Barbeau, 1998, s-a calculat indicele de precocitate al ciclului vegetativ. În cei doi ani, Astra, Blasius și Selena au intrat în vegetație mai repede decât Fetească regală, soi consacrat în Podgoria Târnavă. Între fazele de vegetație și suma temperaturilor utile s-a stabilit o corelație semnificativ pozitivă. Precocitatea ciclului de vegetație a fost influențată de momentul înfloritului. În medie, s-a constatat o precocitate a ciclului vegetativ în anul 2010 ( $iPcy = 100.00$ ) față de cel din anul 2009 ( $iPcy = 99.98$ ), chiar dacă condițiile climatice din anul 2009 au fost mai favorabile culturii viței de vie decât în 2010. Între indicele de precocitate a pârghii și cel al ciclului vegetativ s-a stabilit o corelație pozitiv semnificativă în 2009 ( $r=0.98^*$ ) și una negativă nesemnificativă în 2010 ( $r=-0.93$ ).*

**Cuvinte cheie:** viță de vie, indice de precocitate, înflorire, pârghă

## INTRODUCTION

In septentrional viticulture, precocity of the annual cycle of vegetation is very important for grapes, especially for the harvest quality (Asselin et al., 2001). In regions of northern limit of the vine growing, the amount of temperatures and sun exposure

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during the vegetation are favorable, but also, it can occur periods of high humidity through veraison and grapes ripening (Barbeau et al., 1998).

Knowing the precocity of annual cycle of vine is necessary to ensuring a proper grapes ripening, in the most favorable conditions of the year. Phenological phases: budburst, flowering, veraison and grapes ripening, are indicators of precocity of the vine cycle. The dates of these phases are linked between them, but between flowering and veraisons, is established the closest connection. The rest of the phenophases is best correlated with budburst; this phase depends not only on climate and soil, but also to the winter temperatures and with the pruning moment (Jones et al., 2000).

Mostly flowering, veraison and grapes ripening are influenced by climatic factors. According to Barbeau et al. (1998), precocity is a genetic characteristic of varieties. Morlat (2001) and Carbonneau et al. (1992) showed that the budburst precocity is influenced by active temperatures (above 10°C) for seven consecutive days. Flowering, veraison and grapes ripening are positive correlated with temperature and negatively correlated with precipitation (Jones et al., 2000). Van Leeuwen et al., 2008 revealed a positive correlation between phenological stages and useful temperatures (Winkler index).

## MATERIAL AND METHOD

The research conducted at S.C.D.V.V. Blaj have been pursued the unfolding of phenological phases in the climatic conditions of the years 2009 and 2010. Grapevine varieties studied were Astra Blasius, Selena and Fetească regală.

The plantation was established in 2001, with planting distances of 2.00 m between rows and 1.20 m between vines on row. Training system was Guyot with periodic replacement cordons, pruned on spurs and canes, with a load of 20 buds/m<sup>2</sup>.

The observations and measurements were made on 30 block vines of each variety and phenological stages have been noted using the Baggionioni code. In 2009, budburst was monitored in 8, 11, 15 and 18 April, the flowering in 4, 8 and 12 June, the veraison, since July 25 until August 10 every two days and then at grapes ripening, every five days until harvest. In 2010, due to winter climatic conditions, the start into vegetation was later to all varieties comparing to 2009, so, budburst was monitored on 15, 19 and 22 of April, the flowering in 2, 4, 7, 10 of June, veraison every two days between 30 July to 15 August, and then at grapes ripening to every five days until harvest.

In budburst phase were counted the buds in stage C. The middle budburst was considered when more than 50% of buds were in stage C. The flowering was estimated visually to every inflorescences on each vine. It were note from 1 to 5, depending on the degree of flowering: 1: 0-10%, 2: 10-30%, 3: 30-50% 4: 50-80%, 5: 80-100%. Flowering percentage was calculated using the Bodin's formula (2003):

$$\text{Flowering} = \frac{(n<10\%)x1+(n<30\%)x2+(n<50\%)x3+(n<80\%)x4+(n>80\%)x5}{\text{Total number of inflorescences}}$$

The middle flowering was considered when 50% of inflorescences were flowered. Veraison phase was difficult to pursue because the grapes were white varieties. For a better assessment was combined the visual and tactile scoring. Thus, the grape berries riped had a light green color, soft, with translucent skin. To calculate the veraison percentage, each cluster observed, was noted from 1 to 5 in this way: 1: 0-10%; 2: 10-30%; 3: 30-50%; 4: 50-80%; 5: 80-100%. Percentage of veraison was calculated using the Bodin's formula (2003):

$$\% \text{ Veraison} = \frac{(n < 10\%)x1 + (n < 30\%)x2 + (n < 50\%)x3 + (n < 80\%)x4 + (n > 80\%)x5}{\text{Total number of clusters}}$$

Based on the veraison percentage was calculated the veraison middle. Barbeau et al., (1998) have proposed the following indices: the flowering precocity index (iPf), the veraison precocity index (iPv) and the index of precocity of the annual vegetation cycle (iPcy). Thus indices show the potential of the grapevine variety, of the wine-growing region, etc.

$$iPf = 100 * [1 + (fm - fi) / fm]$$

$$iPv = 100 * [1 + (vm - vi) / vm]$$

$$iPcy = iPf + 100 * [(vm - fm) - (vi - fi) / (vm - fm)]$$

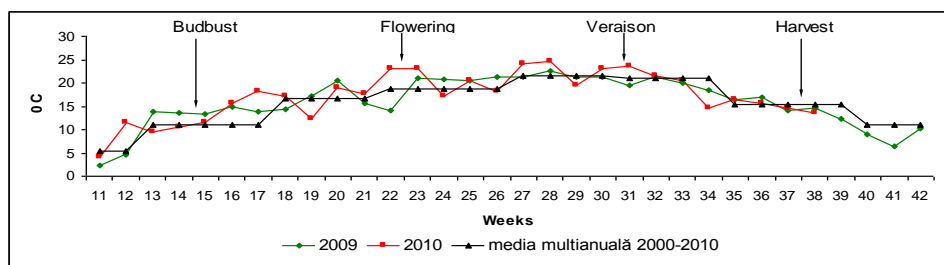
where: fm = flowering middle; fi = flowering at variety;

vm = veraison middle; vi = veraison at variety

Statistical analysis of data was made using Duncan test, variance analysis and correlation between variables (Ardelean, 2007).

## RESULTS AND DISCUSSIONS

Blaj wine-growing center has a long grapevine tradition. The unfolding of the grapevine phenophases is influenced by climatic conditions. In general, at Blaj, vines budburst takes place during the first decade of April. In 2010, due to the lower daily mean temperatures, budburst was delayed with 3-4 days compared to the previous year. In 2010 on the flowering period, the mean temperatures were higher than the annual average and were lower in 2009. The same situation was during veraison period. During the grapes ripening, in both years, the temperatures were below the annual average. In 2010 it can see the temperature variations, which have disrupted the normal unfolding of growing phases (fig. 1).



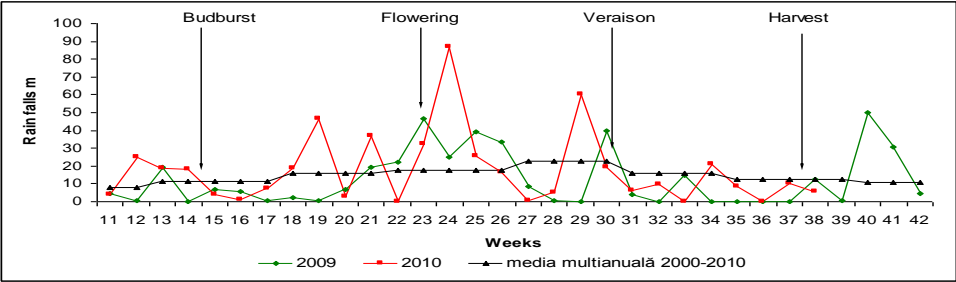
**Fig. 1** - Average temperature during the main phonological phases

Regarding the rainfall level, 2009 was characterized as a droughty year and year 2010 as a rainy one. In the 2009, it can observed two periods in which precipitation have been below the annual average that are immediately after the budburst and then after the veraison, period when is favored the sugars accumulation (fig. 2).

In 2010, the plentiful rainfalls during flowering and before veraison, the phenophases are delayed with 2-3 days compared to last year. Usually, in climatic conditions of Blaj, vines budburst is during the first half of April. In 2010, budburst was delayed compared to 2009 to all studied varieties (fig. 3).

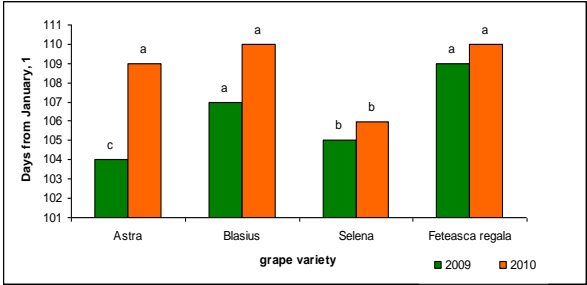
In 2009, the earliest variety was Astra, followed by Selena, at significant difference and the latest were the other two varieties, Blasius and Fetească regală.

In next year, 2010, Selena had the earliest budburst, while the other varieties were significantly later, with no statistically differences between them.



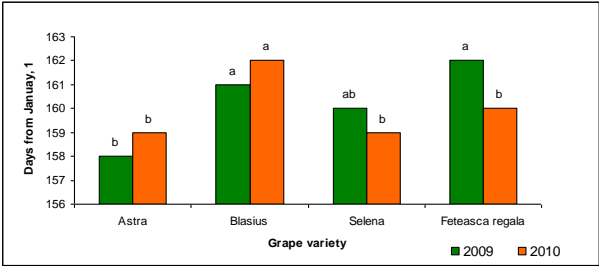
**Fig. 2 - Total rainfalls during the main grapevine phenophases**

Usually, in Blaj, grapevines flowering take place during the first decade of June. From figure 4, it can be observed the varieties difference to flowering, but between years, the differences were very small.



**Fig. 3 - Budburst middle – days after January, 1<sup>st</sup>, 2009 and 2010**

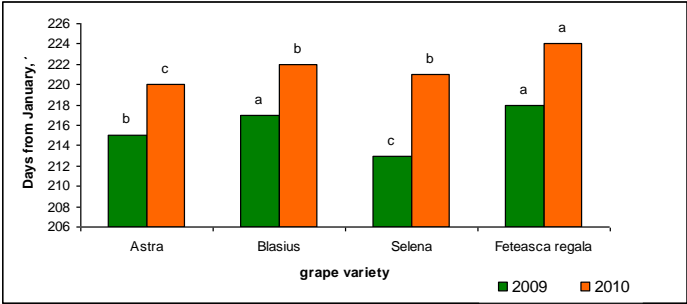
In 2009, there was an earlier flowering for Astra variety, but statistically equal to that of Selena variety. Fetească regală and Blasius had been flowering later with 1-2 days, than previous varieties.



**Fig. 4 - Flowering middle – days after January 1<sup>st</sup>, 2009 and 2010**

In 2010, the earliest flowering was on Astra and Selena, followed by Fetească regală, statistically equal, and Blasius variety was the latest. It can see that, Selena and Fetească regală, had a late flowering in 2009, compared to 2010. Climatic conditions influenced the most the veraison phase, especially by the rainfalls. From figure 5, it can notice a delay of 5-6 days to veraison in 2010, comparing to previous year.

In 2009, the start of veraison was to Selena, followed by Astra, at significant difference. The latest veraison was on Fetească regală and Blasius varieties.



**Fig. 5** - Veraison middle – days after January 1<sup>st</sup>, 2009 and 2010

In 2010, the earlist veraison was on Astra, followed by Blasius and Selena, and the latest was on Fetească regală. It can observe that Selena and Fetească regală varieties had an earlier veraison, even if they had a late flowering, in 2009. As other authors have highlighted (Carbonneau et al., 1992; Van Leeuwen et al., 2008) phenological phases deployment is greatly influenced by the sum of useful temperatures, establishing distinct significant positive correlation( $r = 0.95$ ).

Based on the precocity indices of flowering and of veraison were calculated the precocity indices of vegetative cycle. According to Barbeau, 1998, iPcy values less than 100 means a delay of the cycle of vegetation, and values higher than 100 show a precocious cycle. Between studied years, have been observed the differences of precocity. Thus, Astra and Blasius varieties have better used the climatic conditions of 2010, with the precocity indices of the vegetativ cycle over 100 compared to 2009 when these values were below 100. Instead, in both years, Selena had an earlier vegetation, registering the folowing iPcy values: 104.66 in 2009 and 100.23 in 2010. Fetească regală had a late vegetative cycle in both years (98.01 in 2009 and 96.41 in 2010) (table 1).

*Table 1*

Precocity indices of the annual cycle of vegetation		
Variety/Year	2009	2010
Astra	98.67 ± 1.00	101.82 ± 1.13
Blasius	98.63 ± 0.86	101.53 ± 0.95
Selena	104.66 ± 0.88	100.23 ± 1.08
Fetească regală	98.01 ± 0.89	96.41 ± 1.14
Experience average	99.98 ± 0.55	100.00 ± 0.56

*Table 2*

Correlations between the precocity indices			
Year	iPf/iPv	iPf/iPcy	iPv/iPcy
2009	- 0,88	- 0,79	0,98*
2010	0,97*	0,96*	- 0,93

On average, there is a precocity of vegetative cycle in 2010 ( $iPcy = 100.00$ ) compared to 2009 ( $iPcy = 99.98$ ). To see a better the connection between the three indices different correlations were made between them.

Overall, in 2009,  $iPf$  had no effect on  $iPv$  ( $r = -0.88$ ) and  $iPcy$  ( $r = -0.79$ ), but  $iPv$  had a significant correlation with  $iPcy$  ( $r = 0.98$ ) (table 2).

## CONCLUSIONS

1. Climatic conditions have influenced the unfolding of the main grapevine phenophases.

2. In both studied years, the varieties Astra, Blasius and Selena have an earlier start in vegetation than Fetească regală, grape variety enshrined in Târnave Vineyard.

3. On average, it was found a precocious vegetative cycle in 2010 ( $iPcy = 100.00$ ) compared to 2009 ( $iPcy = 99.98$ ), although climatic conditions in 2009 were more favorable than in 2010.

4. In 2009 between veraison precocity index and precocity index of annual cycle has been established a significant positive correlation ( $r = 0.98^*$ ) and significant negative correlation ( $r = -0.93$ ) in 2010.

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# THE INFLUENCE OF PARRAFIN TYPE ON MAIN CHARACTERS REGARDING GRAFTED VINES QUALITY, AT S.C. JIDVEI SRL, TÂRNAVE VINEYARD

## INFLUENȚA TIPULUI DE PARAFINĂ ASUPRA PRINCIPALELOR CARACTERE URMĂRITE PRIVIND CALITATEA VIȚELOR ALTOITE LA S.C. JIDVEI S.R.L., PODGORIA TÂRNAVE

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**Abstract.** Experience was held at S.C. Jidvei S.R.L., using grape varieties Muscat Ottonel and Fetească regală grafted on SO4 rootstock, clone 762. After grafting, cuttings were dipped in three types of paraffin wax: standard, with 8-Chinolinol and with Oxyquinoleină. Using paraffin 8-Chinolinol the variety Fetească regală was obtained the best callusing (3.8), the largest width of the callus (2.62), highest callusing percentage (93.0), best percentage of bud graft starting (82.5) and the best rooting (rooting degree, root diameter). Cuttings buds paraffined with 8-Chinolinol started in vegetation after 7 days after forcing beginning, they needed the shortest forcing period (12 days) and have obtained the best yield of grafted vines (82.8%). At the variants where has used the standard paraffin, studied parameters recorded the worst results.

**Key words:** grafted vines, paraffin, callusing, rooting

**Rezumat.** Experiența s-a desfășurat la S.C. Jidvei S.R.L., folosind ca material biologic soiurile Muscat Ottonel și Fetească regală altoite pe portaltoiul SO4, clona 762. După altoire, butașii s-au parafinat cu trei tipuri de parafină: standard și cu hormonii de calusare: 8-Chinolinol și Oxyquinoleină. Folosind parafina cu 8-Chinolinol la soiul Fetească regală, s-a obținut cel mai bun grad de calusare (3,8), cea mai mare lățime a calusului (2,62), cel mai mare procent de calusare (93,0), cel mai bun procent de pornire a mugurilor altoi (82,5), cea mai bună înrădăcinare (gradul de înrădăcinare, diametrul rădăcinilor). Mugurii altoi parafinați cu 8-chinolinol au pornit în vegetație după 7 zile de la începutul forțării, au avut nevoie de cea mai scurtă perioadă de forțare (12 zile) și s-au obținut cel mai randament de vițe altoite (82,8%). La variantele la care s-a folosit parafina standard parametrilor studiați au fost înregistrate cele mai slabe rezultate.

**Cuvinte cheie:** vițe altoite, parafină, calusare, înrădăcinare

## INTRODUCTION

Plant hurting, as it is in grafting case, determines physiological processes to heal the wound. Wound healing is made by a formations appearance, an

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agglomeration of cells called callus. Callus formation is influenced by many factors: genetics, the presence of stimulants, the nutritional levels of cutting and rootstock, grafting method, the environmental conditions. Callus should be moderate and evenly formed around the point of grafting, if is too abundant, would flowing, pushing up the graft and if is too weak it does not provide good vascularization (Romberger, 1979).

In the callus forming, paraffin has a particularly important role, so that the paraffin, through its composition should not inhibit the formation of new formations. Hunter et al., 2004, indicates that the callus formation, as scar tissue and welding is an inherited physiological trait, so not all varieties are genetically prone to form callus.

The accretion process takes place as far as welding calluses, is followed by the binding of generating areas, which occurs through physiological differentiation of callus cells under influence of the generating areas of partners (Vişoiu et al., 2002).

## MATERIAL AND METHOD

The experiment was conducted in the production complex of grapevine planting material at SC Jidvei SRL. The grape varieties used in the experiment were Ottonel Muscat (Hungary) and Fetească regală (Jidvei). The varieties were grafted on SO4 rootstock, clone 762 (France).

The graft canes preparation, consisted in testing of the buds viability (by transversal sectioning), in disinfecting and trimming in one eye cuttings. Canes rootstock were soaked and disinfected with Cryptonol solution 3.5% and after that the canes have been shaped in cuttings of  $30 \pm 2$  cm length.

Grafting was done in omega section, mechanically. After grafting, the cuttings were dipped in three types of paraffin wax: a standard wax and the other two types with callusing hormones: 8-Chinolinal and Oxyquinolein. The six obtained variants are the following:

- V1 - Muscat Ottonel / standard paraffin
- V2 - Muscat Ottonel / 8 – chinolinal paraffin
- V3 - Muscat Ottonel / oxyquinolein paraffin
- V4- Fetească regală / standard paraffin
- V5 - Fetească regală / 8 – chinolinal paraffin
- V6 - Fetească regală / oxyquinolein paraffin

The cuttings stratification has been done in boxes with pine sawdust. In the first three days in callusing room the temperature was assured to 32°C , and then the temperature has decreased to 30°C, remaining constant until the forcing end. Over the cycle the cuttings forcing was done in absence of light by covering them with a geotextile fabric over which was placed a 5 cm layer of sawdust. Air humidity was maintained 85%. The experience variants were placed in randomized blocs with repetitions. Thus, for each variant were made three repetitions of 30 grafted vines, resulting 90 cuttings per variant. The following measurements and determinations were made at the end of forcing cycle:

- **callusing degree** (0-4) (Celik, 2000): 0 - no callus, 1 - callus formed in 25%, 2 - callus formed in 50%, 3 - callus formed in 75%, 4 - callus formed at 100%;
- **the callus width** (0-4) (Hamdan, 2010): 0 - less than 2 mm, 1 - between 2,1-5.0 mm, 2 - between 5.1-8.0 mm, 3 - between 8.1-11.0 mm, 4 - more than 11.1 mm;



- **the percentage of callusing cuttings** means the number of grafted cuttings that have well formed callus, circularly, all around the grafting point (I category) per 100;

- **the percentage of grafted buds start in vegetation** means the number of cuttings that have the grafted buds start in vegetation at the end of forcing cycle per 100;

- **the degree of shoots increase** (0-4) (Celik, 2000): 0 - no shoots; 1 - weak formed shoots, with diameters less than 1 mm; 2 - medium size shoots, with diameter between 1.1 to 2.0 mm; 3 - vigorously shoots with diameter from 2.1 to 2.5 mm; 4 - very vigorous shoots, more than 2.5 mm in diameter;

- **rooting degree** (0-3) (Hamdan, 2010): 0 - no formed roots; 1 - formed 1-3 roots, 2 - formed 4-6 roots, 3 - formed more than 7 roots;

- **the roots diameter** (0-2) (Hamdan, 2010): 0 - the root diameter smaller than 1 mm, 1 - diameter from 1.1 to 2.0 mm, 2 - over 2 mm in diameter;

- **yield of grafted vines**: number of grafted cuttings of category I, which have well-defined and formed new parties (callus, shoots, roots), reported at 100;

- **the startup day in vegetation of grafted buds**, was considered when the grafted vines were started in vegetation more than 20%;

- **duration of forcing cycle** - forcing cycle is considered ended when the 95% of grafted buds started in vegetation or even they have the shoots with formed leaves;

Statistical interpretation of experience results was made with Duncan test (Ardelean, 2007).

## RESULTS AND DISCUSIONS

The callus appearance occurred after three to four days after placing in the forcing chamber of cuttings. In favorable environmental conditions, in presence of hormonal substances and under the influence of the injury excitation, meristematic cells from the section surface, as well the cells in the immediately adjacent layers, begin to dividing extensively and formed callus (parenchymal tissue with undifferentiated cells, a fundamentally new tissue, called wound tissue) (Tangolar, 1996).

Excessive proliferation of new tissue cells (callus) is not beneficial in the welding of the two partners (graft and rootstock) due to unnecessary consumption of reserve substances (carbohydrates). Temperature plays a critical role in callus formation during the forcing, so high temperatures (above 30°C) favor the formation of a fragile callus, easily damaged and the separation of the two partners on further handling.

The experience results show that variant V5 have the best callusing degree (3.8), also the largest callus width (2.62) and the highest callusing percentage (93.0). The results of variant V5 were statistically equal with those of the variant V2. For all studied parameters the worst results were obtained at variant V1 (table 1).

The percentage of startup in vegetation at grafted buds is an indicator at least as important as the previous one, the callusing percentage. After the grafts were introduced in forcing room from the 8 to the 9 day, the growth of graft buds begins. At the end of forcing cycle, in most cases (if the forcing conditions in room are complied), most of the cuttings formed shoots with leaf.

Duration of a forcing cycle is of 12-14 days, so there is no danger to etiolate the growth shoots.

Table 1

**Influence of the paraffin type on callusing degree, shoot growth and rooting**

Variant	Callusing degree (0-4)	Callus width (0-4)	Callusing percentage (%)	Percentage of grafted buds at startup in vegetation (%)	Shoot growth degree (0-4)	Rooting degree (0-3)	Root diameter (0-2)
V1	2.70 e	2.05 d	63.00 e	59.30 e	2.50 d	1.27 c	0.87 c
V2	3.60 ab	2.50 ab	89.30 a	77.00 b	2.80 b	1.58 b	1.03 ab
V3	3.20 cd	2.27 b	75.50 c	69.00 c	2.80 b	1.54 b	0.95 bc
V4	3.10 d	2.22 c	67.30 de	73.00 d	2.80 b	1.54 b	0.93 c
V5	3.80 a	2.62 a	93.00 a	82.50a	3.10 a	1.69 a	1.07 a
V6	3.50 b	2.41 c	80.30 bc	77.30 b	2.70 c	1.72 a	1.10 a
DS 5%	0.30	0.13-0.14	5.00	3.00	0.10-0.20	0.09	0.09-0.10

In vine practice at Jidvei, using SO 4 rootstock, clone 762 for grafting the varieties Fetească regală and Muscat Ottonel, were achieved good results regarding percentage of first quality grafts (95% at Fetească regală and 93% at Muscat Ottonel) (Corbean et al., 2009).

To the six variants resulting from the interaction of variety x paraffin, the statistic significance of differences show that V5 had the best starting percentage (82.5%), at significant difference from the variants V2 (77.3%) and V6 (77.3 %). The worst results were obtained in V3 (69.0%) and V1 (59.3%), significantly lower than all variants.

The degree of shoots formation is not very high (maximum value is equal to 4) which means that no matter of type paraffin is used, the varieties did not have an excessive development and so it can be appreciated that grafting material produced, will behave well in nursery vine. Once again, the variant V5 had the best results in regard to form shoots (3.10) followed at significant difference by V2 (2.80). The shoots formed were weakest at variant V1 (2.50) (table 1).

In the experience, no variant had the vigorous roots that exceed 2.0 mm diameter. The best rooting was at variant V5 (1.69 – rooting degree, 1.07 - roots diameter), followed by the variant V2 (1.58 – rooting degree, 1.03 – roots diameter). The worst results of rooting were at variant V1 with the lowest number of roots (1.27) and the most fragile roots (0.87) (table 1).

In new technologies for production of grapevine planting material, the forcing cycle duration is shorter, from 14 to 15 days (Corbean et al., 2009), compared to classical methods when the cycle duration is between 18 to 21 days (Pop, 2010). This is very important, from organizational and economically perspective, because are reduced the production costs, in particular the heating expenses. Creating the favorable environmental conditions stimulates the emergence of new the formations: callus, shoots and roots.

Regarding the influence of the three types of paraffin on the startup in vegetation at grafted buds, it is noted that buds graft from Fetească regală variety paraffined with 8-Chinolinol induce earliness of this character (table 2). Thus, cuttings paraffined with 8-Chinolinol started in vegetation after the 7th day of forcing, while if is used the standard paraffin or the paraffin with Oxyquinolein, the cuttings have started a day later. The most delayed variant was V1, which start after 9.03 days of the forcing cycle.

Table 2

**Influence of the paraffin type regarding the startup in vegetation at grafted buds, the duration of forcing cycle startup and the grafted vines yield**

Variant	The day of startup in vegetation at grafted buds (days)	Duration of forcing cycle (days)	Grafted vines yield (%)
V1	9.03 a	15.50 a	55.70 e
V2	7.03 c	12.40 c	76.70 b
V3	8.07 b	14.30 b	68.70 c
V4	8.07 b	15.10 ab	64.60 d
V5	7.03 c	12.00 c	82.80 a
V6	8.03 b	13.00 c	77.30 b
DS 5%	0.26-0.28	1.20	2.00

The differences significance on the six variants, resulting from the interaction variety x paraffin type, highlights the variant V5 (12 days), with the shortest forcing period at all variants. The variant V5 (12.0 days) is statistically equal to variants V2 (12.4 days) and V6 (13.9 days). The longest forcing cycle duration was to the variant V1 (15.5 days), at significant difference compared to all variants.

The yield of grafted vines after forcing cycle was the best at variant V5 (82.8%), followed at significant difference by the variants V6 (77.3%) and V2 (76.7%). The lowest values of grafted vines yield were to the variants that used standard paraffin V4 (64.6%) and V1 (55.7%).

## CONCLUSIONS

1. The startup in vegetation of grafted buds and the shoots growth, in light absence did not affected the quality of grafted vines.

2. The callusing capacity is almost equal at the two varieties analyzed (Fetească regală and Muscat Ottonel) and the paraffin type used had a decisive influence in the callus forming (callusing degree, the callus width, the callusing percentage).

3. It can be concluded that the best results for all the analyzed parameters have been obtained to variant V5, followed at a significant difference by variant V2. The worst results were recorded to variant V1 (Muscat Ottonel / standard paraffin).

4. The paraffin with 8-chinolinol favored an early start of grafted buds in the forcing room, at both varieties: Fetească regală and Muscat Ottonel. This thing has consequences regarding the economic benefits (reducing energy costs and labor force) but also in terms of the planting material quality.

5. Regarding the experience at the Jidvei, the forcing cycle was shorter (12.2 days) than the classical method (18-21 days) at the variant where is used 8-Chinolinol paraffin to both varieties: Fetească regală and Muscat Ottonel.

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# PHYLOGENETIC RELATION OF THE ROMANIAN NATIVE VARIETIES OF GRAPES BY DNA ANALYSIS

## ÎNRUDIREA FILOGENETICĂ A SOIURILOR AUTOHTONE ROMÂNEȘTI DE VIȚĂ DE VIE PRIN ANALIZA ADN

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**Abstract.** *Deoxyribonucleic acid was analysed using the molecular markers-RAPD Random Amplified Polymorphic DNA from 12 indigenous varieties of grapes. For extraction of DNA from young leaves, the method obtained by Lodhi et al., (1994), amended by Pop R., (2004) was used. Extracted DNA was amplified by 24 primers, the agarose gel bands obtained were visualized in UV. With the help of Jaccard coefficient a dendrogram was drawn show the phylogenetic relation of the studied grape varieties.*

**Key words:** polimorfism, DNA, RAPD, dendrograme.

**Rezumat.** *A fost investigat acidul dezoxiribonucleic molecular cu ajutorul markerilor RAPD-Random Amplified Polymorphic DNA la 12 soiuri autohtone de vita de vie. Pentru extracția ADN-ului din frunzele tinere s-a utilizat procedeul Lodhi și colab., (1994), modificat de Pop R., (2004). ADN-ul extras a fost amplificat cu 24 primeri, benzile obținute în gel de agaroză au fost vizualizate în UV. Cu ajutorul coeficientului Jaccard s-a întocmit dendrograma care redă înrudirea filogenetică a soiurilor luate în studiu.*

**Cuvinte cheie:** polimorfism, ADN, RAPD, dendrogramă.

### INTRODUCTION

Ecological plasticity of *Vitis vinifera* L. has led to thousands of varieties/cultivation spread to all continents of the world today. It has a striking phenotypic variability, which often leads to uncertainty and confusion about the identity of vine varieties. Worldwide, we are witnessing a reduction in crop genetic diversity, a phenomenon called "genetic erosion". No vine has not been bypassed, a phenomenon seen both in the vine varieties cultivated and wild forms of vines.

The twenty-first century brought a new challenge with the economic globalization and the globalization of trade, including wine trade. The effects of globalization of trade which Romanian viticulture should face are the alignment of Romanian wines to international standards for a globalized trade and revaluing local grape varieties as well. Romania as a wine country, has a narrow genetic heritage, about 40-50 fruitful vine indigenous varieties, which were formed by natural selection, aided by anonymous winegrowers.

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## MATERIAL AND METHOD

The biological material was represented by 12 indigenous varieties: Bătută neagră, Busuioacă de Bohotin, Coarnă albă, Coarnă neagră, Fetească albă, Fetească neagră, Fetească regală, Furmint, Galbenă de Odobești, Grasă de Cotnari, Tămâioasă românească and Zghihară de Huși. Of these varieties, only ten still cultivated, while Coarnă albă, Coarnă neagră are in conservation ampelographic collections in the country. Biological material was taken from two ampelographic collections: ampelographic Collection of Faculty of Horticulture and ampelographic collection of Research and Development Station for viticulture and wine, Iasi (Herrera R. et al., 2002).

Table 1

**Primers used in DNA amplification (USAMV Cluj-Napoca)**

Nr.	Primer	Sequence (5'-3')	Nr.	Primer	Sequence (5'-3')
1.	OPA 20	GTT GCG ATC C	13.	OPB-10	TGG CGC AGT C
2.	OPA 01	CAG GCC CTT C	14.	OPB-17	TGC GTG CTT G
3.	OPC 04	CCG CAT CTA C	15.	OPB-08	GAC GGA TCA G
4.	OPO 14	AGC ATG GCT C	16.	OPX-03	TGG CGC AGT C
5.	OPB 17	AGG GAA CGA G	17.	OPE-14	TGC GGC TGA G
6.	OPA 04	AAT CGCGCT G	18.	AB-11	GTG CGC AAT G
7.	OPAL 20	AGG AGT CGG A	19.	OPG 07	GAA CCT GCG G
8.	OPA 03	AGT CAG CCA C	20.	OPF 04	GGT GAT CAC C
9.	OPAB 18	CTG GCG TGT C	21.	OPF 20	GGT CTA GAG G
10.	OPA 09	GGG TAA CGC C	22.	OPD 19	CTG GGG ACT T
11.	OPC 14	TGC GTG CTT G	23.	OPH 15	AAT GGC GCA G
12.	OPC 16	CAC ACT CCA G	24.	OPC 08	TGG ACC GGT G

The measurement of DNA extraction consisted of young leaves, where the protocol of Lodhi et al. (1994), modified by R. Pop et al. in Cluj (2004) was used. Two experiments were conducted in specialized laboratories in the country, respectively Biotechnology Laboratory of Cluj-Napoca and Lecom laboratory from Iași. Extraction of DNA by this method yielded colorless solutions in almost all DNA samples. Deoxyribonucleic acid analysis could be performed in several stages, such as DNA extraction, amplification with specific primers or a series of randomly chosen and electrophoresis products resulting from amplifications (Fanizza G. et al., 1999). View of product amplification was performed under UV light, the bands were automatically detected using a program that sets the size of DNA fragments by comparing them with a DNA standard (DNA Ladder). The used DNA standard consists of 40 fragments ranging from 100-4000 bp (Kim H.S. et al., 2002).

## RESULTS AND DISCUSSIONS

In the statistical analysis were included only bands with a high luminous intensity. Polymorphic bands were scored 1, and the monomorphic 0. The presence of bands (marked with 1) and absence of bands (marked with 0) were entered in a matrix form of binary table.

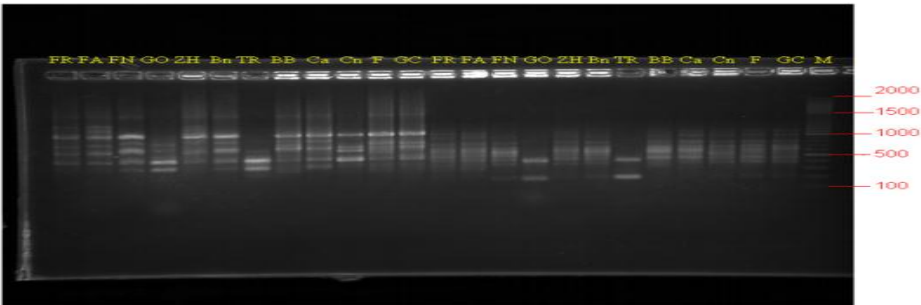
A total of 126 amplified bands, obtained from 24 primers. Interpretation of results obtained by RAPD in the two processes of

extraction and amplification with different primers with similar working principle is basically the same.

Table 2

RAPD data obtained from image analysis (USAMV Cluj)					
No. crt.	Primers	Total bands Bands / primer	Number of polymorphic bands Bands / primer	Number of monomorphic bands Bands / primer	% polimorfism
1.	OPD 20	12	11	1	91,6
2.	OPA 03	9	8	1	88,8
3.	OPAL 20	7	6	1	85,7
4.	OPA 01	7	5	2	71,42
5.	OPB 17	14	13	1	92,8
6.	<b>OPA 04</b>	<b>15</b>	<b>14</b>	<b>1</b>	<b>93,3</b>
7.	OPC 04	8	8	0	100
8.	OPO 14	11	10	1	90,9
9.	OPE 14	4	2	2	50,0
10.	OPF 04	5	1	3	77,7
11.	OPAB 18	9	8	1	88,8
12.	OPX O3	8	1	7	12,5
13.	OPA 20	9	7	2	77,7
14.	OPC 14	3	1	2	33,3
15.	OPF 20	6	1	5	16,6
Total bands		126	96	30	

**Analysis of polymorphic bands.** The highest number of polymorphic bands (the first case of amplification) was obtained with primers OPA 04 (15 lanes), and OPB 17 to 14 polymorphic bands. Lowest number of bands was generated by OPB 07 and OPG 08 primers -2 bands (table 2).



**Fig. 1** - The products of amplification obtained with primers OPAB 18 and OPA 03 the 12 varieties analyzed (polymorphic bands)

Fragments resulting from amplification with primers were polymorphic length between 200 and 2000 bp, most having between 300 and 1000 bp (figure 1). In this image/photography presents the resulting

amplification products resulting from two of the primers used, respectively OPAB 18 and OPA 03.

If OPAB 18 primer amplified bands from nine in total, eight were polymorphic. In the case of the second primer all nine bands were amplified, of which a monomorphic.

Analysis of gel/primer was performed using RFLP scan program, which automatically detects the presence of amplified bands. The data recorded in this table we can see that where amplified bands were detected value is above 1.0, and where there were bands before them, the amount is less than 1.0.

Genetic proximity between the twelve grape varieties analyzed, based on genetic distance matrix and Neighbor Joining Tree algorithm are presented in fig. 1 as a dendrogram. In the first dendrogram is highlighted two main groups A and B. The first group includes the varieties Zghihara Husi, Bătută neagră, Fetească black, Fetească albă, Fetească regală, Furmint and Grasă de Cotnari and the second group B contains Tămâioasă românească varieties, Coarnă neagră and Galbenă de Odobești. In group A there are three subgroups: marked as A1, A2 and A3 (figure 2).

**Subgroup A1** included Zghihara de Husi variety, which is separated from other varieties, indicating a lower degree of relatedness to the studied varieties.

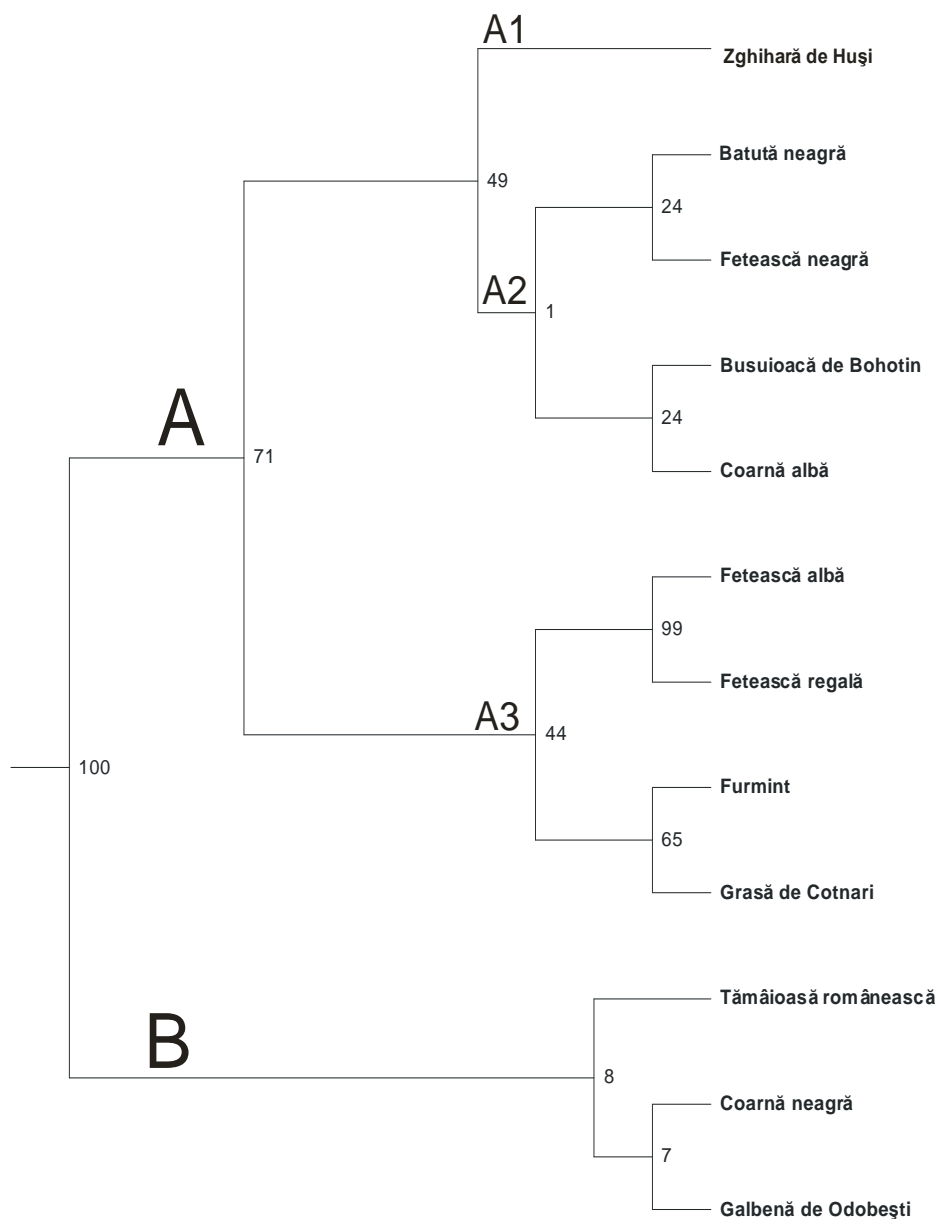
**Subgroup A2** is composed of Batuta neagra, Fetească neagra, Busuioaca of Bohotin, Coarna alba varieties. Fetească neagra variety, from the ssp. *Vitis silvestris* seems to have some common characters with Batuta neagra variety. Busuioaca de Bohotin and Coarna alba varieties are very similar genetically.

**Subgroup A3** - composed of Fetească alba, Fetească regala, Furmint and Grasa of Cotnari varieties. The varieties of this subgroup have a high genetic similarity: Fetească alba and Fetească regala varieties are on the same branch, the genetic distance between them being 0.254 and of the same ecotype. The origin of Fetească regala variety is also verified by its position in the dendrogram, between

Fetească alba and Grasa de Cotnari varieties (natural hybrid between Fetească alba and Grasa of Cotnari). Also, the vicinity of Grasa de Cotnari and Furmint varieties denotes their relatedness, also proving that Grasa de Cotnari originates from Furmint variety. RAPD analysis confirmed the affinity of sub-varieties of the past.

Fetească alba and Grasa de Cotnari varieties (natural hybrid between Fetească alba and Grasa of Cotnari). Also, the vicinity of Grasa de Cotnari and Furmint varieties denotes their relatedness, also proving that Grasa de Cotnari originates from Furmint variety. RAPD analysis confirmed the affinity of sub-varieties of the past.





**Fig. 2** -Dendrogram obtained from the 12 vine varieties analyzed

## CONCLUSIONS

1. It was revealed that RAPD technique is a simple and rapid method for disclosing the genetic polymorphism of vine varieties. In this method we used two protocols/procedures for deoxyribonucleic acid extraction, respectively Lodhi et al., as amended by R. Pop et al.

2. To investigate the genome, an extraction of deoxyribonucleic acid was performed, forming solutions/environments, followed by amplification with different primers and electrophoresis of amplification products. All these working steps are specific RAPD method based on PCR. The choice of primers has proven quite difficult, using a total of 24 primers, 15 gave distinct polymorphic bands, including: OPAB 11, OPA 03, OPAL 20, OPA 01, OPB 17, OPA 04, OPC 04, OPO 14 OPE 14, OPF 04 and OPAB 18.

3. The first group of the dendrogram includes the varieties Zghihara de Husi, Batuta neagra, Fetească neagra, Fetească albă, Fetească regală, Furmint and Grasa de Cotnari and the second group B, Tamaioasa romaneasca, Coarna neagra and Galbena de Odobești varieties.

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# TABLE GRAPEVINE ASSORTMENT IN REPUBLIC OF MOLDOVA: ACTUAL SITUATION AND PERSPECTIVES FOR AMELIORATION

## SORTIMENTUL DE STRUGURI PENTRU MASĂ ÎN REPUBLICA MOLDOVA: SITUAȚIA ACTUALĂ ȘI PERSPECTIVA DE AMELIORARE

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**Abstract.** *The analysis of assortment of table grapevine, preponderantly created in the Republic of Moldova is presented and the perspective of potential for the export of grapes is examined. A distinctive feature of these varieties, obtained in the result of breeding program initiated in the seventies of preceding century, is relative or increased resistance to unfavorable factors of environment, inclusive to winter conditions characteristic for the viticulture zone. For future harmonization of actual assortment are proposed new varieties, inclusive seedless, destined to complete the insufficiently represented groups of maturity of berry, especially with colored berries for extra-early and early groups, but also the later group with grapes long-term storage. At the same time is ascertained creation and presence on the market of impressive diversity of the table grape varieties originated from Ukraine and Russia, also with increased resistance to unfavorable factors, the result of collaboration between scientific institutions and private sector.*

**Key words:** grapevine, table grape, seedless varieties, resistance

**Rezumat.** *Este prezentată analiza sortimentului de struguri pentru masă, preponderent creat în Republica Moldova și examinată perspectiva potențialului de export al strugurilor. O trăsătură distinctivă a acestor soiuri, obținute în urma realizării unui program de ameliorare inițiat în anii 70 ai secolului trecut, este rezistența lor relativă sau avansată la factorii nefavorabili ai mediului ambiant, inclusiv la condițiile de iernare specifice zonei noastre viticole. În scopul armonizării sortimentului actual sunt propuse soiuri noi, inclusiv apirene, menite să completeze epocile de maturarea reprezentate cu un număr insuficient de soiuri, în special cu bobul colorat pentru epocile extratimpurie și timpurie, dar și cea târzie, cu struguri destinați păstrării. Totodată, se constată crearea și prezența pe piață a unei varietăți impunătoare de soiuri cu struguri pentru masă, provenite din Ucraina și Rusia, de asemenea cu rezistență avansată la factorii defavorabili, rezultatul conlucrării instituțiilor de cercetare cu sectorul privat.*

**Cuvinte cheie:** viță de vie, struguri pentru masă, soiuri apirene, rezistență

## INTRODUCTION

According the OIV statistics (Structure of the world vitivinicultural industry in 2007) in 2007 global production of grape for fresh use (table grapes) was about 200 Mqx (millions of quintals) or 30% from global grape production. Is

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established an impressionable increasing of this index – by 48,7% in comparison with the mean value of global table grape production in the period 1996-2000. At the same time human fresh grape consumption in 2007 was 194,1 Mqx or an increasing by 45,8% in comparison with the mean value of table grape consumption for the same reference period. The production of table grapes in Republic of Moldova in 2007 was 1,3 Mqx, that is double in comparison with the mean value of global table grape production in the period 1991-1995 and an increasing by 43% in comparison with the mean value for the period 1996-2000. The consumption of fresh grapes in republic in 2007 was 950 mqx (thousands of quintals), or an increasing by about 50% in comparison with the mean for 2006.

Therefore, in conditions of a permanently increasing of global table grape production and the maintenance of tendency of increasing of import of grapes for fresh consumption, inclusive in Europe, the modernization and development of this sector in Republic of Moldova is an actual objective with strategic importance. Along with the required managerial procedures in this direction, the chances for expansion to external markets, competitiveness of branch in whole, first of all is determined by presented grapevine assortment and strategy for his modernization. Throughout will be analyzed actual table grapevine assortment in republic of Moldova and the perspectives for his amelioration.

## **MATERIAL AND METHOD**

In the paper is analyzed a part of table grapevine varieties admitted, according the Register of Plant varieties (Registrul, 2010), for cultivation in Republic of Moldova. Initial data concerning some agrobiological characteristics of varieties were accumulated according the accepted methodology for description of varieties submitted in State Commission for Crop Variety Testing. On analysis of suitability of varieties for the export of grapes were examined current Standards of EU and USA (Marketing Standard, 2008; United States Standard, 1999).

## **RESULTS AND DISCUSSIONS**

Utilization of accumulated in Institute's Genofond grapevine biodiversity in the frame of program of genetic amelioration of assortment, initiated in the early seventies of past century, contributed to creation and homologation of a whole number of new grapevine varieties for various use with increased resistance to unfavorable factors of environment. Until the 1980 assortment for table grape included only one autochthonous variety – Coarnă neagră, remainder being the varieties of various origin, in majority classic varieties. Beginning from 1980 the table grapevine assortment was permanently completed with new creation resulted from this program.

Actually, from total number of 35 table grapevine varieties included in Register (Registrul, 2010), 21 varieties (60%) are local creations (table 1). For 12 varieties were obtained Patents for Plant Variety.

By the color of the berry predominates the varieties with green-yellow berries that are relatively uniform distributed in all groups of physiological

maturity of the berry (figure 1, a). Varieties with coloured berries (in range from rose to black) are more frequently in groups with middle-late maturity.

Table 1

**Agrobiological characters of homologated table grapevine varieties create in Republic of Moldova (Tuțuc et al., 1998; Savin et al., 2007)**

Name of variety	Bunch weight, g	Berry weight, g	Berry size, mm	Time of maturity of berry	Resistance to frosts
<b>Varieties with green-yellow berry</b>					
Alb de Suruceni**	250-400	6-8	22 x 19	06 (25.IX)	-24°C
Avgustovschii	200-300	3-4	16 x 15	01 (10.VIII)	-26°C
Frumoasa albă**	350-550	6-8	26 x 24	05 (20.IX)	-23°C
Guzun	400-500	4-5	26 x 20	06 (25.IX)	-24°C
Ialovenscii ustoicivâi	400-500	6-8	28 x 23	07 (05.X)	-23°C
Iubilei Juravelea**	400-500	5-7	25 x 26	06 (05.X)	-24°C
Leana**	350-500	4-6	22 x 18	05 (20.IX)	-22°C
Mărgăritar	350-500	6-7	27 x 22	03 (05.IX)	-24°C
Muscat iantarnâi	130-240	2-3	19 x 17	01 (20.VIII)	-18°C
Muscat timpuriu	250-400	6-7	28 x 22	01 (10.VIII)	-23°C
Startovâi	400-500	5-6	23 x 20	05 (15.IX)	-24°C
<b>Varieties with black berry</b>					
Codreanca**	400-500	6-7	31 x 19	03 (15.VIII)	-22°C
Moldova**	320-500	5-6	24 x 19	06 (25.IX)	-22°C
Muscat de Bugeac**	300-350	3-4	21 x 18	06 (25.IX)	-22°C
Osennii ciornâi	450-600	6-8	27 x 22	06 (25.IX)	-23°C
<b>Seedless varieties</b>					
Apiren alb**	270-780	2-3	20 x 18	03 (01.IX)	-22°C
Apiren roz**	256-610	3-5	24 x 22	03 (25.VIII)	-22°C
Apiren negru de Grozești**	200-370	1-2	14 x 11	04 (10.IX)	-24°C
Kiș-miș lucistâi**	500-600	3-4	22 x 17	03 (20.VIII)	-20°C
Kiș-miș moldovenesc**	400-600	5-6	23 x 18	06 (25.IX)	-20°C

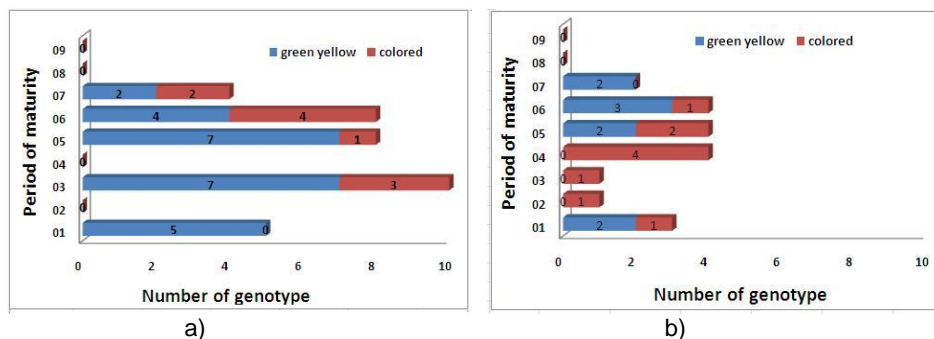
\*) – time of full maturity of berry: code according the Register of Plant varieties (2010) and date after with is attested maturity of berry

\*\*) – for these varieties the Patent for Plant Varieties was obtained

Must be accentuated the inclusion in assortment, beginning with 1988 of created in Republic of Moldova seedless grapevine varieties, that represent a novelty for the republic. Considering the advanced resistance to unfavorable conditions of environment, some of these varieties represent a novelty for our entire viticulture zone (Savin et al., 2007). These varieties diversify and complement, first of all, varietal conveyor for grapes for fresh consumption. By preliminary investigations were established the possibility to use the grape in technological processing in order to obtain must, juice, compote, marinade, jam, raisins and wine.

In the group with early maturity of berry are presented varieties Augustovschii, Muscat timpuriu, Muscat iantarnâi, Perla de Csaba and Muscat jecmijnâi. We note the absence in this group both of seedless varieties and of varieties with colored berry.

The more numerically and relatively well represented by all categories of varieties, inclusive seedless, is the group with early maturity of grape (group 03). It includes the varieties Augustovschii, Muscat timpuriu, Muscat iantarnâi, Perla de Csaba and Muscat jemcijnâi et al.



**Fig. 1** - Repartition of varieties by time of berry maturity: a) homologated varieties; b) perspective varieties

For the group of varieties with middle time of maturity of berry, that includes the varieties Chasselas d'ore, Chasselas mousque, Chasselas rose, Frumoasa albă, Leana and Startovâi – with green-yellow berries and Romulus and Apiren negru de Grozesti – seedless varieties, can be noted the absence of varieties with colored berry and the fact that seedless varieties a preponderantly destined for technological processing.

With the exception of introduced variety Zolotistâi ustoicivâi, in the group with medium-late time of maturity of berry are included only autochthonous varieties - Alb de Suruceni, Guzun, Moldova, Muscat de Bugeac, Osenii ciornâi and seedless variety Kiş-miş moldovenesc. The group with late maturity of berries is not numerous – Ialovenschi ustoicivâi and Karaburnu with green-yellow berries and Coarnă neagră and Muscat de Hamburg with black berries.

At the same time are in process of evaluation a number of new created varieties and elites (Table 2), destined to complement current assortment. First of all these varieties are destined to increase the number of varieties in the groups of maturity less of all represented, inclusive with colored berry (Figure 1, b).

For the group with early maturity of berries are proposed 5 new varieties and elites, inclusive Marta, Zviozdnâi ustoicivâi and one seedless variety with extra-early time of maturity of berry (Apiren roz extratimpuriu).

Perspective varieties and elites can also complement the group with early-middle and middle time of maturity of berry (Straşenschi, Vieru-59, Basarabia, Apiren roz Basarabean and so) and with middle-late and late time of maturity of berry (Gen Vierul, Gagarin, I-5-58 and so).

In order to evaluate the export potential of grapes, both for homologated assortment and perspective varieties and elites, were considered a number of criteria according the Commercial Standards for table grapes. Standard in force for European Union (Marketing Standard, 2008) stipulates three category of quality for table grapevine destined for sale (market), the main criterion being the

minimum accepted weight of bunch: class “Extra” – 210 grams, class I – 150 g and class II – 100 g. For the grapes considered with little berry minimum accepted weight of bunch is 150, 100 and 75 grams respectively. Special remarks concerning the admissible size of berry are not presented.

Table 2

**Agrobiological characters of perspective table grapevine varieties created in Republic of Moldova (fragment)**

Name of variety	Bunch weight, g	Berry weight, g	Berry size, mm	Time of maturity of berry	Resistance to frosts
<b>Varieties with green-yellow or rose berry</b>					
Gagarin	400-600	5-7	29 x 23	05 (16.IX)	-24°C
Zviozdnâi ustoicivâi	350-500	5-8	24 x 23	01 (15.VIII)	-21°C
Tighin	350-500	5-6	32 x 25	06 (25.IX)	-24°C
I-5-58	470-820	5-7	33 x 30	07 (01.X)	-23°C
<b>Varieties with black berry</b>					
Marta	400-650	5-7	29 x 24	03 (20.VIII)	-23°C
Straşenscii	600-900	7-9	28 x 25	04 (05.IX)	-21°C
Vierul 59	350-500	6-8	36 x 20	05 (15.IX)	-23°C
Gen Vierul	350-500	6-8	30 x 20	06 (01.X)	-23°C
Basarabia	385-570	3-4	32 x 31	04 (10.IX)	-22°C
<b>Seedless varieties</b>					
Apiren roz extratimpuriu	200-350	1-2	16 x 14	01 (25.VII)	-24°C
Apiren roz Basarabean	250-400	1-2	14 x 12	04 (05.IX)	-24°C

USA Standard in force (United States Standards, 1999) includes 6 grades of quality, two of them are for the export of grapes – “U.S. Extra Fancy Export” and “U.S. Extra Export”. Are specified unique requirement concerning minimal weight of bunch – 226,8 grams also the restrictions concerning the size of berry. The bunches for category “U.S. Extra Fancy Export” must have the berry not less than 20,6 mm in diameter for varieties Cardinal, Robin, Italia Muscat and other similar varieties and 17,5 mm in diameter for seedless varieties and other varieties not included in these two groups. For category “U.S. Extra Export” the size of berry must be not less than 19,1 mm and 15,9 mm respectively.

Refer to the assortment of table grape in Republic of Moldova (homologated and perspective), can be ascertained that by the weight of bunch, even in the case of varieties considered with small-middle berry, all presented varieties can be assigned to the class “Extra” (according EU Standard) or to the class “U.S. Extra Fancy Export” (according USA Standard). Also by the size of berry the majority of varieties satisfy the standards.

During the last 15-20 years, in the result of collaboration of scientific institutions and private sector were created and launched of the markets of Russia and Ukraine an impressive diversity of varieties for table grapes with advanced resistance to unfavorable factors of environment, with divers colors and size of berries. In creation of these varieties must be accentuated a wide utilization of varieties created in Republic of Moldova. The varieties Arkadia rozovaia, Arkadia (Moldova x Cardinal), Argo (ZOS-1 x Codreanca), Gala (Podarok Zaporozhiu x

Codreanca), Antonii Velikii, Balet, Blagovest, Victor, Kiş-miş Nahodka (Talisman x Kiş-miş lucistâi), Prometei (Arkadia x Kiş-miş lucistâi) represent only a little fragment from existing ones. Some of these varieties were temporary admitted for testing in production conditions in republic. Together with the direct utilization in production they represent an interest as initial material for pre-breeding and breeding programs (Savin et al., 2009).

## CONCLUSIONS

1. Homologated varieties correspond to requirements of market and perspective ones have the potential for complementation, diversification of assortment for export. Majority of them have advanced resistance to winter conditions, need a limited number of chemical treatments.

2. All groups of maturity of berry are relatively uniformly represented in homologated assortment and perspective varieties and elites offer the possibility for its harmonization complementing intermediary group of maturity of berry, inclusive with varieties with colored berry, seedless varieties.

3. Medium- and long-term strategic purposes for continuing diversification of assortment presuppose elaboration and execution of scientific program for creation of new varieties with increased genetic resistance to unfavorable factors of environment prioritizing to the market demands: seedlessness; berry with crispy pulp; size of berry and bunch - medium-large; color of berry – rose, green-yellow, black; delicate, slightly perceptible aroma; suitable for transportation and long-term storage.

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# EVOLUTION OF POLIPHENOLIC COMPLEX OF WINES DURING AGING IN CONTACT WITH OAK WOOD

## EVOLUȚIA COMPLEXULUI POLIFENOLIC AL VINURILOR LA MATURAREA LOR ÎN CONTACT CU LEMNUL DE STEJAR

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**Abstract.** *The study of phisico-chemical process at accelerated aging by modern procedure in a white and red wines proves that mentaining in a contact wiht oak chips the wines evolves more quickly that modifications of phenolic compounds and organoleptical characteristics remarks. It was determine the optimum lenth of wine maintaining on chips depending on phisical-chemical size studied were: summary of poliphenolic compounds, the concentration of total anthocyanins in red wines, the chromatic characteristics, and the sensorial profile.*

**Key words:** oak chips, maturation, poliphenol complex, profile sensorial.

**Rezumat.** *Studiarea proceselor fizico-chimice la maturarea accelerată printr-un procedeu modern in vinurile albe și roșii a demonstrat ca la menținerea în contact cu talașul de stejar vinurile evoluează mai rapid fapt remarcat de modificările compușilor fenolici și ale caracteristicilor organoleptice. S-a determinat durata optimă de menținere a vinului pe talașul de stejar în dependență de indicii fizico-chimici studiați: suma compușilor fenolici, concentrația antocianilor în vinurile roșii, caracteristicile cromatice, profilul sensorial.*

**Cuvinte-cheie:** talaș de stejar, maturare, complex polifenolic, profil sensorial.

### INTRODUCTION

Moldova was and continues to be famous for its white wines, as well as for its young red wines, with pronounced aspect of grape variety or matured with shades of oak. Young, fresh and aromatic white wines from the localities of origin Cricova, Hîncești, Mereni, Onești, as well as red wines Romanești, Purcari, Cahul, which are associated with old wines, matured in barrels for several years, enjoy a wide popularity in the world.

Today, the former practice of wine aging in oak containers is becoming more and more abandoned in many wine-making countries; it was replaced by modern procedures of accelerated aging, such as wine micro oxygenation, the administration of oak wood in various forms or oenological tannin, in red and white wines.

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The impact of oak on the processes taking place in wine and on its organoleptic characteristics, have been the subject of numerous latest researches (Chatonnet P., Dubourdieu D., 1998; Mosedale J.R., Feuillat F., 2001; Prida A., Grina B., Puesh, 2005).

The purpose of this work was to study changes in polyphenolic complex of white and red wines at their aging in the presence of oak chips.

## MATERIAL AND METHOD

As material we used raw white wine of grape variety Feteasca, cultivated on wine region of Center (Codru) of Republic of Moldova, raw red wines of grape variety Cabernet-Sauvignon and Merlot from South region (Cahul) and locally made oak chips belonging to the category of quality - standard (in accordance with technical prescriptions 67-38473646-004:2006PT).

The administrated doses of oak chips in wines was about 1,2 and 3 g/L; the white wine remained in contact over a ranging period between 20 and 45 days at the temperature of 14-16°C, and the red ones - from 10 to 30 at the temperature of 18-20°C. As control served the wines that were stored in wooden casks, with 300 L capacity.

In samples taken at certain times was determinate the amount of phenolic compounds with Folin-Ciocalteu reagent, the concentration in anthocyanins; wines were analyzed with spectrometer and on this basis we determined the chromatic characteristics (intensity and hue), then the expert-tasters jury determined sensory profile.

Basic physico-chemical indices were determined by methods conformable to applicable standards.

## RESULTS AND DISCUSSIONS

Basic physico-chemical indices and those specifically to the studied wines are presented in table 1.

Table 1

Physico-chemical indices of wines

No.	Determined index	Feteasca	Cabernet-Sauvignon	Merlot
1.	Alcohol concentration, % vol. Mass concentration of:	11,4	12,7	11,8
2.	Reducing sugars, g/L	2.7	2.8	2.0
3.	Non reducing dry extract, g / L	18.2	21.0	19.8
4.	Titables acids (expressed in tartaric acid), g/L	7.3	5.6	6.2
5.	Volatile acids (expressed in acetic acid), g/L	0.28	0.45	0.53
6.	Sulfuric acid total / free, mg / L	168/24	100/12	112/15
7.	Iron, mg/ L	4	7	6
8.	The amount of phenolic compounds, mg / L	97	2340	1312
9.	Anthocyanins concentration, mg/ L	-	265	90
10.	Report anthocyanin / tannin A / T x 100, units	-	10.9	6.87
11.	Staining intensity	0.123	0.94	0.92
12.	Hue	-	0.71	0.65

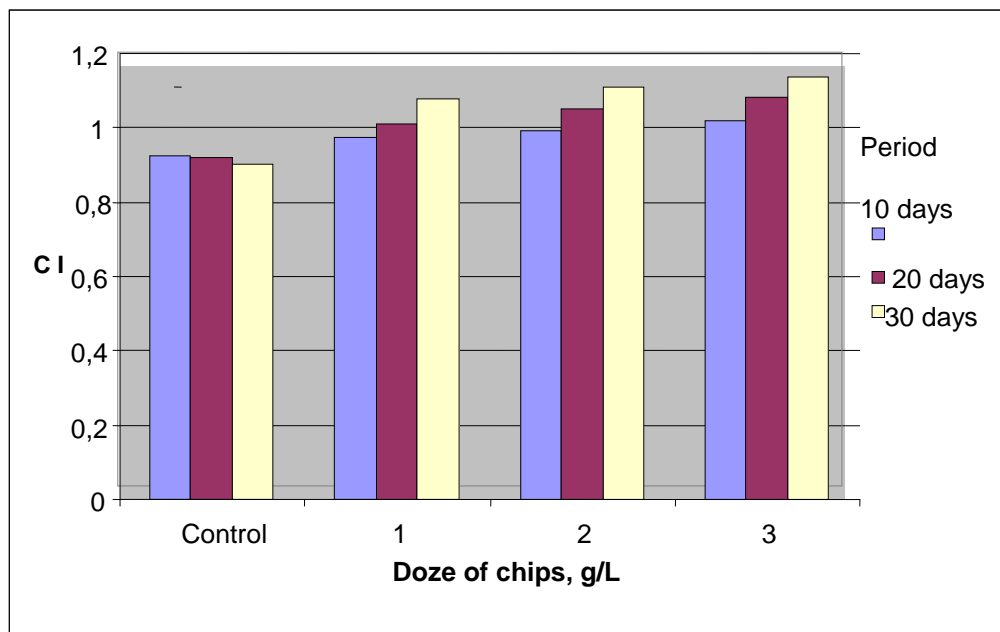
It should be noticed, that wines have had a fairly high alcoholic degree, the titratable and the volatile acidity are characteristic for this type of wine. Regarding specific indications, Cabernet Sauvignon wine was much richer in polyphenolic compounds, including anthocyanins, and greater color intensity than Merlot wine.

During maintenance of wine on oak chips increased negligible the concentration of phenolic substances in comparison with their value in witness sample.

Note that with increasing dose of oak chips and duration of maintenance in contact of analyzed wine occurs the increase of the total extract, including the amount of phenolic compounds and the color intensity. During the wine tasting we have already noted that after 15 days appeared light oak nuances, that after 30 days became quite intense and after 45 days was a easily perceptible taste of bitterness (table 2).

Coming out the results of organoleptic characteristics was recommended version II for the production of, which aims to keep wine Feteasca in contact with the oak chips administered in dose of 2 g /L for a period of 30 days.

In variants with red wines were observed similar changes in behavior of the main calculations. Thus, after 10 d of keeping Cabernet Sauvignon wine on oak chips (dose of 1 g / L, was registered as light extraction, the concentration of phenolic compounds increased with 2-3%. On the 20th day the phenolic compounds were 6.6% more than in witness sample, but after 30 days – on average with 8%. In the variants with doses of 2 and 3 g/L, the growth of the phenolic concentration was higher, the color and intensity of it was also higher (fig.1).



**Fig. 1**-Evolution of color intensity in red wines of mentenance in contact with oak chips

Table 2

**Specific changes of the characteristics of the wine Feteasca at the maintenance on oak chips**

No	Determined index	Period, days								
		15			30			45		
	Dose of oak chips, g/L	1	2	3	1	2	3	1	2	3
1.	Non reducing dry extract, g /L	18.388	18.357	18.372	18.354	18.367	18.385	18.452	18.491	18.526
2.	Volatileacids, g /L	0.32	0.35	0.35	0.33	0.37	0.36	0.36	0.38	0.38
3.	Phenolic compounds, mg/L	112	123	129	126	146	161	131	152	160
4.	Color intensity CI	0.142	0.163	0.179	0.156	0.174	0.185	0.173	0.187	0.199

The modifications of the color intensity in red wines means the enrichment of the polyphenolic wine's complex with polyphenolic compounds extracted from the oak wood and their combination with colored substances. This way, the totality of pigments increase, equivalent to the growth of colored intensity and the concentration of colored substances. At the same time rise and the value of color depth thanks to the increase of brown pigments, determined at the 420 nm wavelength.

From the table 3 was observed that with the rise concentration of colored substances, the rapport anthocyanins/tannins in the witness wine decreases, but at the maintenance on oak chips – rises.

Table 3

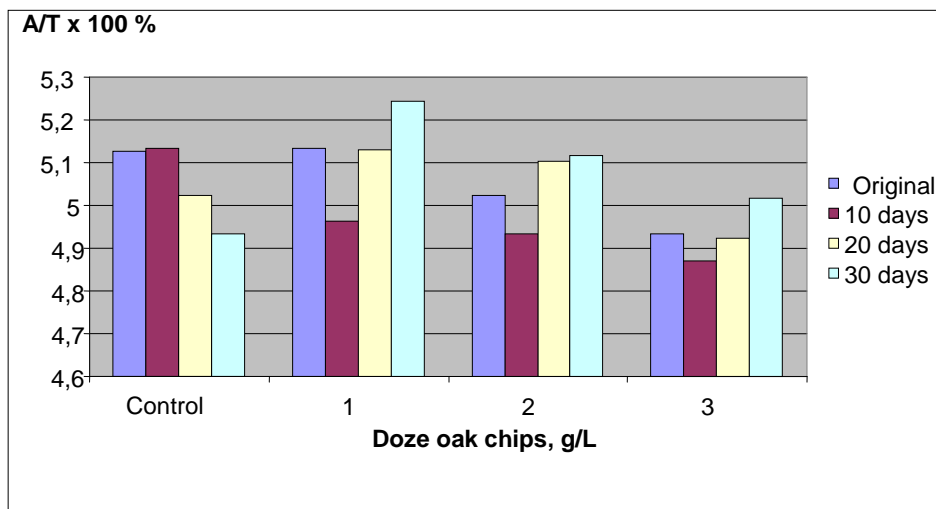
**Evolution of characteristic specific of wine Cabernet Sauvignon**

Variant	Period,d	Colored substances, mg/L	A/T x 100 %	C I	Nc
Control	Original	89,82	5,126	0,942	0,645
	10	90,03	5,134	0,936	0,647
	20	88,26	5,023	0,921	0,650
	30	86,72	4,932	0,901	0,653
Doze 1 g/L	10	92,10	4,962	0,964	0,691
	20	95,70	5,131	0,980	0,690
	30	97,80	5,244	0,993	0,698
Doze 2 g/L	10	96,38	4,933	0,969	0,704
	20	98,75	5,103	0,985	0,710
	30	100,07	5,117	1,002	0,718
Doze 3 g/L	10	100,38	4,869	1,007	0,712
	20	104,67	4,924	1,021	0,725
	30	106,22	5,018	1,102	0,731

From the figure 2 is observed the variation of the rapport anthocyanins/tannins (A/T) in all cases that depends on the period of maintenance and on the doses of oak chips. The most optimal rapport was enregistered in the wine kept in contact with 2g/L on a period of 20-39 days. This result was confirmed by the organoleptic analysis.

So, the optimal variant for red wines will be the dose of 2 g/l, but the optimal period of maintenance - 20 days.

Mathematic processing of obtained results by the Student method and the determination of regression equations emphasized the linear dependence by the organoleptic points and color depth of red Merlot and Cabernet Sauvignon wines. The correlation coefficient presented values extent between 0,64- 0,992, what confirm that the selected factors are the most significant.



**Fig. 2** Modification of report antocyanins/tannins in red wine Merlot

## CONCLUSIONS

The researches' results allowed recommending the optimal variants that provide the maintenance in contact with oak chips administrated in dose of 2g/L on a period of 30 days to Feteasca wine, but to red ones, Merlot and Cabernet Sauvignon wines -20 days. These technological process parameters assure the fortification of organoleptic qualities, in way to obtain an expressive wine, intense in taste, equilibrate and complex in a short period of time.

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# STUDIES ON THE QUANTITY OF TANNINS IN SOME RED WINES OBTAINED THROUGH DIFFERENT MACERATION-FERMENTATION TECHNOLOGIES IN IASI VINEYARD

## STUDII ASUPRA CANTITĂȚII DE TANINURI LA UNELE VINURI ROȘII DIN PODGORIA IAȘI OBTINUTE PRIN DIVERSE TEHNOLOGII DE MACERARE-FERMENTARE

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**Abstract.** *The study has analysed wines produced from four black grape varieties (Cabernet Sauvignon, Merlot, Fetească neagră and Băbească neagră) from Iași vineyard. The wines were obtained by applying different maceration-fermentation techniques: classical maceration-fermentation, ROTO-maceration, thermo-maceration and microwave maceration. The obtained wines were analysed after the second racking, in order to evaluate the tannins level through several spectral analysis methods. At the same time, parameters specific for red wines were determined: total polyphenolic index, Folin-Ciocalteu index, pH and total anthocyanins quantity. The results showed the presence of higher quantities of tannins in the wines obtained by thermo-maceration and microwave maceration versus wine samples obtained through ROTO-maceration and classical maceration-fermentation.*

**Key words:** Iași, tannin, maceration

**Rezumat.** *Studiul a analizat vinuri obținute din patru soiuri de struguri Cabernet Sauvignon, Merlot, Fetească neagră și Băbească neagră din podgoria Iași. Vinurile au fost obținute în urma folosirii diferitelor tehnici de macerare-fermentare: macerare-fermentare clasică, macerare în cisterne rotative, termomacerare precum și prin aplicarea macerației cu microunde. Probele de vin au fost analizate după protocoalul al doilea. Nivelul taninurilor a fost evaluat prin diverse tehnici de analiză spectrală. Au fost determinați și alți parametri specifici vinurilor roșii: indicele polifenolic total, indicele Folin-Ciocalteu, pH-ul și cantitatea totală de antociani. Rezultatele obținute demonstrează prezența unor cantități mai mari de tanin în variantele procesate prin termomacerare și macerare cu microunde în detrimentul probelor obținute prin rotovinificare și macerare-fermentare clasică.*

**Cuvinte cheie:** Iași, taninuri, macerare

## INTRODUCTION

Tannins are phenolic compounds that are found in all of vine's organs and are responsible for the astringency sensation, especially in red wines. They are water soluble and form colored compounds that have the capacity to precipitate

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proteins, inhibit enzymes' activity and contribute together with the alcohols and acids in wine conservation (Pomohaci N., 2005).

The tannin quantity in the must depends on the contact period between the stalks, skins and seeds and also on the processing technology of the grapes.

According to the quantity in which they are present, fact that depends on the category and wine type, tannins contribute in a positive but also negative manner to the sensorial characteristics of the wine (Cotea D. V., 2009).

According to the used maceration-fermentation technology in red wine production the tannin level is evaluated through analysis and comparison of results choosing in the end the most efficient method.

## MATERIAL AND METHOD

The wines of four grape varieties were taken into study, two of them being local (Băbescă neagră – variant  $V_1$  and Fetească neagră – variant  $V_2$ ) and two being cosmopolitan (Cabernet Sauvignon – variant  $V_3$  and Merlot – variant  $V_4$ ). The grapes were harvested at technological maturity from Copou and Bucium viticultural centers.

The grapes were divided in 4 equal parts and several maceration-fermentation were used in order to evaluate the influence of the technology on the tannins composition and on the physical-chemical characteristics.

The used maceration technologies were: classical maceration (code  $V_{x1}$ ), microwave maceration (code  $V_{x2}$ ), thermo-maceration (code  $V_{x3}$ ) and roto-tanks maceration (code  $V_{x4}$ ).

During the thermo-maceration technology, the working temperature was 70 °C for 30 mins, while, during the microwave maceration, the grape samples were treated at 750 W for 15 mins. The classical maceration and roto-tanks maceration were done over a period of 5 days until the grape skin showed no more color variation. After the end of the alcoholic fermentation, the wine was racked into glass vessels kept at room temperature in order to stimulate malolactic fermentation. After 7-8 days, the wine was filtered and bottled with an Enomatic Tenco device.

Immediately after, a dose of 40 mg/L sulphur dioxide per bottle was used, the bottles were corked with a Mini T.S. device 6 months after bottling; the wines were analyzed to evaluate the physical-chemical parameters and also some specific macro parameters of tannins.

The following parameters were evaluated: volatile and total acidity, pH, alcoholic concentration, total dry extract and non-reductive extract. The used analytical methods are according to the European standards and those of the OIV.

During the characterization of the phenolic compounds, a series of spectrometric analyses for evaluation of the total polyphenolic index, Folin-Ciocalteu index (Flanzy M., Poux C., 1958) and total anthocyanins quantity -pH variation method- was performed. An Analytik Jena S200 spectrometer was used. The total polyphenolic index or D280 represents a global photometrical determination of all phenolic compounds present in wines, determined by a direct analysis of wine's absorbency at 280 nm reported at water's absorbency. In the case of red wines, a dilution is made or quartz vials are used, that have an optical distance less than 10 mm. The equivalence of epi-cathechine can be expressed by using a calibration curve of 280nm.

The Folin-Ciocalteu index represents a kinetic determination of compounds with reductive properties that are oxidized by phosphomolybdate and phosphotungstate mixture, when, after a 30 minutes, an equilibrium is attained and a blue complex realized in a sodium basic medium. This complex absorbs at 750 nm



and according to the quantity of the compounds present in the wine sample, the necessary dilutions will be made in order to obtain reproducible results in the linearity of the detector (spectrophotometer).

To evaluate the tannins' content, two spectrometric analyses were done to determine the tannins in epicatechine equivalent units. A used method (Sameckis C. J., 2006) was the one where tannins are precipitated with methylcellulose, by evaluating spectral differences at 280 nm, while their concentration can be determined with a calibration curve.

Wine's turbidity is much influenced by the tannins' quantity and in order to have an alternative method of estimating the macromolecules' concentration, this photometrical method of tannins' evaluation was also proposed (De Freitas V. A. P., 1995)

Another analysis method for the tannins composition is based on the Bate-Smith reaction (Bate-Smith E. C., 1954) that has as basis an oxidative depolymerisation reaction. The proanthocyanidols were calculated with the help of a calibration curve, found in specialized treatises (Țârdea C., 2007).

The HCl index is used to reflect the tannins' polymerisation state in wines. This method is based on the instability of procyanidines in a concentrated clorhidric acid environment, where the precipitation speed depends on the polymerisation degree.

By calculating the chromatic parameters of the CielAB76 system, L, a, b, the effect of the maceration method on the colour parameters of the wine can be registered.

## RESULTS AND DISCUSSIONS

Table 1 presents the results of the physical chemical analysis of the studied wines. The volatile acidity (g/L acetic acid) has values between 0.27 g/L ( $V_{14}$ ) and 0.38 g/L ( $V_{31}$ ), while the same results expressed in g/L tartaric acid are between 5.02 g/L ( $V_{11}$ ) and 8.98 g/L ( $V_{21}$ ).

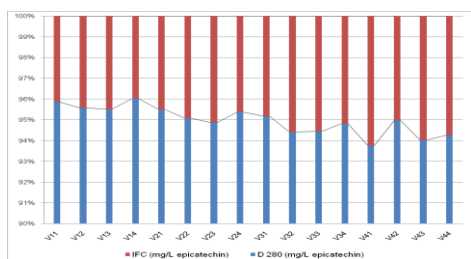
Table 1

Results of the physical chemical analysis

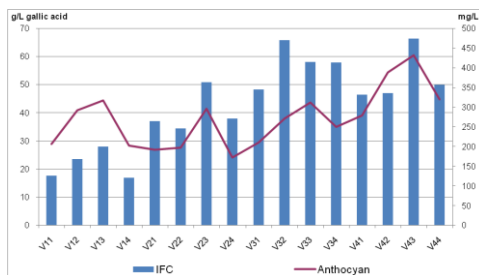
Technology for grape variety/Physical chemical parameters	Volatile acidity g acetic ac./L	Total acidity g tartaric ac./L	pH	Alcohol % vol.	Total dry extract g/L	Non-reductive extract g/L
$V_{11}$	0.33	5.02	3.79	11.2	21.6	18.93
$V_{12}$	0.29	5.99	3.56	11.1	24.8	22.57
$V_{13}$	0.28	5.44	3.69	11.4	24.5	21.59
$V_{14}$	0.27	5.14	3.71	11.1	20.9	18.85
$V_{21}$	0.33	8.98	3.56	13.45	42.1	38.42
$V_{22}$	0.27	7.42	3.61	13.1	34.6	31.83
$V_{23}$	0.33	7.33	3.65	13.6	34.9	32.1
$V_{24}$	0.33	8.44	3.54	13.1	45.7	41.84
$V_{31}$	0.38	6.07	3.71	10.15	29.2	27.02
$V_{32}$	0.27	7.42	3.60	10.41	33.1	30.57
$V_{33}$	0.25	7.25	3.57	10.4	31.8	29.3
$V_{34}$	0.32	6.24	3.65	10.2	28.4	26.16
$V_{41}$	0.30	6.74	3.49	12.9	26.8	23.4
$V_{42}$	0.34	7.84	3.40	13.2	30.2	27.99
$V_{43}$	0.31	7.29	3.51	12.6	30.5	27.79
$V_{44}$	0.30	7.12	3.41	12.7	27.4	24.13

The pH of the wines varies between 3.41 ( $V_{41}$ ) and 3.79 ( $V_{11}$ ). The lowest values of the alcoholic concentration were found in Cabernet Sauvignon wines (10.15 % vol. ( $V_{31}$ ) and 10.41 % vol. ( $V_{32}$ )), as the grapes were harvested earlier due to unfavorable climatic conditions, when the sugar content was of 178.3 g/L. The Băbească neagră and Cabernet Sauvignon wines obtained by roto-tanks maceration have minimal values for the total dry extract and non-reductive extract while the values of the same indices in samples obtained through microwave maceration are maximal. The samples obtained from Fetească neagră have maximum values in microwave maceration while at samples obtained from Merlot, the minimal values are found in variants processed through classical maceration and the highest in thermal processed samples.

Figure 1 presents the evolution, in percentages, mg/L epicatechine for the D280 and IFC, in order to evaluate the influence of the applied technology upon wines. The local varieties have the same distribution of values between the classical and roto tanks compared with thermal maceration of the four technology options evaluated. A particular case is at Merlot wines when the classical and thermal procesys presents lower values than microwave and roto tanks. Values are discussed in terms of D280 percentage (can be discussed in the same manner for IFC). With few exceptions, it can be generalized, that heat maceration variants have higher significant values for IFC.



**Fig. 1** – Percentual evolution of parameters D280 and IFC

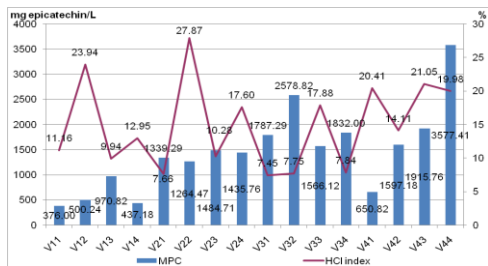


**Fig. 2** – Total anthocyanins quantity and IFC evolution

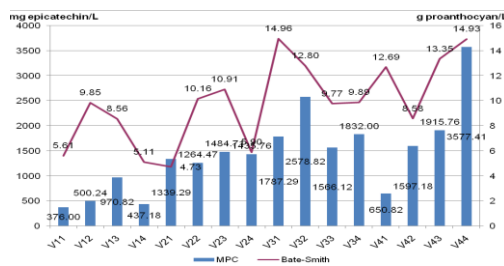
Figure 2 presents the quantitative results for IFC (g/L gallic acid) and total anthocyanins quantity (mg/L) in the studied samples. Analyzing the graphical distribution from the figure, it can be said that in the thermal variants (indexed 2 and 3 at  $V_x$ ) the highest quantities of anthocyanins are found and also the highest quantities of compounds with reductive properties (the anthocyanins ratio is according to the grape variety of which the wine was made). In the Băbească neagră wines, higher values appear at anthocyanins than IFC values. By comparing the data of figures 1 and 2 it can be seen that the highest quantity of anthocyanins is obtained by applying classical thermo-maceration, but in the case of Cabernet Sauvignon wines, the microwave maceration technique can also be efficient.

Figures 3 and 4 present an evaluation of tannins present in wine samples. For evaluating the total quantity of tannins the methyl cellulose method was used. The level and tendency that these compounds have in wine are showed in fig. 3.

High values of the HCl index are found in wines obtained through microwave maceration from local grape varieties. Small quantities of the same index are registered in the wine samples obtained from cosmopolitan grape varieties. High values (>25%) of this index represent already polymerized tannins or with an tendency for precipitation, while small values (<10%) represent the presence of monomeric tannins.

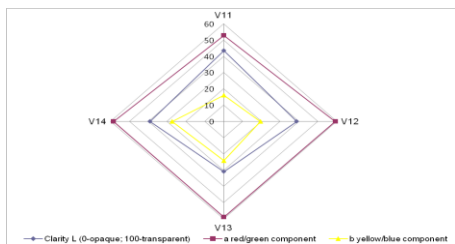


**Fig. 3** – Methyl-cellulose index and clorhydric index variation

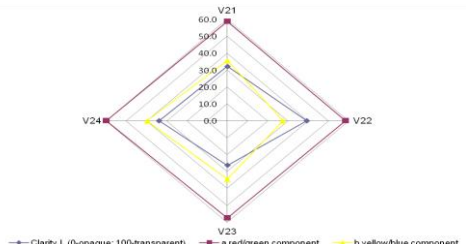


**Fig. 4** – The methyl-cellulose index compared to Bate-Smith reaction values

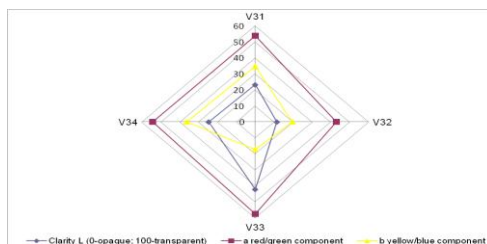
Figure 4 presents the results of an oxidative depolymerisation test (Bate-Smith) compared with the results obtained in the methylcellulose precipitation test. Some of the applied technological variants induce the appearance of superior polymeric structures especially in wines obtained through thermal macerations from local grape varieties. The high value of V<sub>31</sub> (the result of the oxidative polymerisation reaction), compared to HCl index, can be explained through the fact that the wine obtained through this method has suffered a slight acetic fermentation, probably at the same time with the alcoholic fermentation (this is the sample with the highest values in volatile acidity from V<sub>3x</sub> variants, low alcohol and total acidity). Due to the significant tannin quantity, the value of Bate-Smith reaction is higher. Analysing the two figures (3 and 4), one can note that cosmopolitan grape varieties present higher tannins indeces that have superior implications like a better stability in time for maturation compared to the wines obtained from local grape varieties.



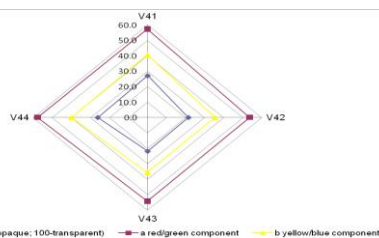
**Fig. 5** – Orthogonal distribution of color parameters L, a, b in V<sub>1x</sub>



**Fig. 6** – Orthogonal distribution of color parameters L, a, b in V<sub>2x</sub>



**Fig. 7** – Orthogonal distribution of color parameters L, a, b in  $V_{3x}$



**Fig. 8** – Orthogonal distribution of color parameters L, a, b in  $V_{4x}$

Figures 5, 6, 7, 8 are spatial distributions of colorimetric characteristics of the wines obtained by different maceration techniques. Figure 7 shows that there is not an orthogonality of the parameters and that, implies a significant variation of the wine's colour taking into consideration the applied maceration technique. The small colorimetric differences can be noticed only in the case of  $V_2$  (Fetească neagră) and  $V_4$  (Merlot).

## CONCLUSIONS

1. The thermal and microwave maceration in red wines, compared with classical maceration techniques, leads to the extraction of higher quantities of phenolic compounds – tannins – in wines;

2. Cosmopolitan grape varieties are richer in phenolic compounds than local grape varieties. The use of modern maceration fermentation methods can enrich the quality of obtained wines as well as the bioactive character of some varieties with less potential (Băbească neagră).

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# INTENSIFICATION OF THE PROCESS EXTRACTION DURING RED WINE PRODUCING TECHNOLOGIE

## INTENSIFICAREA PROCESULUI DE EXTRAȚIE LA PRODUCEREA VINURILOR ROȘII

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**Abstract.** *The paper includes the results of comparative analysis of two red wines producing technologies: conventional fermentation, with manual cap punching and delestage. The results have shown that the application of delestage increase significantly the speed of alcoholic fermentation up to 1.35 times, produce the growth of alcohol percent with 0,2 % vol. The extraction of phenolic compounds was 29 % higher in delestage wines, including anthocyanins – 11,5%. Sensory analysis has shown that there has been an essential improvement of the sensory characteristics of experimental wines. Thanks to diminish the negative effect of harsh tannins from seeds and condensation reactions of phenolic compounds, the delestage wines are more balanced in flavor. As the extraction of volatile phenolic compounds and esters has grown, the aroma profile became more intense and complex. The delestage can be recommended as an effective alternative maceration method, which can be used in red young wines production in the conditions of Republic of Moldova.*

**Key words:** must, maceration-fermentation, delestage, phenolic compounds, anthocyanes, tannins.

**Rezumat.** *Lucrarea include rezultatele analizei comparative a două procedee tehnologice de producere a vinurilor roșii la întreprinderea SA „Românești”: macerarea-fermentarea clasică și procedeul delestage. S-a demonstrat că aplicarea procedeului experimentat accelerează viteza fermentării alcoolice de 1,35 ori; determină creșterea tăriei alcoolice cu 0,2 % vol.; sporește proporția substanțelor fenolice extrase cu până la 29 %, inclusiv a antocianilor cu 11,5%. Analizele senzoriale efectuate au arătat că a avut loc o ameliorare esențială a caracteristicilor organoleptice ale vinurilor experimentale, care au un echilibru remarcant în gust, grație diminuării efectului negativ al taninurilor dure din semințe și formării taninurilor condensate; la nivel aromatic au devenit mai intense și complexe datorită acumulării sporite a esterilor cinamici. Pcedeul tehnologic delestage poate fi recomandat ca metoda alternativă eficientă de macerare-fermentare, pentru producerea vinurilor roșii tinere în condițiile Republicii Moldova.*

**Cuvinte-cheie:** mustuiala, macerare-fermentare, delestage, complex polifenolic, antociani, taninuri.

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## INTRODUCTION

Red wines have always been the subject of the technological and strategically researches, in order of increasing of the extraction rate of all compounds from the grapes and improvement of the final product quality, while ensuring its long-term stability. The main point in all the researches have always been focused on the different fermentation varieties, which have essential impact on the red wines structure. It was found that the classical punch-down technology couldn't discover whole harmony and balance of red wines.

As the result of those researches in winemaking have been introduced pump-overs and different varieties of this operation, including delestage (Bosso, 2001; Cottrell, 2003; Delteil, 2006). The research of delestage have begun to be studied in USA in 2000 and have been continued at the wine research laboratories in Aquitaine, Val de Loire, Burgundy, Midi-Pyrenees in 2003. First results of these researches have shown that delestage allows a better extraction of phenolic compounds from red grapes, the wine becoming better structured, balanced in taste and discover new different flavors. Also, those wines can be consumed earlier than wines obtained using punch-downs or other classical fermentations varieties (Vinsonneau, 2008).

The aim of the present work was to verify the influence of delestage on wine under the local specific conditions in Romanesti, Republic of Moldova comparing with the wine obtained in the same region using punch-downs.

## MATERIAL AND METHOD

For the research in this paper were used Cabernet-Sauvignon grapes, juice and wine. Cabernet-Sauvignon grapes (100 kg) received at S.A. "Romanesti" were proceeded in two different technological lines. The first one included fermentation using 4-5 daily punch-downs for 7 days. The second one included delestage, consisting from following operations: juice free running from tank into a sump using a screen for seed separation, pumping of the free running juice into a different tank, fermentation apart of juice and pomace for 2-3 hours and the return of juice into initial tank. Delestage were applied 3-4 times during fermentation (5 days): at the beginning, in the middle and at the end. During fermentation were analyzed the level of sugar and alcohol.

After pressing, the obtained fermented wine from both lines were inoculated with the *Oenococcus* bacteria for malo-lactic fermentation at 20 °C.

After the malo-lactic fermentation the young wine was racked from lees, the level of sulfur dioxide was raised to 70 mg/L and the wine was stored until March, when was made another racking and were analyzed the basic and secondary wine characteristic, as fenolic compounds, anthocyanins. Also the obtained wines were tasted.

## RESULTS AND DISCUSSIONS

The studies of fermentation processes in the same termical conditions (26-30°C) have showed that the speed of fermentation increases in case of

delestage obtained wines about 1.35 times compared with the wines obtained using daily punch-downs (fig. 1).

The effectiveness of delestage procedure can also be sawn from analyze of the basic characteristics at the end of alcoholic fermentation (tab.1)

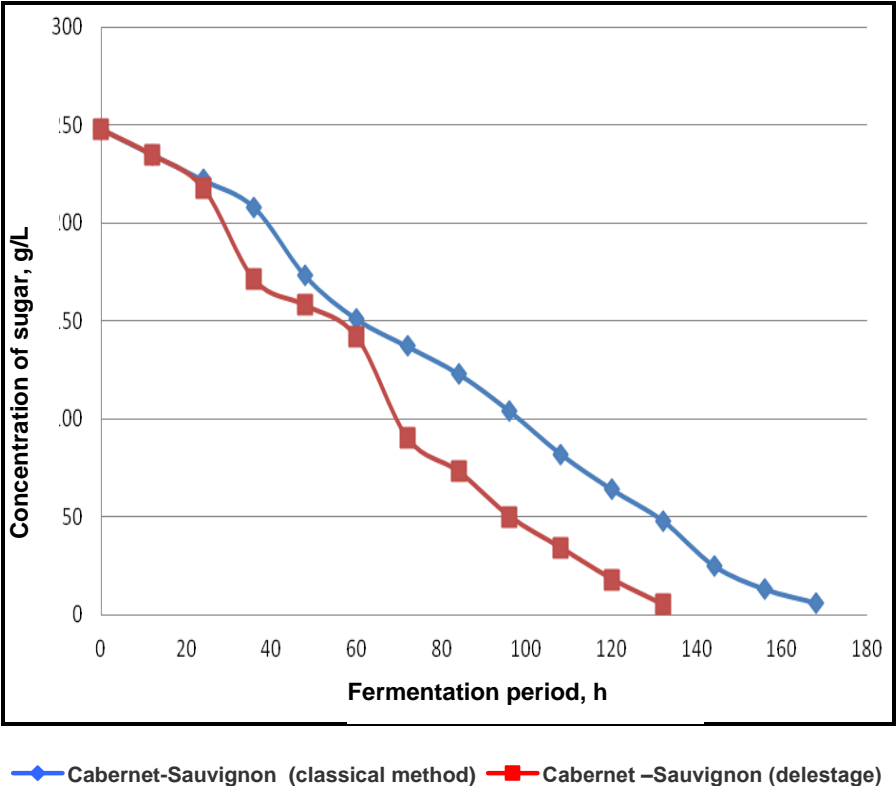


Fig. 1 -The dynamic of sugar levels during fermentation

Table 1

Basic characteristics of wine after alcoholic fermentation							
Variant	Alcohol % vol.	Sugars g/L	Acides g/L	Volatil acides g/L	Sulfur dioxide, free/ total mg/L	Phenolic compounds mg/L	Anthocyanins mg/L
Classic	13,6	2	6,2	0,24	6/18	1850	278
Delestage	13,8	2	6,0	0,32	5/15	2300	314

From the table 1 it can be observed that the main characteristics aren't very different, excepting the acids level and VA. At the same time, delestage developed more intensive extraction of phenolic compounds from solid parts. The level of phenolic compounds was 19% higher and the anthocyanins level

were 11.5% higher comparing with the classical fermentation with punch-downs.

Figure 2 show that delestage procedure has a significant impact on the levels and the structure of phenolic compounds in red wines

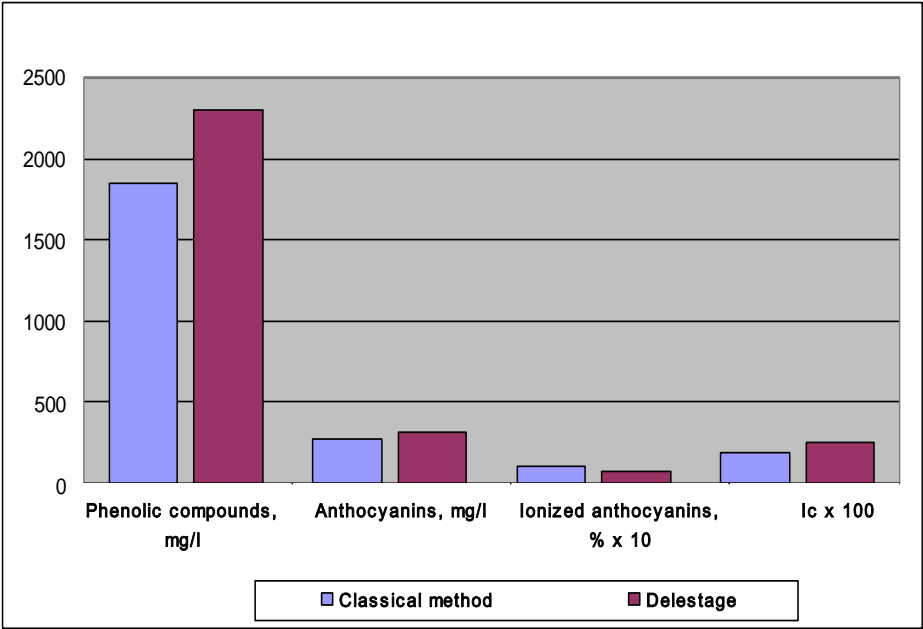


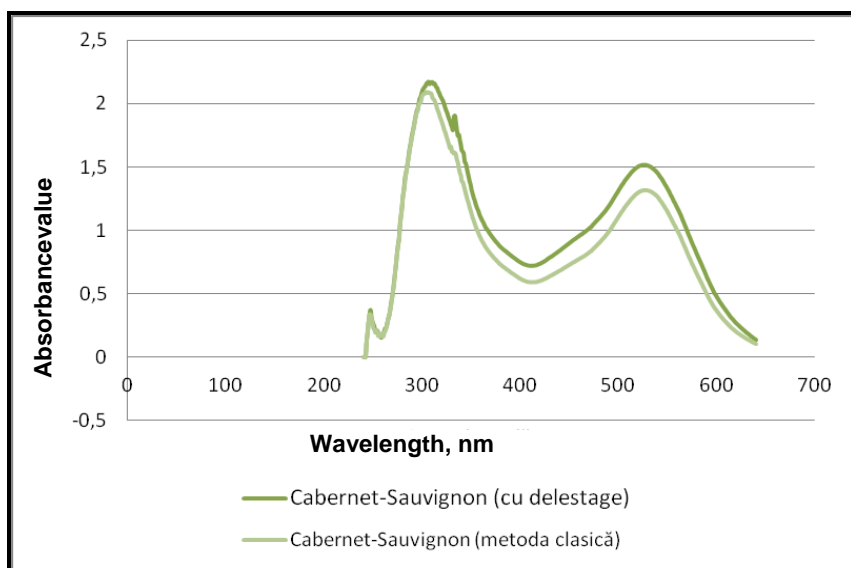
Fig. 2 -The levels of the phenolic compounds in obtained wines

As confirmation of this fact served the spectral analysis of wines, which helped in the determination of the rate of some types of phenolic compounds and showed the differences between the analyzing wines (fig. 3).

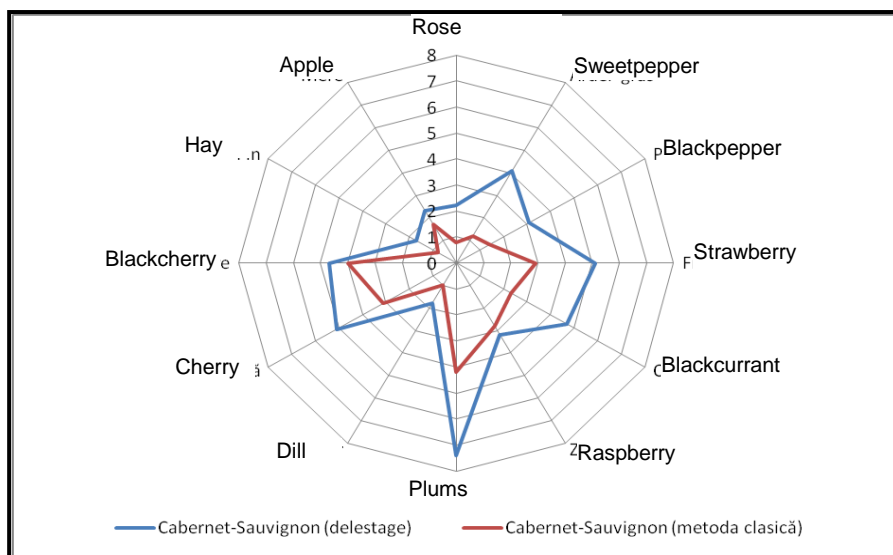
In wine obtained using delestage concentration of the extracted tannins ( $\lambda < 310$  nm) was similar with the concentration of tannins in the wine obtained using punch-downs. The level of colorant compounds ( $\lambda = 520-580$  nm) were about 17,6% higher in the delestage obtained wines. Also the concentration of cynamic esthers ( $\lambda = 314$  nm), that have impact on the flavour of the wine were 13% higher.

Descriptive tasting analysis have shown that most of the tasters have detected big differences in the color of the samples (89% of answers), taste (52% of answers) and flavors (29% of answers)





**Fig. 3** -Spectral analysis of wines



**Fig.4** - Descriptive tasting analysis of wines

The wine obtained using delestage were richer and more intense in flavor, higher fruitiness comparing with the wine obtained using classical punch-downs. The general descriptive tasting using some typical descriptors for red wines have shown the differences between the analyzed samples fig.4.

Fig. 4 shows that wine obtained using delestage have a higher aromatic potential. From detected flavors the most significant were those of the black

fruits, especially the flavors of: plums, black currant, raspberry, forest strawberry and cherry bone. Also were detected light capsicum flavors.

## CONCLUSIONS

Delestage have impact on the speed of fermentation, the obtained wines were less acid and richer (about 19%) in phenolic compounds and anthocyanins (about 11.5%).

The colorant intensity of delestage obtained wines was 1.32 times higher when in the other sample. The rate of ionic anthocyanins was less with about 3.4%.

As a result of delestage the tannins from wine become softer, after condensation and polymerization reaction between monomer phenolic compounds. Wine becoming more balanced, like an aged wine. In young wines obtained using classical method, harsh uncondensed tannins coupled with higher acidity give unpleasant taste sensation.

Wines obtained using delestage can be sold without ageing, reducing the cost of the final product.

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# PRELIMINARY CHARACTERIZATION OF POLYPHENOLIC EXTRACTS FROM GRAPE SEEDS

## CARACTERIZAREA PRELIMINARĂ A UNOR EXTRACTE POLIFENOLICE OBȚINUTE DIN SEMINȚE DE STRUGURI

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**Abstract.** *The capacity of grapevine varieties to assemble various types of polyphenols represented a rather less studied segment of study which is currently raising more interest. These compounds may be found especially in grape skins and seeds from where they are transmitted to must and wine by macerating processes. Studies on polyphenols from grapes proved to be on the one hand essential for assessing grapevine varieties' oenological potential, and on the other hand very important in the evaluation of their beneficial effects on maintaining the metabolic balance and the health condition of the human body. In this paper we make a preliminary presentation and characterization of polyphenolic extracts from the grape seeds of seven grapevine varieties, among which four national varieties (Fetească neagră, Băbească neagră, Arcaș, Negru de Drăgășani), two international ones Cabernet Sauvignon, Merlot) and the disease resistant Chambourcine variety.*

**Key words:** seed, grape, phenolic acids, resveratrol, tanins

**Rezumat.** *Capacitatea soiurilor de viță de vie de a acumula diferite clase de polifenoli a constituit un segment de preocupare relativ îngust dar care se amplifică în prezent. Acești compuși se regăsesc cu precădere în semințele și pielea boabelor de struguri de unde sunt preluați, în musturi și vinuri în timpul procesului de macerație. Studiile privind polifenolii din struguri s-au dovedit pe de o parte esențiale în evaluarea potențialului oenologic al diferitelor soiuri de viță de vie, iar pe de altă parte foarte importante în evaluarea proprietăților benefice ale acestora în menținerea echilibrului metabolic și a stării de sănătate a organismului uman. În lucrare sunt prezentate și caracterizate preliminar extractele polifenolice obținute din semințele de strugurii a șapte soiuri de viță de vie, dintre care patru soiuri autohtone (Fetească neagră, Băbească neagră, Arcaș, Negru de Drăgășani), două din sortimentul internațional (Cabernet Sauvignon, Merlot) și soiul cu rezistență sporită Chambourcine.*

**Cuvinte cheie:** semințe, struguri, acizi fenolici, resveratrol, taninuri

## INTRODUCTION

Using plant extracts as a source of remedies for preventing or healing several diseases captured people's attention since the oldest times. A great part of the active biologic composites of vegetal extracts are the polyphenols, that represent a class of over 8000 composites of which the majority have been

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identified in different anatomic segments of plants (Georgescu C. et. al, 2005).

Among the total of superior plants, *Vitis vinifera* species contains significant quantities of almost all the classes of composites with known phenolic structure. Moreover, black grapes contain complex mixtures of composites with polyphenolic structure easy to be extracted (Tudose Irina, 2002). These composites are usually found in seeds and grape skins where from they are absorbed in musts and wines, during the maceration process. In the context of the most frequent national and international use of the natural products, the research in the present work aims to achieve a preliminary characterization of some polyphenolic extracts, obtained from grape seeds of some autochthonous varieties of grapes as well as from the international assortment. This study is also justified by the abundance of information in the specialty literature, which attracts the attention upon the anti-anaemic, anti-inflammatory, antioxidant, cardiovascular, immunomodulator and even upon the oncochemiotherapeutic effects of polyphenolic extracts (Mittal A. et al., 2003; Vitseva O. et al., 2005; Višnja Katalinic et. al., 2010).

## **MATERIAL AND METHOD**

Polyphenolic extracts have been obtained from grape seeds of some autochthonous varieties of grapes as well as from the international varieties (Fetească neagră, Băbească neagră, Arcaș, Negru de Drăgășani, Cabernet Sauvignon, Merlot and Chambourcine). After breaking up at dimensions of 1-2 mm, the vegetal materials have been degreased with ethylic ether. The procedure of extraction has been done in a continuous system in the Soxhlet device, using the ethylic alcohol as solvent in a proportion of 1/10 (vegetal material, g/solvent, mL).

For the preliminary characterization of polyphenolic extracts there were determined the total polyphenols through Folin-Ciocalteu method and the coefficient of tannoid substance (I.T.S) through the method established by Bourzex. Also, through HPLC analysis (chromatography of high performance liquids) there have been identified and quantified a series of phenolic acids, stilbene (trans-resveratrol) as well as some non-hydrolysable tannins (catechin and epicatechin).

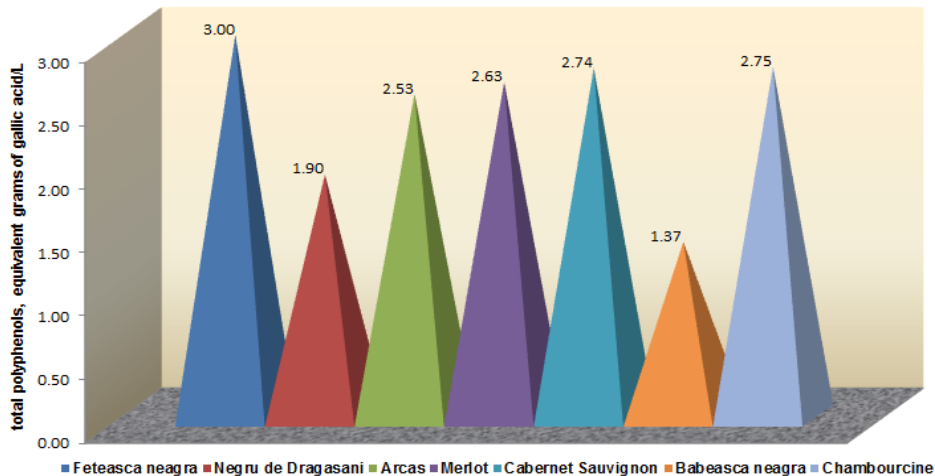
## **RESULTS AND DISCUSSIONS**

In order to assess the beneficial properties of the polyphenolic extracts obtained from grape seeds in maintaining the metabolic equilibrium and the wellness of the human organism, these have been subjected to a process of preliminary characterization.

Therefore, in figure 1 there are presented data regarding the contents in total polyphenols of the extracts obtained in a continuous system from the varieties taken into account in this study. In the graphical representation there was noticed the vegetal extract from grape seeds belonging to the variety Fetească neagră, with a concentration in total polyphenols of 3,0 g GAE/L (equivalent grams of gallic acid). As regards the extracts obtained from seeds belonging to the varieties Chambourcine, Cabernet Sauvignon, Merlot and Arcaș there was noticed that these ones represent relatively closed values of the concentration in total

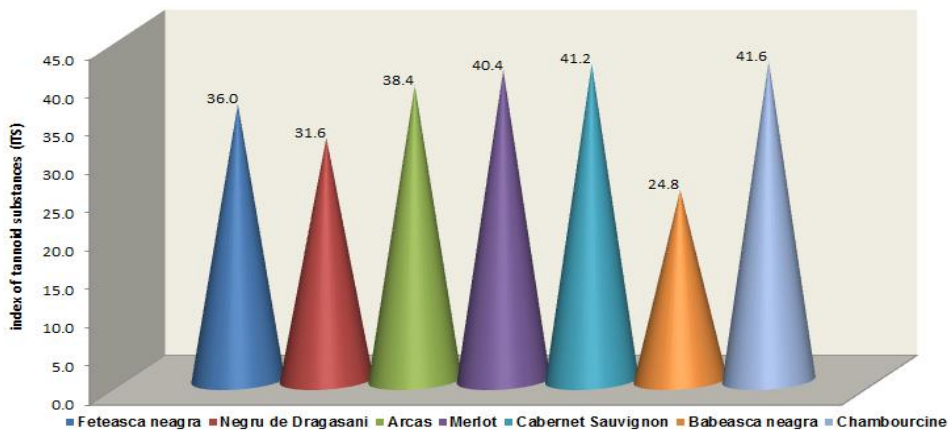
polyphenols (figure 1), respectively between 2,53 and 2,75 g GAE/L.

The same tendency was noticed in the case of the index of tannoid substances, the values being of 41,6 for the extract obtained from the seeds of the Chambourcine variety, of 41,2 for Cabernet Sauvignon, 40,4 for Merlot, respectively 38,4 for Arcaş (figure 2).



**Fig. 1** – The content in total polyphenols of the polyphenolic extracts obtained from the seeds of the varieties taken into account in the present study

The extracts obtained from the varieties Negru de Drăgășani and Băbească neagră indicated the smallest values both for the coefficient of tannoid substances (31,6 and 24,8) and for the concentration in total polyphenols (1,90 and 1,37 g GAE/L).



**Fig. 2** - The coefficient of tannoid substances (I.M.T.) of the polyphenolic extracts obtained from the seeds of the varieties taken into account in the present study

Among the polyphenolic acids, the phenolic acids are the most common for the vegetal extracts, these ones being noticed as mixtures between the hydroxbenzoic and hydroxicinamic acids (table 1 and 2). Both categories of acids

present an interest in the characterization of the polyphenolic extracts due to the antiseptic, diuretic and stimulative action of the biliary secretion.

In the case of the analyzed extracts, the content of the hydroxibenzoic acids varied within large limits (table 1). The most important hydroxibenzoic acid, the gallic acid, presented values between 7,794 mg/L in the case of Negru de Drăgășani and 12,452 mg/L in the case of Arcaș. As regards the salicylic acid, although in the specialty literature there is noticed the fact that it forms during the process of alcoholic fermentation, it has been identified in significant quantities in the polyphenolic extracts obtained from seeds, respectively between 42,845 mg/L at Băbească neagră and 96,639 mg/L at Cabernet Sauvignon. In relatively large quantities was found the syringic acid, with variation limits between 32,537 mg/L and 114,046 mg/L. In the analyzed polyphenolic extracts there were also identified other hydroxibenzoic acids, such as the p-hydroxibenzoic acid, m-hydroxibenzoic acid and the vanilic acid.

Table 1

**Hydroxybenzoic acids identified in the polyphenolic extracts obtained from the seeds of the varieties taken into account in the present study**

Varieties	p-hydroxibenzoic acid, mg/L	m-hydroxibenzoic acid, mg/L	salicylic acid, mg/L	vanilic acid, mg/L	gallic acid, mg/L	syringic acid, mg/L
Fetească neagră	0.946	0.401	92.863	0.446	10.083	114.046
Negru de Drăgășani	1.045	0.206	56.124	1.008	7.794	32.537
Arcaș	3.448	2.287	52.280	2.214	12.452	49.646
Merlot	3.049	0.200	89.675	0.320	10.786	85.451
Cabernet Sauvignon	3.145	0.403	96.639	0.655	9.960	81.482
Băbească neagră	3.295	0.502	42.845	0.585	10.016	57.682
Chambourcine	3.498	0.341	70.146	0.428	11.066	50.826

Through the HPLC analysis of the polyphenolic extracts there was also identified a series of hydroxycinnamic acids, respectively the caffeic, p-coumaric, ferulic and sinapic acids, the obtained results being presented in table 2.

Table 2

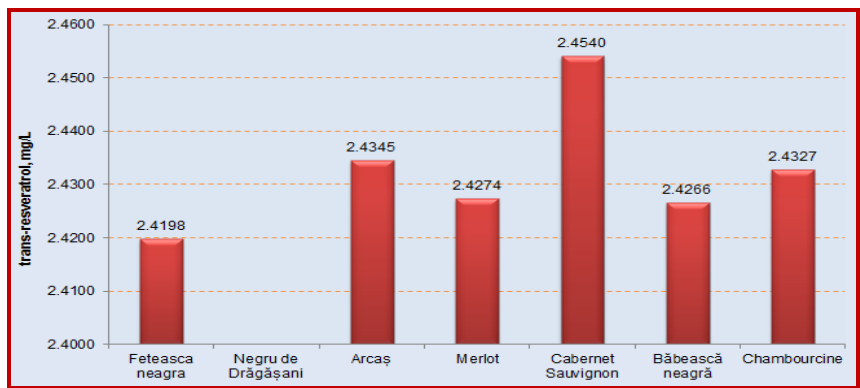
**Hydroxycinnamic acids identified in the polyphenolic extracts obtained from the seeds of the varieties taken into account in the present study**

Varieties	caffeic acid, mg/L	p-coumaric acid, mg/L	ferulic acid, mg/L	sinapic acid, mg/L
Fetească neagră	0.525	4.576	0.967	0.355
Negru de Drăgășani	0.409	4.562	0.988	0.329
Arcaș	0.447	4.563	0.961	0.366
Merlot	0.485	4.569	0.981	0.378
Cabernet Sauvignon	0.487	4.580	0.970	0.337
Băbească neagră	0.447	4.639	0.990	0.358
Chambourcine	0.503	4.575	0.973	0.375

Analyzing the data, one may notice the caffeic, ferulic and sinapic acids present reduced concentrations. Moreover, it can also be noticed that no matter the variety of which were obtained the extracts, the content in hydroxycinnamic acids does not indicate significant variations, the values being very close one to

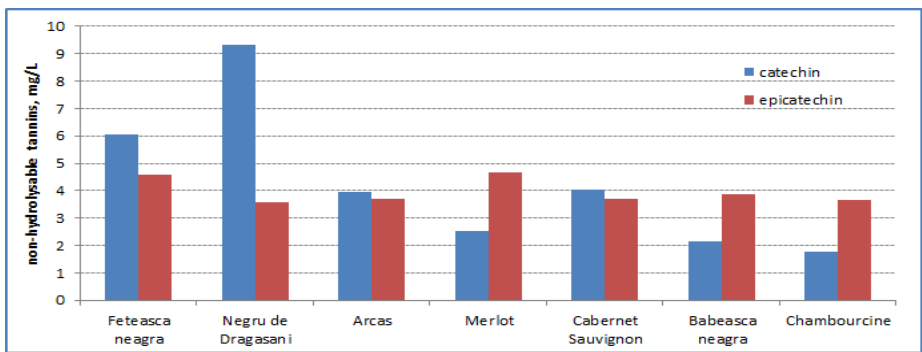
another.

Except for the phenolic acids in the extracts obtained from the seeds of the varieties taken into account in the present study, there was also identified the trans-resveratrol. This functions as an anti-inflammatory agent, conferring the extracts from grape seeds the capacity of reducing the values of the triglycerides and of the cholesterol in the blood. Analyzing the graphical representation of the obtained data (figure 3) one might notice a small variation of the concentration of trans-resveratrol between 2,4198 and 2,4540 mg/L, as well as its absence in the extract obtained from the seeds of Negru de Drăgășani.



**Fig. 3** - The content in trans-resveratrol of polyphenolic extracts obtained from the seeds of the varieties taken into account in the present study

Through the analysis of the polyphenolic extracts obtained from seeds there was noticed the presence of some non-hydrolysable tannins (condensed), respectively the catechin and the epicatechin (figure 4).



**Fig. 4** – The variation in concentration of non-hydrolysable tannins in the polyphenolic extracts obtained from the varieties taken into account in the present study

As regards the content of catechin it can be noticed the large interval of variation, from 1,785 mg/L at Băbească neagră to 9,319 mg/L at Negru de Drăgășani. In the case of the epicatechin, higher values were noticed at the varieties Fetească neagră (4,583 mg/L) and Merlot (4,679 mg/L), in the case of the other varieties the values being close one to another.

## CONCLUSIONS

1. The polyphenolic extracts obtained from grape seeds belonging to the varieties Chambourcine, Cabernet Sauvignon, Merlot and Arcaș indicated relatively close values of the concentration in total polyphenols of the coefficient of tannoid substances. The extracts that were obtained from Negru de Drăgășani and Băbească neagră characterized through low values, both for the coefficient of tannoid substances (31,6 și 24, 8) and for the concentration in total polyphenols. (1,90 și 1,37 g GAE/L).

2. As regards the phenolic acids, it was noticed that the gallic acid indicated values between 7,794 mg/L at Negru de Drăgășani and 12,452 mg/L at Arcaș. The salicylic and siringic acids were identified in significant quantities, with variation limits between 42,845 mg/L and 96,639 mg/L, respectively 32,537 mg/L and 114,046 mg/L. No matter the variety from which were obtained the extracts, the content in hydroxicinamic acids (caffeic, p-coumaric, ferulic, sinapic) did not present significant variations, the values being very close one to another.

3. There was noticed a small variation of the concentration of trans-resveratrol between 2,4198 and 2,4540 mg/L, as well as its absence from the extract obtained from the seeds of Negru de Drăgășani.

4. The preliminary characterization of the polyphenolic extracts obtained from the seeds of different varieties of grapes contributes to the assessment of their oenological potential and implicitly at the assessment of the beneficial properties in maintaining the metabolic equilibrium and the wellness of the human organism.

**Acknowledgments:** *This work was cofinanced from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/I.89/1.5/S62371 "Postdoctoral Schole in Agriculture and Veterinary Medicine area".*

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# STUDIES REGARDING THE CHITOSAN FILM PROTECTION OF APPLES SO AS TO MAINTAIN THEIR QUALITY IN THE FRIGORIFIC STOREHOUSES

## STUDII PRIVIND PROTEJAREA CU PELICULĂ DE CHITOSAN A FRUCTELOR DE MĂR, ÎN VEDEREA MENȚINERII CALITĂȚII LOR ÎN DEPOZITELE FRIGORIFICE

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**Abstract.** Chitin, a natural polysaccharide having a linear structure that may be found in the shell of marine crustaceans and the internal structure of certain invertebrates, is the second biopolymer that may be mainly encountered in the nature after cellulose. Chitin may be processed into chitosan through an initial decalcification in a diluted watery solution of chlorine hydride followed by deproteinization in a watery solution of diluted sodium hydroxide. Due to its special biological properties, biodegradability and biocompatibility, chitosan is widely used in the pharmaceutical industry, the food industry, medicine and biotechnologies. The films give fruits a special protection due to its pellicular properties, on the one hand, and anti fungal properties, on the other hand. Moreover, since they are biocompatible and biodegradable films, they may be ingested by consumers. The benefic action of chitosan on the human body has already been demonstrated by the curative properties it has.

**Key words:** chitosan film, fruit quality, frigorific storehouses

**Rezumat.** Chitina, o polizaharidă naturală cu structură liniară care se găsește în carapacea crustaceelor marine și în structura internă a altor nevertebrate, este al doilea biopolimer care se găsește preponderent în natură după celuloză. Chitina poate fi ușor procesată în chitosan printr-o decalcifiere inițială în soluție apoasă diluată de acid clorhidric, urmată de o deproteinizare în soluție apoasă de hidroxid de sodiu diluat. Datorită proprietăților biologice deosebite, a biodegradabilității și biocompatibilității sale, chitosanul este larg folosit în industria farmaceutică, industria alimentară, medicină și în biotehnologii. Peliculele conferă fructelor de măr o protecție special deoarece pe de o parte datorită proprietăților peliculare, iar pe de altă parte proprietăților antifungice pe care le are chitosanul. Mai mult, fiind pelicule biocompatibile și biodegradabile, pot fi ingerate de consumatori. A fost deja demonstrată acțiunea benefică a chitosanului asupra organismului uman, prin proprietățile curative pe care le are

**Cuvinte cheie:** peliculă chitosan, calitate fructe, depozite frigorifice

## MATERIAL AND METHOD

The apple fruits belonging to Generos, Starkrimson, Idared and Jonagold variety were subjected to a post-harvest pellicular treatment. They were immersed in a

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solution of chitosan film, concentration 3%, before placing the mincold cells. (M.B. Pérez-Gago, et colab. 2003)

After exterior moisture has evaporated, all variants were stored in the frigorific cell having a temperature of 2°C, a relatively high humidity of 90-95% and air circulation with a speed of at least 0.25 m/s, for a circulation coefficient of 30 recirculations/hour. (Beceanu D. 2000, 2003)

We monthly drew samples from each variant and variety which were then analysed in the lab of Technology of horticultural products department within USAMV Iași. (Anghel Roxana, 2009, 2010)

These samples were subjected to a series of physical determinations and chemical analyses to estimate their physiological state and biochemical content.

Thus, we determined:

- starch content by the iodine test
- the content of soluble dry substance by the refractometric method
- titrating acidity by the titrimetric method
- breathing intensity by means of Pettenkofer device
- structural-textural firmness by means of penetrometric method.

## RESULTS AND DISCUSSIONS

In the first four months of refrigeration, the evolution of fruits was the following, presented in tables 1-4 and figures 1-4.

In table 1 we may notice that fruits were harvested at an optimal hydrolization degree for storage in frigorific storehouses. The hydrolysis of starch was more intense for all blank tests and we could notice an exhaustion of the starch reserve ever since February.

*Table 1*

**The evolution of starch content (note the sample with iodine)  
fruit during cold storage**

Period /variety	Generos blank	Generos treated	Stark rimson blank	Stark rimson treated	Idared blank	Idared treated	Ionagold blank	Ionagold treated
November	8,0	8,0	8,0	7,0	8,0	7,0	8,0	8,0
December	9,0	8,2	9,0	7,4	9,0	7,2	9,0	8,2
January	9,8	8,5	9,8	8,0	9,6	8,0	9,8	8,5
February	10	9,4	10	9,0	10	9,0	10	9,2
March	10	9,6	10	9,2	10	9,4	10	9,6
April	10	9,8	10	9,6	10	9,8	10	9,8

In table 2 we may notice the evolution of the content in soluble dry substance of the stored fruits. At the beginning of the period of frigorific storage, the blank tests had a higher content in soluble dry substance as compared to the treated variants. In the first months of storage, the content in soluble dry substance increases due to hydrolization of fruit starch. After the starch reserve has been consumed, the content in soluble dry substance decreases due to its gradual exhaustion in metabolic processes.

At the end of the period of frigorific storage, the treated variants had a higher content in soluble dry substance as compared to the blank tests.

Among all the variety under study, Starkrimson variety stood out having the highest content in soluble dry substance. Ionagold variety had the lowest content in soluble dry substance. The same trend of increase of the content in soluble substances manifested throughout the frigorific storage for all the variety under study due to the enriching with monoglucids during the gradual hydrolization of starch.

Table 2

**Evolution of soluble solids content (<sup>0</sup>Bx) fruit during cold storage**

Period /variety	Generos blank	Generos treated	Stark rimson blank	Stark rimson treated	Idared blank	Idared treated	Ionagold blank	Ionagold treated
November	12,8	12,2	13,8	13,4	12,2	11,8	11,8	11,4
December	13,2	12,4	14,0	13,6	12,8	12,2	12,4	12,0
January	13,6	12,8	14,6	13,8	13,4	12,8	13,0	12,6
February	13,4	13,2	14,0	14,2	13,2	13,4	12,6	12,8
March	12,8	13,4	13,2	14,4	12,4	13,8	11,6	13,2
April	12,0	13,6	12,4	14,4	11,8	14,0	11,0	11,6

Table 3

**Evolution of acidity titrated (g a. malic/100gproduct) fruit during cold storage**

Period /variety	Generos blank	Generos treated	Stark rimson blank	Stark rimson treated	Idared blank	Idared treated	Ionagold blank	Ionagold treated
November	0,56	0,62	0,34	0,36	0,58	0,60	0,52	0,55
December	0,55	0,60	0,30	0,35	0,56	0,58	0,50	0,53
January	0,48	0,53	0,27	0,32	0,44	0,51	0,42	0,48
February	0,40	0,47	0,22	0,29	0,37	0,45	0,35	0,42
March	0,38	0,44	0,21	0,25	0,33	0,38	0,31	0,36
April	0,36	0,38	0,20	0,21	0,27	0,33	0,25	0,30

Titrating acidity (tab. 3) had the same decreasing trend during the frigorific storage, with the observation that at the end of the storage period, the blank tests had a much lower content in organic acids than the treated variants. Generos variety stood out having the highest acid content (0.38 g malic acid/100 g product).

Structural-textural firmness (tab. 4) is relatively good in the first months of frigorific storage and we could notice its faster decrease in January and February. We must mention that the treated variants exhibit a better firmness as compared to the blank test, all variety having lower values of this parameter.

Table 4

## Evolution structuro-textural firmness (UP / 5sec) during cold storage

Period /variety	Generos blank	Generos treated	Starkrimson blank	Starkrimson treated	Idared blank	Idared treated	Jonagold blank	Jonagold treated
November	25	23	20	18	28	26	27	24
December	28	24	24	20	32	28	30	26
January	33	27	28	25	38	31	34	30
February	38	30	32	28	42	36	39	34
March	40	34	36	32	44	38	41	36
April	42	38	38	35	45	40	43	39

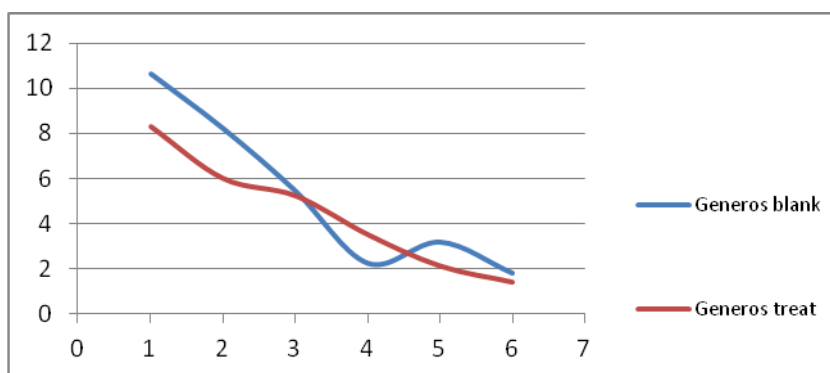


Fig. 1 –Respiration intensity of Generous variety during cold storage

The diagram of breath intensity for Generous variety (fig. 1) showed the climacteric point for the blank test in February. The descending trend of values for this parameter indicates that the metabolism of fruits is much slowed down. For the treated variant we could notice that the intensity of breathing was lower than for the blank test ever since the first month and then it increases linearly but it does not reach its climax.

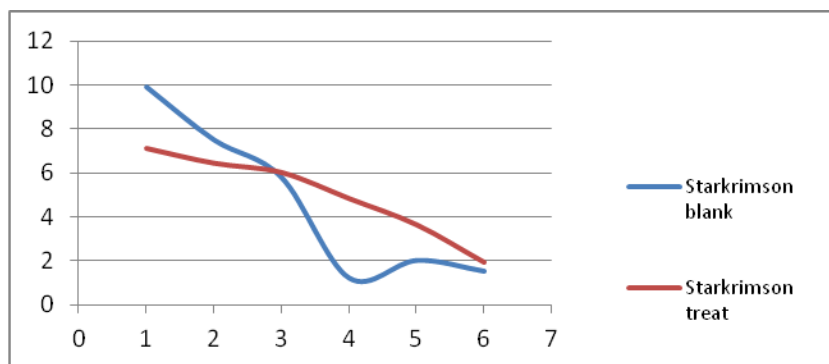
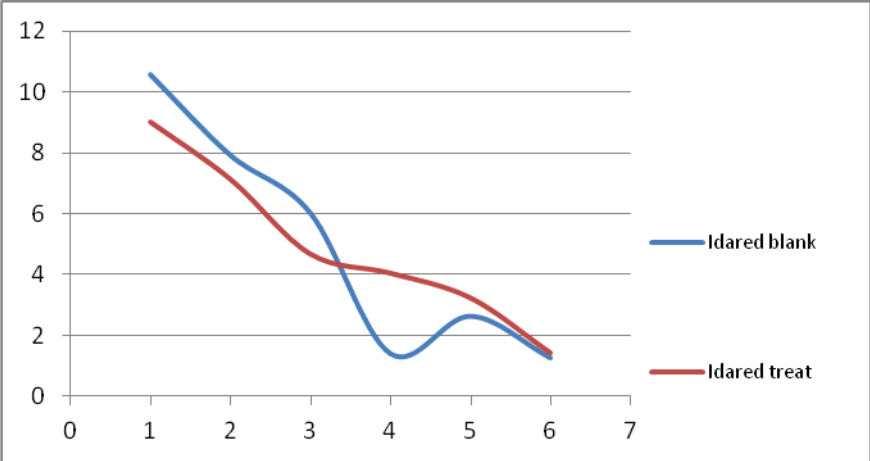


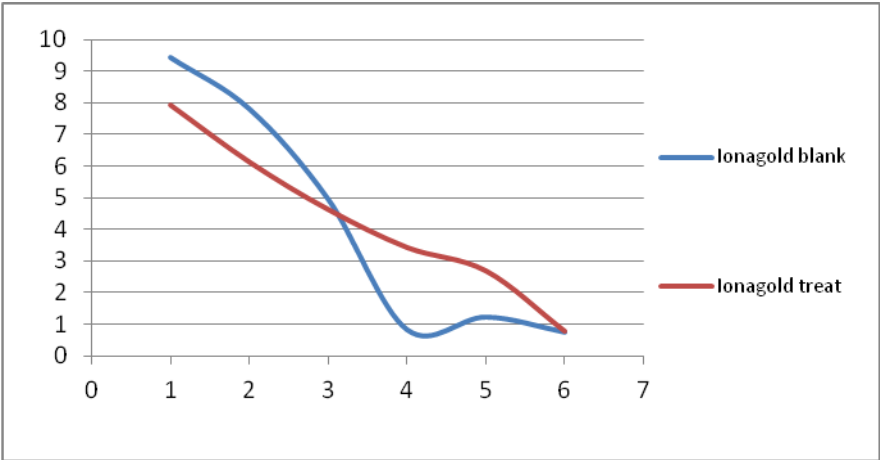
Fig. 2 – Respiration intensity of Starkrimson variety during cold storage

We could also notice the climacteric point for the blank test of Starkrimson variety (fig. 2) in February. Under the influence of the pellicular treatment, fruits had a lower metabolism and this decrease was steady throughout the frigorific storage.



**Fig. 3** – Respiration intensity of Idared variety during cold storage

In case of Idared variety (fig. 3), we could notice a relatively intense decrease of breathing intensity for both variants, but in different period. For the blank test, the decrease is constant in the first four months (until February), when fruits enter the climacteric phase, and the treated variant the decrease is intense in January - April.



**Fig. 4** –Respiration intensity of Ionagold variety during cold storage

For Ionagold variety (fig. 4), the metabolism of the treated fruits was lower than for the blank test in the first months of storage until February, when untreated fruits entered their climacteric phase.

## CONCLUSIONS

The chitosan film treatment in concentration of 3% applied to Generos, Starkrimson, Idared and Ionagold apple variety helped maintaining a high quality of fruits.

Considerable differences were registered ever since the first month of frigorific storage both between variety and variants.

The degree of starch hydrolization was more intense for the blank tests, so that in the first three months the starch reserve got exhausted.

This has led to a considerable increase of the content in soluble dry substance followed by an abrupt decrease of this parameter since simple glucides were consumed in the metabolic processes.

At the end of the period of frigorific storage, we may notice a higher content in organic acids for the treated variants as compared to the blank test.

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# STUDIES REGARDING THE CARBOXYMETHYL CELLULOSE FILM PROTECTION OF APPLES SO AS TO MAINTAIN THEIR QUALITY IN THE FRIGORIFIC STOREHOUSES

## STUDII PRIVIND PROTEJAREA CU PELICULĂ DE CARBOXIMETILCELULOZĂ A FRUCTELOR DE MĂR, ÎN VEDEREA MENȚINERII CALITĂȚII LOR ÎN DEPOZITELE FRIGORIFICE

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**Abstract.** *The edible films have been more and more used recently to maintain the quality of fruit and vegetables during their marketing in fresh state. They already know a series of biodegradable films successfully used in the developed countries. The materials used to obtain such films must meet a series of requirements related both to the protection of the products for which they are used and the consumers' protection. Besides the protective function, these films may have benefic actions on the human body. Many of these biodegradable films are made of derivatives of cellulose and starch. Carboxymethylcellulose is obtained from cellulose which is the main polysaccharide and constituent of wood and all plants' structure. It has multiple uses, mainly as a thickening agent, but also as a filling, dietary fibers, anti-agglomerating agent and emulsifier. In medicine, carboxymethylcellulose is generally used as a gastric antacid and laxative. Carboxymethylcellulose is highly soluble and it may be fermented in the large intestine.*

**Keywords:** carboxymethyl cellulose, protective film, fruit quality

**Rezumat.** *Peliclele comestibile sunt tot mai mult utilizate în ultimul timp pentru menținerea calității fructelor și legumelor în procesul valorificării în stare proaspătă. Se cunosc deja o serie de pelicule biodegradabile, folosite cu succes în țările dezvoltate. Materialele utilizate pentru obținerea acestor pelicule trebuie să îndeplinească o serie de cerințe, legate atât de protecția produselor pentru care se folosesc, cât și de protecția consumatorilor. Pe lângă funcția de protecție, aceste pelicule pot avea acțiuni benefice asupra organismului uman. Multe din aceste pelicule biodegradabile sunt constituite din derivați ai celulozei și amidonului. Carboximetilceluloza se obține din celuloză, principalul polizaharid și constituent al lemnului și tuturor structurilor plantelor. Are multiple utilizări, în principal ca agent de îngroșare, dar și ca umplutură, fibre dietetice, agent antiaglomerant și emulgator. În medicină, carboximetilceluloza se folosește, în special, ca antiacid gastric și laxativ. Carboximetil celuloza este foarte solubilă și poate fi fermentată în intestinul gros.*

**Cuvinte cheie:** carboximetilceluloză, peliculă protectoare, calitate fructe

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## MATERIAL AND METHOD

The apple fruits belonging to Generos, Starkrimson, Idared and Ionagold variety were subjected to a post-harvest pelicular treatment. They were immersed in a solution of carboxymethyl cellulose film, concentration 3%, before placing the mincold cells (M.B. Pérez-Gago, et colab. 2003).

After exterior moisture has evaporated, all variants were stored in the frigorific cell having a temperature of 2°C, a relatively high humidity of 90-95% and air circulation with a speed of at least 0.25 m/s, for a circulation coefficient of 30 re-circulations/hour (Beceanu D., 2010).

We monthly drew samples from each variant and variety which were then analysed in the lab of Technology of horticultural products department within USAMV Iași.

These samples were subjected to a series of physical determinations and chemical analyses to estimate their physiological state and biochemical content (Anghel Roxana, 2008).

Thus, we determined:

- starch content by the iodine test
- the content of soluble dry substance by the refractometric method
- titrating acidity by the titrimetric method
- breathing intensity by means of Pettenkofer device
- structural-textural firmness by means of penetrometric method.

## RESULTS AND DISCUSSIONS

In the first four months of refrigeration, the evolution of fruits was the following, presented in tables 1-4 and figures 1-4.

*Table 1*

**The evolution of starch content (note the sample with iodine) fruit during cold storage**

Period /variety	Generos blank	Generos treated	Stark rimson blank	Stark rimson treated	Idared blank	Idared treated	Ionagold blank	Ionagold treated
November	8,0	7,0	8,0	8,0	8,0	7,0	8,0	7
December	9,0	7,3	9,0	8,2	9,0	7,4	9,0	7,2
January	9,8	7,8	9,8	8,6	9,6	8,0	9,8	7,9
February	10,0	8,6	10,0	9,0	10,0	8,8	10,0	8,6
March	10,0	9,0	10,0	9,2	10,0	9,2	10,0	9
April	10,0	9,4	10,0	9,6	10,0	9,6	10,0	9,4

The harvesting of fruits for frigorific storage was made at an optimum hydrolization level of starch (tab. 1). During the frigorific storage, starch hydrolysis was more visible in all blank tests, thus since February this parameters shows that there is starch reserve in the fruit.

The evolution of the soluble dry substance (tab. 2) is correlated to the manner of starch hydrolization. The blank tests showed a high content of this parameter in the first months of storage due to the faster hydrolysis of starch. After starch has been completely hydrolyzed, the content in soluble dry substances decreases as they are consumed in the metabolic processes.



Table 2

**Evolution of soluble solids content (<sup>0</sup>Bx) fruit during cold storage**

Period /variety	Generos blank	Generos treated	Stark rimson blank	Stark rimson treated	Idared blank	Idared treated	lonagold blank	lonagold treated
November	12,8	12,6	13,8	13	12,2	12	11,8	11,6
December	13,2	12,8	14,0	13,6	12,8	12,4	12,4	11,8
January	13,6	13,2	14,6	13,8	13,4	12,8	13,0	12,4
February	13,4	13,4	14,0	14,2	13,2	13,2	12,6	12,8
March	12,8	13,6	13,2	14,4	12,4	13,6	11,6	13,2
April	12,0	13,8	12,4	14,4	11,8	13,6	11,0	13,4

The blank tests had a different evolution of the soluble dry substance meaning that during the six months of frigorific storage starch was not completely hydrolyzed, consequently the soluble dry substance content increased progressively from one month to another.

At the end of the frigorific storage period, the treated variants have a higher content in soluble dry substance as compared to the blank tests.

Table 3

**Evolution of acidity titrated (g a. malic/100g product) fruit during cold storage**

Period /variety	Generos blank	Generos treated	Stark rimson blank	Stark rimson treated	Idared blank	Idared treated	lonagold blank	lonagold treated
November	0,56	0,60	0,34	0,38	0,58	0,58	0,52	0,56
December	0,55	0,59	0,30	0,35	0,56	0,57	0,50	0,53
January	0,48	0,53	0,27	0,31	0,44	0,5	0,42	0,46
February	0,40	0,48	0,22	0,27	0,37	0,46	0,35	0,41
March	0,38	0,45	0,21	0,25	0,33	0,39	0,31	0,36
April	0,36	0,39	0,20	0,22	0,27	0,36	0,25	0,33

Throughout the frigorific storage, titrating acidity (tab. 3) had the same decreasing trend for all variety and variants under analysis.

We may notice that the blank tests had a lower content in organic acids as compared to the treated ones, an aspect visible up to the last month of storage.

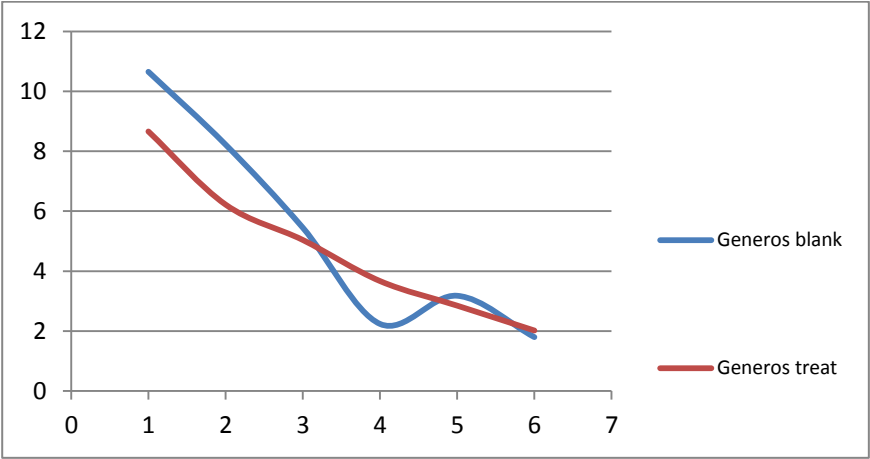
Table 4

**Evolution structuro-textural firmness (UP / 5sec) during cold storage**

Period /variety	Generos blank	Generos treated	Stark rimson blank	Stark rimson treated	Idared blank	Idared treated	lonagold blank	lonagold treated
November	25	24	20	20	28	26	27	25
December	28	25	24	21	32	27	30	26
January	33	27	28	26	38	30	34	32
February	38	31	32	30	42	35	39	36
March	40	36	36	33	44	37	41	36
April	42	39	38	37	45	40	43	38

Structuro-textural firmness (tab. 4) has amore pronounced downward trend in the first months of cold storage, attributed to more pronounced hydrolysis of starch which has the effect of softening tissues.

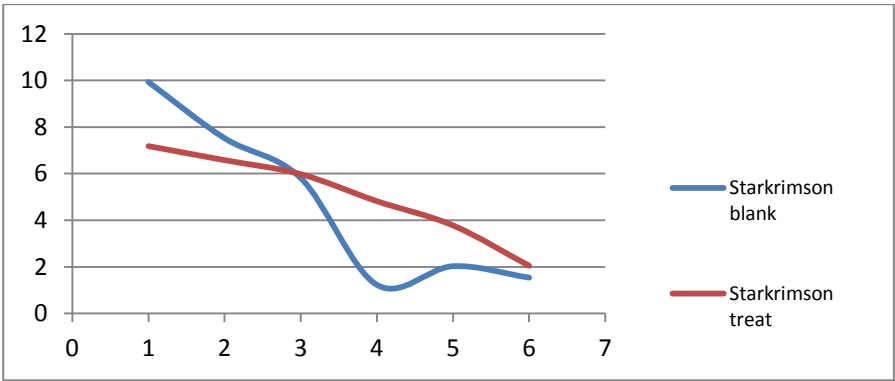
Film treatment with CMC was able to maintain good fruit firmness of apple, something seen in all varieties studied.



**Fig. 1** –Respiration intensity of Generous variety during cold storage

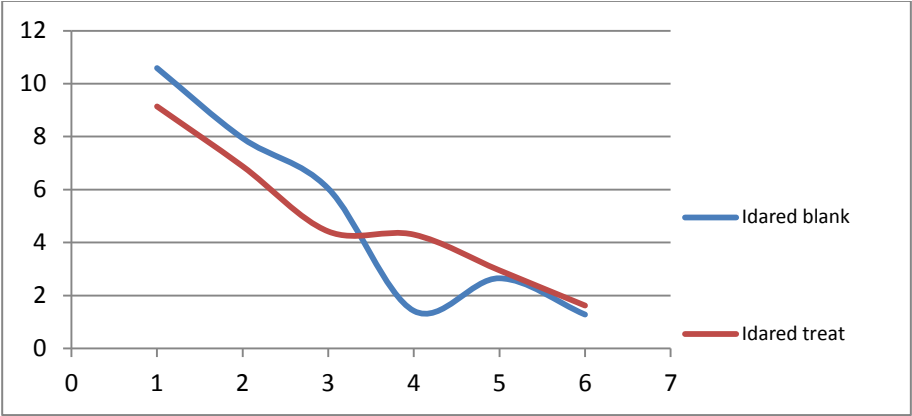
For the blank test of Generos variety (fig. 1), the climacteric phase may be seen ever since February. As the ethylene emission increases, the metabolism of fruits is slightly accentuated in March, but in April metabolism slows down.

In the treated variant, we may notice a decreasing trend of breathing intensity due to the CMC film that partially prevents the gas exchange with the exterior. The metabolism of fruits is slower and slower and fruits do not enter the climacteric phase.



**Fig. 2** –Respiration intensity of Starkrimson variety during cold storage

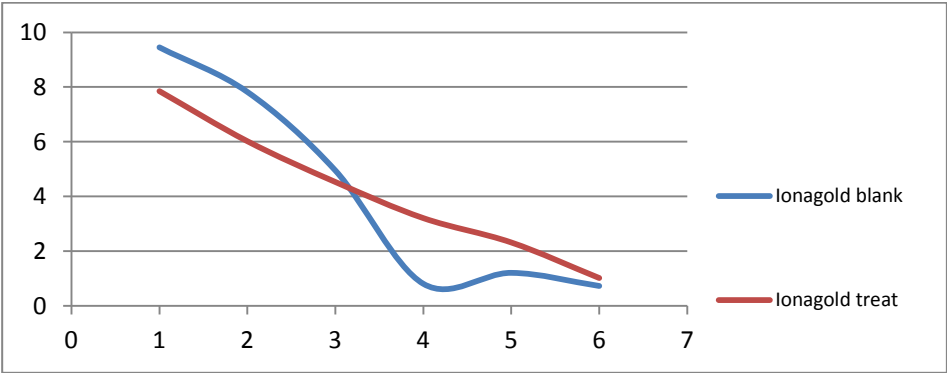
The film slowed down the metabolism of fruits in the first months of frigorific storage (fig. 2), thus the breathing intensity has lower values as compared to the blank test. As for the blank test, we may notice that in February fruits entered their climacteric phase.



**Fig. 3-**Respiration intensity of Idared variety during cold storage

The breathing intensity (fig. 3) has a decreasing trend during the period of frigorific storage for all variety and variants under study.

In the fourth month of storage, the apple fruits of the blank test entered their climacteric phase and the abrupt increase of breathing intensity from the next month was due to the higher ethylene emissions finally leading to speeding up of fruit metabolism.



**Fig. 4 –**Respiration intensity of Ionagold variety during cold storage

In Ionagold variety (fig. 4), the metabolism of treated fruits was lower as compared to the blank test in the first months of storage.

In February, the fruits of the blank test entered their climacteric phase.

## CONCLUSIONS

The pellicular treatment with carboxymethyl cellulose shows its efficiency in maintaining the quality of apples during the frigorific storage.

At the end of the storage period, the treated fruits registered superior values as compared to the blank tests both in terms of the content in soluble dry substance and the content in organic acids.

The hydrolization level of starch was more accentuated in the blank tests, whereas in the treated variants we could notice that they still contained this reserve substance.

The structural-textural firmness of fruits from the treated variants was higher due to the decrease of breathing intensity, namely the slowing down of metabolism, and the limitation of gas exchange with the exterior environment.

Considerable differences were registered ever since the first month of frigorific storage both among variety and among variants.

The level of hydrolization of starch was much faster for the blank tests, thus in the first three months the starch reserve was exhausted.

This led to a considerable increase of the content in soluble dry substance followed by an abrupt decrease of this parameter and simple glucides were consumed in the metabolic processes.

At the end of the period of frigorific storage, we may notice a high content in organic acids for the treated variants as compared to the blank tests.

The graphic representation of breathing intensity shows the entry of fruits in the climacteric phase for the blank test in February, whereas in the fruits of the treated variants the decrease of breathing intensity was almost constant without highlighting the climacteric point until April.

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# AMPELOMETRIC STUDY OF NATIVE GRAPEVINE VARIETIES BY CLUSTER ANALYSIS METHOD

## STUDIUL AMPELOMETRIC AL UNOR SOIURI AUTOHTONE DE VIȚA DE VIE PRIN METODA ANALIZEI CLUSTER

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**Abstract.** Cluster analysis method enables the characterization and grouping of vine varieties on the basis of "closeness" expression ampelometric. In this paper are presented results on the basis ampelometric phenotypic similarity for 21 indigenous grape varieties belonging to different ecologic-geographic groups. The cluster analysis method based on measurements performed on adult leaves, it was determined the degree of phenotypic similarity between varieties. The dendrogram analysis finds the existence of two polythetic groups, group A consists of subgroups A1 and A2 and group B consists of B1 and B2 subgroups. Relatively high phenotypic homogeneity adult leaves are found in group B, with a smaller dissimilarity index (30097.283) compared with group A (35914.064). The greater homogeneity phenotype registered subgroup B2 consists of Frâncușă, Furmint, Miorița, Negru moale, Negru vârtos and Cruciuliță varieties (14562.078).

**Key words:** grapevine varieties, ampelometry, phenotype, cluster analysis, dendrogram

**Rezumat..** Analiza cluster oferă posibilitatea caracterizării și grupării soiurilor de viță de vie pe baza "apropierii" expresiei ampelometrice. În lucrare sunt prezentate rezultate referitoare la asemănarea fenotipică pe baze ampelometrice pentru 21 de soiuri autohtone aparținând unor grupe ecologice-geografice diferite. Prin metoda analizei cluster, pe baza măsurătorilor efectuate pe frunza adultă, a fost stabilit gradul de similitudine fenotipică dintre soiuri. Din analiza dendrogramei soiurilor se constată existența a două grupuri politetice, grupul A format din subgrupurile A1 și A2, și grupul B alcătuit din subgrupurile B1 și B2. Omogenitate fenotipică relativ mare a frunzelor adulte se constată la grupul B, cu un indice de disimilaritate mai mic (30097,283), comparativ cu grupul A (35914,064). Cea mai mare omogenitate fenotipică a înregistrat subgrupul B2 alcătuit din soiurile Frâncușă, Furmint, Miorița, Negru moale, Negru vârtos și Cruciuliță (14562,078).

**Cuvinte cheie:** soi, viță de vie, ampelometrie, fenotip, analiza cluster, dendrograma

## INTRODUCTION

Description of the vine varieties by multivariate statistical methods is a recent concern in ampelography research. Cluster analysis complements

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traditional ampelometric method, allows the processing of large volumes of data and enables the characterization and grouping of grapevine varieties on the basis of ampelometric expression similitude (Rotaru, 2000, 2002; Țârdea, 2002; Volpi, 1990).

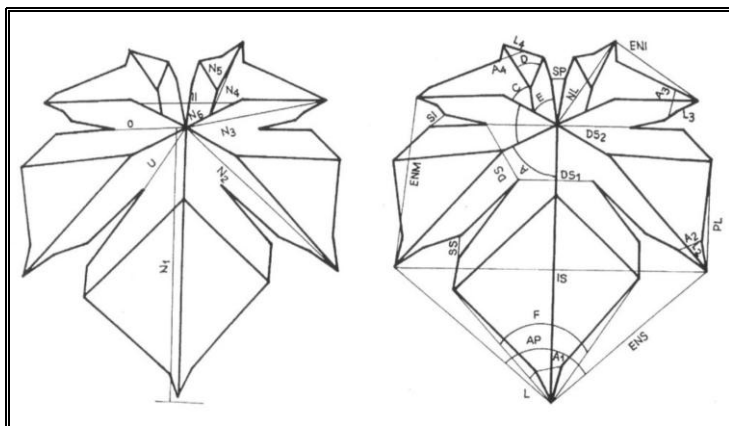
The cluster method admits existence of the polythetic groups, whose elements are equivalent or similar according to several criteria, but not for all characteristics. This method starts from the basic concept of distance between elements (cases) and allows sharing of subject group under study in branches according to the existing similitude or dissimilarity.

The application of this method in ampelography allows the establishment of the resemblances between the grapevine varieties on the basis of their "closeness" ampelometric expression, so as two varieties have the chaining index less, even to their phenotypic similarity is higher.

## MATERIAL AND METHOD

Were analyzed 21 native grapevine varieties belonging to different ecologic-geographic groups from Collection ampelographic of S.C-D.V.V. Odobesti. From each grapevine variety were harvested 20 adult leaves situated in the middle of the shoots (between nodes 7-12), who showed no symptoms of disease or pest attack. We chose this sampling portion of the material as it is known from literature that this area is very small variability ampelographic characters. The time to collected the leaves was before entrance harvest grapes of Parga, calendar, late July-early August.

Starting from the classical ampelometric method were established in leaf architecture 51 benchmarks points and have made 68 direct ampelometric measurements, on which were calculated another 53 ampelometric values (figure 1). For symmetrical characters we measured and calculated the both values.



**Fig. 1** – Ampelometrical measurements effectuated on leaves of grape varieties

The data obtained allowed the build up a statistic population made of variation strings of 20 values for all 121 characters examined and for all grapevine varieties analyzed. The data set was represented by the average value of each character analyzed.

To elaborated of grapevine varieties dendrogram, cluster analysis was based on establishing and aggregation the groups (branches), which depend on the size of square Euclidean distance of the elements subjected to grouping. The clustering or aggregation algorithm was performed according to the principle of variance or minimum inertia loss (Ward principle generalized), using multidimensional statistical software statistiXL 1.8x version.

## RESULTS AND DISCUSSIONS

Statistical processing of ampelometric data sets by cluster analysis method, resulted in the elaboration of the dendrogram of hierarchical classification of grapevine varieties (figure 2). From the analysis of the dendrogram could be identified the existence of two optimal groups or branches, each had two subgroups or sub-branches.

Group A consists of two subgroups: subgroup A1 result from the aggregation of grapevine varieties: Milcov, Busuioacă de Bohotin, Balada, Țâța caprei, Fetească albă and subgroup A2 formed by the chaining of Băbească neagră, Țâța vacii, Băbească gri, Codană, Fetească neagră, Șarba varieties.

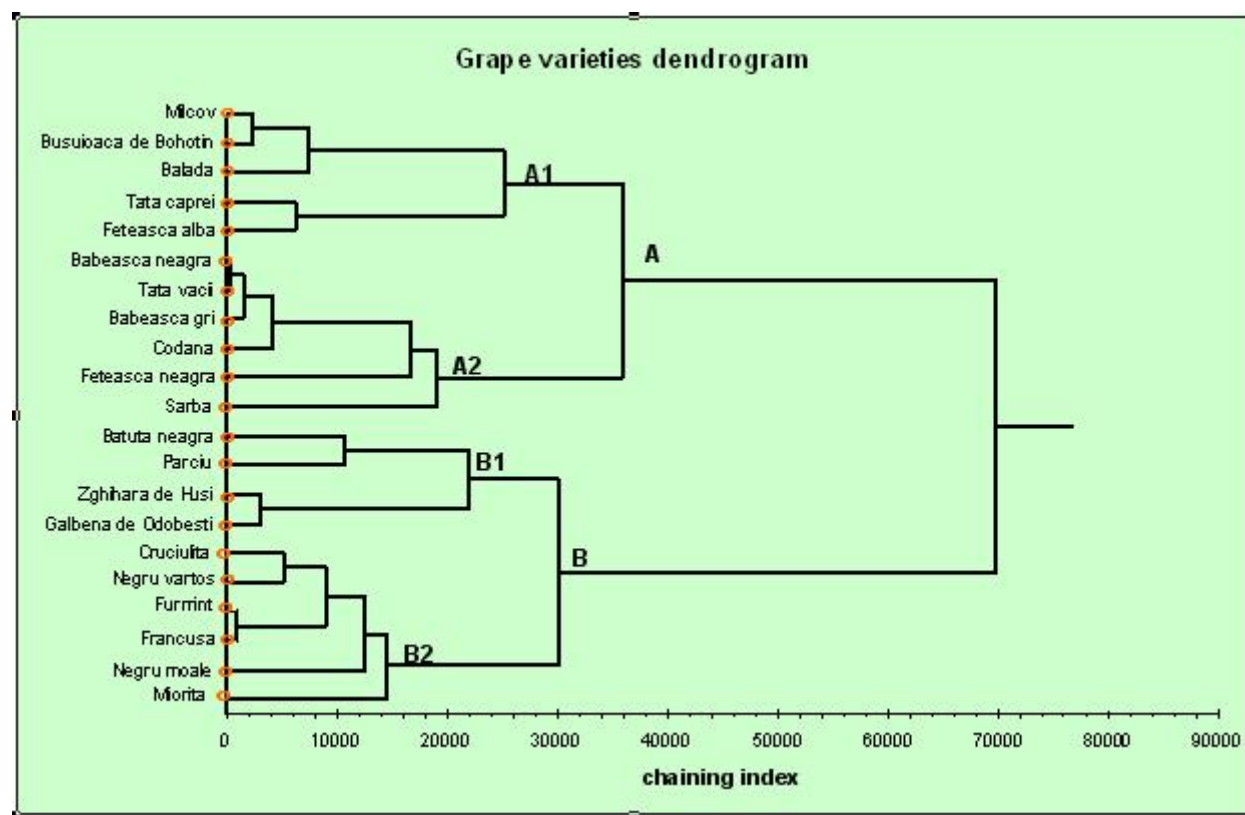
Group B consists of two subgroups: subgroup B1 is the result from aggregation of Galbenă de Odobești, Zghihară de Huși, Bătută neagră and Pârciu; subgroup B2 is made of the grapevine varieties Frâncușă, Furmint, Miorița, Negru moale, Negru vârtos and Cruciuliță.

The two main groups can be characterized as follows (table 1):

Group A, is the less homogeneous, because is aggregates at the highest dissimilarity index 30097.283 and is composed from grapevine varieties having smaller leaves, with different forms: orbicular, wedge-shaped, kidney-shaped, orbicular slightly wedge-shaped, cordiform slightly tapered, slightly kidney-shaped orbicular and generally most of the ampelometric data had the lowest values. Between the two subgroups, the greater homogeneity showed varieties formed the subgroup A2 (Băbească neagră, Țâța vacii, Băbească gri, Codană, Fetească neagră and Șarba), with a dissimilarity index of 18991.971.

Group B has a higher homogeneity because the chaining index value is less than 30097.283. From the architectural leaf point in this group is vine varieties with large leaves, closer in form: cordiforme, orbicular-cordiform, orbicular-cuneiform, and ampelometric data values were generally higher. The greater homogeneity in this group showed grapevine varieties that make subgroup B2 (Furmint, Frâncușă, Cruciuliță, Negru vârtos, Negru moale and Miorița) with a dissimilarity index of 14562.078. Grouping of the varieties Galbenă de Odobești, Bătută neagră and Zghihară de Huși at the same node, checking the hypothesis their common origin; the common origin demonstrates with aggregation at the same node the varieties Băbească neagră, Băbească gri and Codană;

Total inertia of the assembly is 69780.094 and the values of the dissimilarity of the two groups of sub-optimal and which are made to reflect the hierarchical classification and histogram of the studied varieties (figure 3).



**Fig. 2** – Dendrogram of hierarchized classification of grape varieties



Table 1

## Levels of grape varieties chaining in elaboration of the dendrogram

No. node	Node making	No. of varieties in the node	Value of chaining index
1	Băbească neagră - Țâța vacii	2	295.840
2	Furmint - Frâncușă	2	870.485
3	Băbească neagră - Țâța vacii - Băbească gri	3	1505.209
4	Milcov - Busuioacă de Bohotin	2	2226.612
5	Zghihară de Huși - Galbenă de Odobești	2	3100.030
6	Băbească neagră - Țâța vacii - Băbească gri - Codană	4	4079.744
7	Cruciuliță - Negru vârtos	2	5084.323
8	Țâța caprei - Fetească albă	2	6153.266
9	Milcov - Busuioacă de Bohotin - Balada	3	7410.058
10	Cruciuliță - Negru vârtos - Furmint - Frâncușă	4	8933.803
11	Bătută neagră - Pârciu	2	10665.150
12	Cruciuliță - Negru vârtos - Furmint - Frâncușă - Negru moale	5	12541.199
13	Cruciuliță - Negru vârtos - Furmint - Frâncușă - Negru moale - Miorița	6	14562.078
14	Băbească neagră - Țâța vacii - Băbească gri - Codană - Fetească neagră	5	16659.492
15	Băbească neagră - Țâța vacii - Băbească gri - Codană - Fetească neagră - Șarba	6	18991.971
16	Bătută neagră - Pârciu - Zghihară de Huși - Galbenă de Odobești	4	21889.435
17	Milcov - Busuioacă de Bohotin - Balada - Țâța caprei - Fetească albă	5	25104.400
18	Bătută neagră - Pârciu - Zghihară de Huși - Galbenă de Odobești - Cruciuliță - Negru vârtos - Furmint - Frâncușă - Negru moale - Miorița	10	30097.283
19	Milcov - Busuioacă de Bohotin - Balada - Țâța caprei - Fetească albă - Băbească neagră - Țâța vacii - Băbească gri - Codană - Fetească neagră - Șarba	11	35914.064
Total inertia		21	69780.094

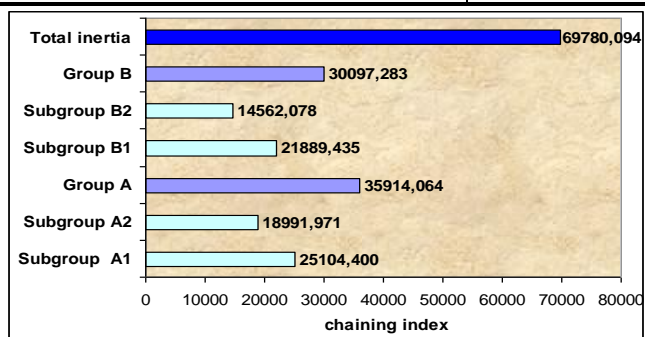


Fig. 3 – Histogram of grape varieties chaining

## CONCLUSIONS

1. Cluster analysis allows the grouping of grape varieties analyzed depending on the existence of their similarity expression ampelometric. Resulted two groups politeness (A, B), each consisting of two gubgroups (A1, A2 and B1, B2);

2. Group B consists of aggregating the varieties Furmint, Frâncușă, Cruciuliță, Negru vârtos, Negru moale, Miorița, Galbenă de Odobești, Zghihară de Husi, Bătută neagră and Pârciu, demonstrated a greater degree of homogeneity, having a lower index of dissimilarity ( 30097.283);

3. Grouping of the varieties Galbenă de Odobești, Bătută neagră and Zghihară de Huși at the same node, checking the hypothesis their common origin;

4. The common origin demonstrates with aggregation at the same node the varieties Băbească neagră, Băbească gri and Codană;

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# BIOMETRIC DETERMINATION ON CANOPY AT SOME GRAPE VARIETIES CREATED AT R.D.S.V.V. BLAJ, IN TÂRNAVE VINEYARD

## DETERMINĂRI BIOMETRICE ASUPRA APARATULUI FOLIAR LA UNELE SOIURI DE VIȚĂ DE VIE, CREATE LA S.C.D.V.V. BLAJ, PODGORIA TÂRNAVE

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**Abstract.** *The grape varieties created at S.C.D.V.V. Blaj (Astra, Blasius, Selena) are characterized by medium growth vigor, but higher than Fetească regală, which was the control variety. The three bud loads (25, 35, 45 buds/block vine) significantly influenced the following studied elements: leaf area/vine, total leaf area/ha, exposable leaf area/ha, excess leaf area/ha, foliar index and the direct exposure degree of vine canopy to solar radiation (%). The largest leaf area/vine was recorded at variety Blasius (14.17 m<sup>2</sup>/vine) at a bud load of 45 buds/vine and the lowest at Fetească regală (4.96 m<sup>2</sup>/vine) at a load of 25 buds/vine. Leaf area/vine and excess leaf area/ha were significantly influenced by bud load. The studies had demonstrated that exposable leaf area depended on the training form, of the height and width of canopy. The leaf index and the degree of exposure of canopy to solar radiation had varied widely between varieties and have been recorded the significant negative correlations.*

**Key words:** grapevine varieties, canopy, foliar index, leaf area

**Rezumat.** *Soiurile studiate: Astra, Blasius, Selena, obținute la S.C.D.V.V. Blaj, se caracterizează printr-o vigoare de creștere mijlocie, dar mai mare față de soiul martor, Fetească regală. Cele trei încărcături de rod aplicate la tăierea în uscat (25, 35, 45 ochi/butuc) au influențat semnificativ următoarele elemente luate în studiu: suprafața foliară/butuc, suprafața foliară totală, suprafața foliară expozabilă, suprafața foliară excedentară/hectar, indicele foliar și gradul de expunere directă a aparatului foliar la radiația solară. Cea mai mare suprafață foliară/butuc s-a înregistrat la soiul Blasius (14,17 m<sup>2</sup>/butuc) la încărcătura de rod 45 ochi/butuc, iar cea mai mică la Fetească regală (4,96 m<sup>2</sup>/butuc) la 25 ochi/butuc. Suprafața foliară și excedentară a fost semnificativ influențată de încărcătura de rod. Suprafața foliară expozabilă a depins de forma de conducere, înălțimea și lățimea peretelui foliar. Indicele foliar și gradul de expunere directă al aparatului foliar au variat în limite largi atât între soiuri, mai ales în funcție de sarcina de rod, înregistrându-se corelații semnificativ negative.*

**Cuvinte cheie:** soiuri pentru vin, aparat foliar, indice foliar, suprafață foliară

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## INTRODUCTION

An scientific interest and a major practical importance are represented by knowing the relations established between growth and fructification at vine. This constitute the premise of biological scientific foundation in vine agro-technical management, which aimed the directing of growth process to achieve a good quality production (Pop, 2010). Vine canopy plays the role of "power plant" of the vine. Its efficacy is determined by capturing sunlight and distributing the energy to different organs (shoots, inflorescences etc.). Canopy size can be appreciated by measuring the foliar leaf area (Spayd, 2002).

Abnormal growths at vine affects plant light exposure and its microclimate, with direct consequence on quantity and quality of harvest (Smart et al., 1990). On average, at the vines on the trellis monoplan, outer layers of leaves directly exposed to light can capture two thirds of the sunlight, while the shaded leaves captures only one third of solar radiation. These two areas are considered physiologically functional. According to Roussilion, 2001, the leaves inside the canopy have a physiological efficiency that can be neglected. Rachid et. al. (2009) argues that ensuring an optimal balance between the leaf area surface and bud load is a condition which must be assured by vine management, related to the fact that the nutrition area, the training system and the pruning level involves changes on photosynthetic activity, influencing sugar accumulation and favoring the wood ripening.

## MATERIAL AND METHOD

At R.D.S.V.V. Blaj the researches were conducted during 2010, on Astra, Blasius, Selena and Fetească regală grape varieties grafted on Kobber 5BB. In 2001, the plantation was established, with vines planted at distance of 2.2/1.2 m. The gaps percentage was 15% resulting about 3219 vines/ha less of each variety. Vines are trained in Guyot with periodic replacement cordons and in spring are pruned in 25, 35 and 45 buds/vine, distributed on spurs with 2 buds and canes of 10-12 buds.

In the second week of August, after shoots topping, was measured height and width of vine canopy and also were measured the holes in leaves wall, due to the absence of vine blocks from plantation. Also, leaves were harvested from each variety and on each variant of bud load, to calculate the leaf area/vine by the fresh weight method. Fresh weight of discs method is a destructive method, but leaf area calculation can be done with an accuracy of 95% (Sepulveda, 1983).

Leaf area/hectare ( $\text{m}^2/\text{ha}$ ) was calculated by multiplying the average of leaf area/vine by number of vines/hectare. In vine practice, one of the most foliar indicators used is the **exposable leaf area** (ELA,  $\text{m}^2/\text{ha}$ ). It represents the leaf surface that can be exposed to the sun on hectare and it is calculated according to formula proposed by Dufourcq et Bonnisseau, 2002:

$$\text{ELA} (\text{m}^2/\text{ha}) = 10000 / E \times (1 - t / D) \times \text{ExLA}$$

where:  $10000 / E$  = total length of the rows of vines/ha of plantation;

$(1 - t / D)$  = the gaps in plantation;

ExLA = exterior leaf area ( $\text{m}^2/\text{m}$ )

**Excess leaf area** ( $\text{m}^2/\text{ha}$ ) was calculated by difference between total leaf area/hectare and exposed leaf area/hectare ( $\text{m}^2/\text{ha}$ ).

**Foliar index** (FI) express leaf density in vine canopy. It is calculated by the report between external leaf area (ExLA) and total leaf area (TLA), on a meter of row.

Optimum values of the foliar index are between 0.75 to 1.00. Lower values than 0.75 indicates a high density of leaves and higher values then 1.0 characterizes a rarely vine canopy, which do not correctly evaluate the space of trellis system (Maigre et Murisier, 2002). Foliar index was calculated using to next formula (Irimia, 2006):

$$FI = (1 - t / D) \times ExLA / TLA$$

where:  $(1 - t / D)$  = gaps in vine canopy ( $m^2/m$  row);

ExLA = external leaf area ( $m^2/m$  row);

TLA = total leaf area ( $m^2/m$  of row).

**The degree of exposed leaf area (DELA, %)** express the percentage leaf area exposed to direct solar radiation (IRIMIA, 2006):

$$DELA (\%) = ExLA \times 100 / TLA$$

Statistical analysis of data was by variance analysis, Duncan test and also were calculated the coefficients of correlation between two variables (Ardelean, 2007).

## RESULTS AND DISCUSSIONS

During winter, in Târnave vineyard there are frequently low temperatures, often below resistance limit of vine, so is necessary to use a semi-protective system of culture, especially Guyot with arms replaced periodically. In Blaj wine-growing center, during growing season of 2010, the climatic conditions expressed by precipitation and temperatures with values bigger than the multiannual averages, favored luxuriant growth of vine canopy.

The combined influence of variety and bud load on the leaf area/vine it is presented in table 1. From statistically point of view, the differences between the four varieties are significant, recording an average of  $10.19 m^2$  leaf area /vine at Blasius variety, followed at significant difference by Selena variety with  $9.03 m^2$ /vine. The lowest value of leaf area was registered on varieties Astra ( $7.15 m^2$ /vine) and Fetească regală ( $7.11 m^2$ /vine), results statistically equal.

Table 1

**Combined influence of variety and buds load on the leaf area per vine**

<b>Bud load</b> <b>Variety</b>	<b>25 buds/vine</b>	<b>35 buds/vine</b>	<b>45 buds/vine</b>	<b>Variety average (A)</b>
Astra	5.91 k	6.45 j	9.09 c	7.15 O
Blasius	8.10 f	8.31 e	14.17 a	10.19 M
Selena	6.82 i	7.88 g	12.38 b	9.03 N
Fetească regală	4.96 l	7.81 f	8.55 d	7.11 O
<b>Bud load average (B)</b>	6.45 B	7.61 B	11.05 A	-

DS 5% for two averages A (variety) = 0.43 – 0.46

DS 5% for two averages B (bud load) = 2.00

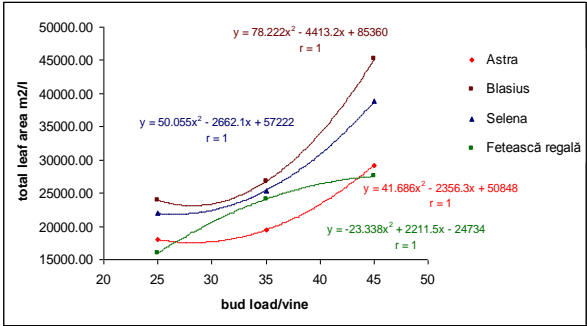
DS 5% for two averages AxB (variety x bud load) = 0.25 – 0.27

\* difference between two values followed by at least one common point is insignificant

Regarding the bud load/vine at 45 buds was recorded an average leaf area of  $11.05 m^2$ /vine followed at significant difference by  $7.61 m^2$ /vine at 35 buds per vine and by  $6.45 m^2$ /vine at a load of 25 buds. Analyzing the twelve variants, resulted from the interaction of variety and the bud load, it can be observed that the largest leaf area ( $14.17 m^2$ /vine) was registered on Blasius variety at a load of 45 buds/vine and the lowest to Fetească regală ( $4.96 m^2$ /vine) at 25 buds/vine.

Between all possible combinations resulted from the interaction of the two factors (variety x bud load) differences are significant (table 1).

Knowing the leaf area per vine, it was calculated leaf area per hectare. Total leaf area/hectare increased with bud load, but leaf area increasing was not proportional to with the increase of bud load. Among the four varieties, the largest leaf area per hectare was registered to Blasius variety at all three bud loads (23917.17 m<sup>2</sup>/ha - 25 buds/vine; 26717.70 m<sup>2</sup>/ha 35 - buds/vine, 45162.57 m<sup>2</sup>/ha - 45 buds/vine). At the opposite side was Fetească regală variety with a leaf area per hectare of 15966.24 m<sup>2</sup>/ha at 25 buds/vine, of 24078.12 m<sup>2</sup>/ha at 35 buds/vine and of 27522.45 m<sup>2</sup>/ha at a load of 45 buds/vine. The results of leaf area/hectare had expressed a high vigor at varieties Astra, Blasius and Selena, and a significant increase of this indicator with the increase of buds number per vine, thing that it was illustrated also by the correlation coefficient values (r = 1) (fig 1).



**Fig. 1** - Correlation between bud load and leaf area per hectare

Exposed leaf area (ELA, m<sup>2</sup>/ha) differs from one training system to another, but also to one grapevine variety to another, depending on growth vigor. For properly express of leaf area, actually this area can be limited to leaves surface exposed to sun light. The photosynthetic activity of leaves exposed to sun light influencing the accumulation of sugar in the grapes berries. Reception of the 90% of sunlight is on the first layer of leaves exposed to light.

*Table 2*

Exposed leaf area (m <sup>2</sup> /ha)				
Nr. crt.	Variety	Exponed leaf area m <sup>2</sup> /ha	±d m <sup>2</sup> /ha	Difference significance
1	Astra	15148.00	-240.24	ns
2	Blasius	16753.67	1365.43	**
3	Selena	15689.30	301.06	ns
4	Fetească regală	13962.00	-1426.24	oo
Average (Control)		15388.24	-	-

LDS 5 % = 866.27 ; LDS 1% = 1297.31 ;LDS 0,1%= 2043.24

The excess leaf area is the factor with direct influence in sunlight capture. By knowing the exposed leaf area, it can be calculated the surplus of leaves per vine. The experience results shows that excess leaf area increased with the bud load level and the excess leaf area increase was significant to all varieties, according to correlation coefficient, r = 1. The excess leaf area varies between limits 0.7 to 2 m<sup>2</sup>/vine to a load of

25 buds/vine and between 4 to 8.5 m<sup>2</sup>/vine to a load of 45 buds/vine (fig. 2). A part of this surplus of leaves was removed by a partial defoliation made in august, in veraison period.

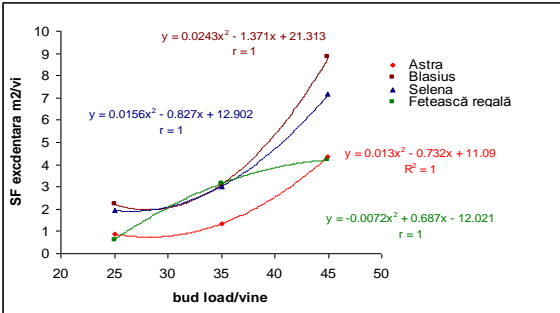


Fig. 2 - Correlation between bud load and excess leaf area (m<sup>2</sup>/vine)

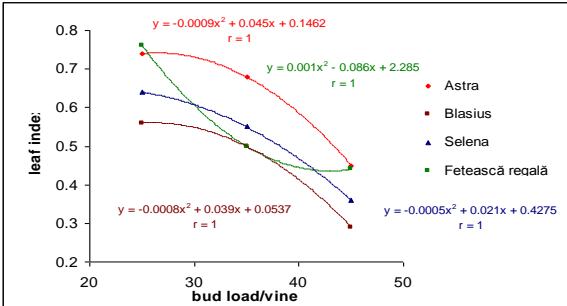


Fig. 3 - Correlation between buds load and foliar index (IF)

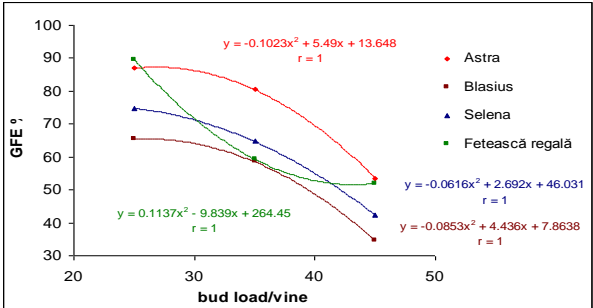


Fig. 4 - Correlation between bud load and degree of exposed vine canopy (DELA, %)

The foliar index (FI) was calculated as ratio between external leaf area (ExLA) and total leaf area (TLA). Regarding the foliar index, the results near to the optimal values (0.75 to 1,00) were registered to the lowest bud load (25 buds/ vine) to Astra (0.74) and to Fetească regală (0.76). At the same bud load, the foliar index calculated for variety Selena (0.56) and Blasius (0.64) was below the optimum. Increasing the buds number to pruned had led to a significant decrease of the foliar index ( $r = 1$ ), so to a bud load of 45 buds/vine, the foliar index was lower of 0.50 to all studied varieties. This shows that these varieties have very large leaves with high density (fig. 3).

To all varieties, the degree of exposed leaf area had the biggest percentage at the lower bud load of 25 buds/vine. At this bud load, values of direct sun exposure of vine canopy varied in a wide range, from 65% (Blasius) to 89 % (Fetească regală). At the maximum bud load (45 buds/vine), the degree of exposure of vine canopy was below 55%. Just as with the foliar index, direct sun exposure has decreased significantly ( $r = 1$ ) with a increasing of bud load (fig. 4).

## CONCLUSIONS

1. The largest leaf area ( $14.17 \text{ m}^2/\text{vine}$ ) was obtained at Blasius variety to 45 buds/vine, the lowest values of leaf area was at Fetească regală ( $4.96 \text{ m}^2/\text{vine}$ ) to 25 buds/vine and between all the experiences variants have registered significant differences.

2. The leaf area per hectare increases with the bud load, but the increase of leaf area was not proportional with the increase of fruit load to all four varieties.

3. Training system, Guyot with periodic replacement cordons, favored a better exposure to sunlight of vine canopy, the highest value ( $16753.67 \text{ m}^2/\text{ha}$ ), has been registered at Blasius variety, value above experience average at distinct significant difference.

4. Increasing to pruning of the buds number per vines led to an excessive density of the vine canopy to all studied varieties. The bud load significantly influenced foliar index and exposable leaf area to direct sunlight, negative correlations being established between those variables in all varieties.

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# RESEARCH REGARDING THE INFLUENCE OF ROOTING SUBTRATE IN FERTILE POTS ON YIELD OF GRAFTED VINES, AT S.C. JIDVEI S.R.L, TÂRNAVE VINEYARD

## CERCETĂRI PRIVIND INFLUENȚA SUBSTRATULUI DE ÎNRĂDĂCINARE ÎN GHIVECE NUTRITIVE, ASUPRA RANDAMENTULUI DE VIȚE ALTOITE LA S.C. JIDVEI S.R.L., PODGORIA TÂRNAVE

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**Abstract.** At SC Jidvei S.R.L., the biological material used in the experience was represented by Fetească regală grape variety grafted on rootstock SO4, clone 762. For rooting of the grafted vines were used three variants of mixtures: A - 50% forest ground, 30% red peat, 15% sand, 5% conifer sawdust, B - 60% of forest ground, 25% black peat, 10 % sand, 5% conifer sawdust, C - 70% forest ground, 15% sand, 15% conifer sawdust. At variant B has been registered the largest percentage of primordial roots at grafted vines (25%), as well the highest rooting percentage (81.1). The biggest increases at grafted vines, expressed by the length and diameter of shoots, have been obtained at variant B and at variant C were recorded the lowest shoots increases. At variant B has been obtained the highest percentage of quality grafted vines (91.5%) and also at this variant were recorded the lowest losses (6.1% vines entered in vegetation and dried after that and 1.5% vines unstarted in growth).

**Key words:** grafted vines, fertile pots, nutritive substrate, peat, sand, sawdust

**Rezumat.** Materialul biologic folosit în experiența de la S.C. Jidvei S.R.L. este reprezentat de soiul Fetească regală altoit pe portaltoiul SO4-762. Pentru înrădăcinarea vițelor altoite s-au utilizat trei variante de amestec: A - 50% pământ de pădure, 30% turbă roșie, 15% nisip, 5% rumeguș de conifere; B - 60% pământ de pădure, 25% turbă neagră, 10% nisip, 5% rumeguș de conifere; C - 70% pământ de pădure, 15% nisip, 15% rumeguș de conifere. Varianta B a înregistrat cele mai mari procente de vițe la care au apărut primordiile rădăcinilor (25%) și cele mai ridicat procent de înrădăcinare (81,1). Cea mai mare vigoare de creștere a vițelor altoite (lungimea și diametrul lăstarilor) a fost obținută la varianta B, iar cele mai reduse creșteri au fost înregistrate la varianta C. La varianta B s-a obținut cel mai mare procent de vițe altoite înrădăcinate de calitate (91,5) și s-au înregistrat cele mai mici pierderi (6,1% vițe pornite în vegetație și uscate, respectiv 1,5% vițe nepornite în vegetație).

**Cuvinte cheie:** vițe altoite, fertil-pot, substrat nutritive, turbă, nisip, rumeguș

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## INTRODUCTION

The rooting of grapevine planting material in controlled environment rooms, used for filling gaps in vineyards or for the establishment of new vineyard, was initiated in Germany in the early 1930's (Becker et al. 1970). Later, the method has been acquired, improved and promoted in France, where it passed to the production of grafted vines in pots made of cardboard, the method called "*en cartonnage*" (Guillot, 1977). Since 1977, the Barbier company began the producing grafted vines in nutrient pots from pressed peat, of tapered shape with 10 cm height, using a mixture of 60% peat, 20% sand, 20% ground (Board, 2005).

In Romania, after the studies carried out was reached to the optimum values regarding the shape, size and material of the nutrient pots and also to the mixtures composition and rooting planting method (Grecu, 1983). At SCPVV Iași, the best results, from point of view of the rooting mixture for filling pots, were obtained with a mixture 25% sand, 50% peat and 25% ground. In exchange, at I.C.V.V. Valea Călugărească the best results (70% yield of quality vines) were obtained with a mixture composed of 33% peat, 33% compost and 33% river sand (Pop, 2010). At Jidvei, have been obtained good results (75% yield of quality vines) at rooting cuttings in polyethylene bags using a mixture of 20% ground, 25% sand, 40% peat and 15% compost (Grecu and Comșa, 1986).

## MATERIAL AND METHOD

The experience was carried out at S.C. JIDVEI S.R.L., in complex of grafting and of planting material production. The biological material used was Fetească regală variety (Jidvei) grafted on rootstock SO 4, clone 762 (France). After grafting and forcing, the grafted vines have been acclimatized in tunnel greenhouses.

Vines rooting were done in pots of pressed cardboard, Fertil-Pot type, with 7/9 cm size. For rooting of grafted vines were used three types of nutrient mixtures. The difference between types of nutrient mixtures, consist in using from different quantities of each component for nutrient mixtures: forest soil, peat, sawdust and sand. The pH correction of nutrient mixture was made with calcium carbonate.

A - 50% forest ground, 30% red peat, 15% sand, 5% conifer sawdust;

B - 60% forest ground, 25% black peat, 10% sand, 5% conifer sawdust;

C - 70% forest ground, 15% sand, 15% conifer sawdust.

For each variant were rooted 10,000 grafted vines. At each variant were 10 repetitions with 1000 vines each.

In the first week after planting in tunnel greenhouses, the temperature is maintained at 25-30°C and after this period, the temperature decreases to 20-22°C. In first two weeks, until the first leaves appearances, the air hygrosopicity was around 85% and then 60%. The nutrient mixture humidity is maintained at an optimal humidity level by weekly watering (28-30% weight of rooting mixture).

Pests and diseases combating were done by carrying out of weekly treatments with the products of contact and systemic. The radicular and foliar fertilization was done with hydrosoluble fertilizer based NPK and with micronutrients. After around 3-4 weeks of fortifying, were removed all rootstock shoots and have been pinched the rest of shoots. During vines rooting the following observations and determinations have been made:

- the weight at each variant to the pots with nutrient mixture,

- percentage of primordial roots,
- percentage of roots out from pot,
- the length (cm) and diameter (mm) of the shoots, measured above the first leaf to the shoots, with electronic caliper,
- percentage of quality grafted vines (I, II and III vines quality),
- percentage of vines entered in vegetation and dried then,
- percentage of vines unstated on growth %,
- percentage of grafted vines which can be used for planting.

The statistical interpretation of experimental data was performed by analysis of variance, using "t test" (Ardelean, 2007).

## RESULTS AND DISCUSSIONS

The results were negative for the three variants of the mixture after testing the nutrient mixture samples to detect the nematodes from *Longidoridae* and *Globera* families.

Variant C had the bigger pots weight, because the percentages of ground (70%) and sand (15%) were higher than variants A and B. After statistical processing of data, the values assured statistic were recorded to all the three variant, with significant positive differences compared to the experience average (282.17 g), considered as control.

Table1

Influence of pots with nutrient mixture regarding the rooting of grafted vines

Nutrient mixture variant	The mean weight of fertile pots with nutrient mixture, g	Root appearance after 10 days %	Root output from Fertile Pots %		
			After 15 days	After 25 days	After 30 days
A (forest ground, red peat, sand, sawdust)	247.90 <sup>o</sup> ± 2.16	18.30 <sup>oo</sup> ± 1.13	19.40* ± 0.48	50.30 <sup>o</sup> ± 1.68	75.30* ± 1.54
B (forest ground, black peat, sand, sawdust)	274.70 <sup>(o)</sup> ± 4.04	24.30* ± 0.90	23.20* ± 0.63	66.00 <sup>ns</sup> ± 1.26	81.10* ± 1.50
C (forest ground, sand, sawdust)	323.90* ± 6.86	15.90 <sup>o</sup> ± 1.17	12.50 <sup>ns</sup> ± 0.56	41.10 <sup>ns</sup> ± 0.75	58.10 <sup>ns</sup> ± 1.39
Experience average	282.17 ± 6.42	19.50 ± 0.89	18.18 ± 0.88	52.47 ± 2.04	71.50 ± 1.99

The content in nitrogen and organo-mineral materials of soil mixtures had favored positively the rooting of vines cuttings. The values recorded, at all three variants of soil mixtures, were statistically assured compared with the experience average (19.5%). Among these, B variant had the highest percentage of vines with primordial roots (almost 25%). Variant C, to which it was used only forest soil, sand and sawdust, had not registered satisfactory results, rooting percentage being only of 15.9% (table 1).

Regarding the percentage of roots out from nutrient pots was studied their rate growth. Pots were thinning to avoiding the thickening and interpenetration of roots, after which appreciation was done the rooting percentage (%). Variant B had the best rooting percentage after planting: 23.2% after 15 days; 66.0% after 25 days 66.0 and 81.1% after 30 days. At all the three moments of observations, to variant C, average values obtained were not assured statistically.

As regard the shoots length, measured after 20, 25 and 30 days, for the all three variants were obtained values, positive and negative, statistically assured, compared with experience averages (15.97; 18.18 respectively 25.53 cm). Variant B, but also the experience average, has presented statistically significantly higher values compared to variants A and C, in all three moments to measuring of the length and diameter shoots (table 2).

Table 2

Growth vigor of the grafted vines

Variant	Shoot lenght cm			Shoot diameter mm		
	20 th day	25 th day	30 th day	20 th day	25 th day	30 th day
A (forest ground, red peat, sand, sawdust)	15.10 <sup>oo</sup> ±0.87	19.30 <sup>oo</sup> ± 1.05	25.10 <sup>oo</sup> ± 0.77	2.21** ± 0.12	3.39 <sup>oo</sup> ± 0.05	4.09 <sup>oo</sup> ± 0.24
B (forest ground, black peat, sand, sawdust)	18.20* ± 0.79	24.20* ± 1.30	30.20* ± 1.25	2.22** ± 0.19	3.77* ± 0.07	4.81* ± 0.12
C (forest ground, sand, sawdust)	14.60° ± 0.86	16.90° ± 0.80	21.30° ± 1.40	2.13 <sup>oo</sup> ± 0.14	3.13° ± 0.15	3.83° ± 0.08
Experience average	15.97 ± 0.55	18.18 ± 0.88	25.53 ± 0.94	2.19 ± 0.09	3.43 ± 0.07	4.24 ± 0.12

The shoots diameter, at the second internode, doubled within 10 days since the first classification for all variants. The obvious increase in diameter was at variant B, where the diameter increased from 2.22 mm, after 10 days, to 4.81 mm, after 30 days. At the experience end, shoots diameter to all the three variants has different values, with limits ranging between 3.83 mm (variant C ) to 4.81 mm (variant B), on which the deviation of shoots diameter were significantly higher compared to the experience average. To the variant C, shoots diameter of grafted vines have less than 4 mm, so these vines were not classified in the quality standard (table 3).

During rooting period, on 20, 25 and 30 days after planting in nutrient pots, were made three rankings of grafted vines. At classifying, the grafted vine must have at least: 15 cm length of shoots, 2 mm of shoots diameter and the roots must to be out of pots.

According to table 3, at the first vines clasification, the variants B and A have recorded significantly higher results, of 83.10% respectively of 80.40%, than

the experience average of 77.73% grafted vines, in quality standard. In the same time, the variant C value (69.70%) was significantly below to experience average. Surprisingly, at the second and the third classification, variant C had higher percentages (7.30% and 3.80% standard grafted vines), compared to variants A and B, but also compared to the experience average (6.10% and 3.07%).

Table 3

Quality of grafted vines obtained in Fertile Pots

Variant	First ranking % 20th day	Second ranking % 25th day	Third ranking % 30th day	Vines entered in vegetation and dried then, %	Vines unstarted on growth, %	Quality grafted vines %
A (forest ground, red peat, sand, sawdust)	80.40* ± 1.42	4.40 <sup>o</sup> ± 0.56	2.20 <sup>o</sup> ± 0.25	12.20* ± 0.25	2.20** ± 0.25	86.20** ± 1.73
B (forest ground, black peat, sand, sawdust)	83.10* ± 1.68	6.60** ± 0.69	3.20** ± 0.66	6.10 <sup>ns</sup> ± 0.48	1.50 <sup>o</sup> ± 0.22	91.50** ± 0.22
C (forest ground, sand, sawdust)	69.70 <sup>o</sup> ± 2.15	7.30** ± 0.42	3.80*** ± 0.59	18.80* ± 1.34	2.40*** ± 0.34	77.40 <sup>oo</sup> ± 1.63
Experience average	77.73 ± 1.46	6.10 ± 0.39	3.07 ± 0.32	12.37 ± 1.07	2.03 ± 0.17	85.03 ± 1.33

A major criterion concerning the rooting of grafted vines on different nutritive substrates is the percentage of vines entered in vegetation and dried then. At variant B was recorded the lowest percentage of vines entered in vegetation and dried then (6.1%) compared to variants A (12.2%) and C (18.8%), which had significantly higher percentages compared to the experience average (12.37%).

After data processing, from table 3, it can see a high variability between the examined character averages (grafts unstarted in vegetation), and between the examined character and the experience average. It is noted that the values recorded in variants A (2.2%) and C (2.4%) are superior the experience average (2.03%). The variant B had the lowest percentage of grafts unstarted in vegetation (1.5%), the value being below the experience average. In this case, the results showed a great influence of the substrate on entering in vegetation of the grafted vines.

Regarding the best percentage of quality grafted vines (20 cm minimum shoots length and at least 4 mm shoots diameter at the second internode), were recorded differences distinct significantly higher than experience average (85.03%) at variants A (86.2%) and B (91.5%), on which it was used peat in composition of the nutritive mixture. The variant C (77.4%) had the worst results, below the experience average.

## CONCLUSIONS

1. As regard the rooting of grafted vines, variant B presented the best percentage of rooting in Fertil - Pots (81.10%).

2. Measurements made on shoots (length and diameter) have showed that the best results were obtained at variant B (black peat), followed by variant A (red peat) and the worst results were to variant C (forest soil, sawdust and sand).

3. To the first classification of grafted vines have been recorded results significantly higher than the experience average (77.73%) at the variants B (83.1%) and A (80.4%), while the variant C value (69.7%) was significantly below compared to the experience average.

4. At variant B (black peat) was registered the lower rate of the grafts that entering in vegetation and dried then (6.1%), the smaller percentage of grafts unstarted in vegetation (1.5%), but also the best percentage of quality grafted vines (91.5%).

5. Recommendations: The use of the Fertile Pots has the following advantages:

- favors a fast roots growth,
- an uniformity of vines growing,
- high yields of quality grafted vines,
- an undisturbing vines roots at planting,
- a easy removal of any impurities,
- a reduced cost by shortening of the growing season,
- a superior exploitation of land surface,
- a better control of environment conditions,
- a reducing the cost of planting material.

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# THE AMPELOGRAPHIC COLLECTION BELONGING TO THE FACULTY OF HORTICULTURE IAȘI, AS VITICULTURAL SOURCE OF GERMPLASM

## COLECȚIA AMPELOGRAFICĂ A FACULTĂȚII DE HORTICULTURĂ IAȘI, SURSĂ DE GERMOPLASMĂ VITICOLĂ

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**Abstract.** *Ampelographic collection of Faculty of Horticulture was founded in 1985, registered in the International Catalogue of Ampelographic Collections, since 1994. Recognized as an important center for the preservation of genetic diversity of vines and source of germplasm, currently, collection occupies an area of 1.8 hectares and comprises 175 species and varieties belonging to the Vitis genus, of which 114 varieties belonging to Vitis vinifera, 32 interspecific direct producers hybrids and 29 species, varieties and clones of rootstocks. Initially created for teaching purposes, ampelographic collection is a valuable applicative base for research, into its territory it runs a series of experiments, necessary to research contracts, and for the preparation of license, disertation and doctoral thesis or for elaboration of scientific papers.*

**Key words:** ampelographic collection, grape varieties, genetic resources, Iași.

**Rezumat.** *Colecția ampelografică a Facultății de Horticultură din Iași, a fost înființată în anul 1985, fiind înscrisă încă din anul 1994 în Catalogul Internațional al Colecțiilor Ampelografice. Recunoscută ca un important centru de conservare a diversității genetice a viței de vie și sursă de germoplasmă, în prezent colecția ocupă o suprafață de 1,8 ha și cuprinde un număr de 175 de specii și soiuri ale genului Vitis, din care: 114 soiuri aparținând speciei Vitis vinifera; 32 hibrizi producători direcți interspecfici și 29 specii, soiuri și clone de vițe portaltoi. Creată inițial în scop didactic, colecția ampelografică constituie și o valoroasă bază aplicativă a cercetărilor în domeniu, pe teritoriul său desfășurându-se o serie de experiențe necesare contractelor de cercetare, întocmirii lucrărilor de licență, disertație și doctorat sau pentru elaborarea unor lucrări științifice.*

**Cuvinte cheie:** colecție ampelografică, soiuri de struguri, genofond, Iași.

## INTRODUCTION

Ampelographic collection of the Faculty of Horticulture belonging to the University of Agricultural Sciences and Veterinary Medicine (UASMV Iasi), is located in the C1a european vine growing zone being part of V.

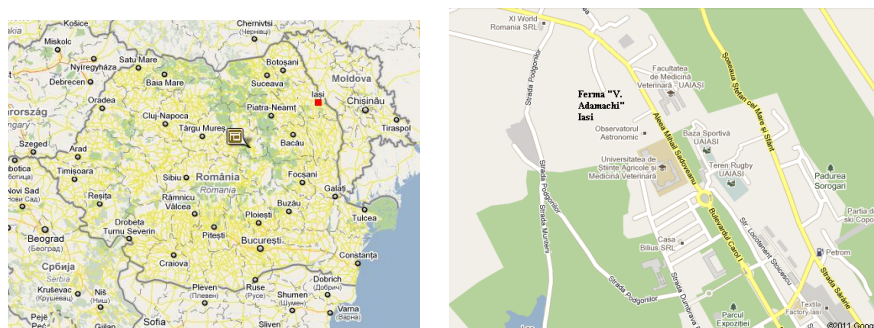
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Adamachi agricultural farm Iasi, and it has as geographic coordinates 27°53' east longitude and 47°09' north latitude, taking advantage of a favorable microclimate for growing vine (fig. 1).

Wishing to integrate education with research and production, in 1985, came the need to collect valuable indigenous genetic resources in a new ampelographic collection. This, has been extended every year, with new romanian and cosmopolitan creations and rootstock varieties, with special genetic value. Today is one of the major centers of vine biodiversity in Romania, not by the area they occupy, but through the important number of species and varieties that it contains.

This study, is a brief account of the main groups of species and varieties of vines, existing in the ampelographic collection belonging to the Faculty of Horticulture Iasi, adapted to specific climatic conditions of this area.



**Fig.1** - Location of the ampelographic collection of Faculty of Horticulture Iasi, Romania (source: Google maps)

## MATERIAL AND METHOD

Ampelographic collection of the Faculty of Horticulture, belonging to Experimental Teaching Station of USAVM Iași, occupies an area of 1.8 hectare, and is structured, on the main production, in: table grapes varieties with extra early and early maturation, table grapes varieties with medium maturation, table grapes varieties with late maturation, seedless varieties, white table wines varieties, white quality wines varieties, rose and red table wines varieties, rosé and red quality wines varieties, hybrids direct producers for table grapes, hybrids direct producers for wine grapes, rootstock species and varieties.

The land, where was established the ampelographic collection, has an altitude of 150-160 m, S-SV exposure, 6-7% slope inclination and rows orientation is the N-S direction. Cambic chernozem soil is formed on the seam of shale sands, deep ground water are at over 2.5 - 3 meters depth.

Ampelographic collection of Faculty of Horticulture, was founded in 1985, initially comprising: 21 varieties of table grapes, 3 seedless varieties, 34 varieties of grapes for white wines, 3 varieties for aromatic wines, 17 varieties of grape for red wines and 28 rooted rootstocks. In 1990, the collection was supplemented with another 12 varieties of table grapes and 26 direct producers



hybrids. Currently, ampelographic collection includes a number of 175 species and varieties, belonging to the genus *Vitis*, of which 114 varieties of the *Vitis vinifera* species, 32 interspecific direct producers hybrids and 29 species, varieties and clones of rootstocks. Each genotype is represented by 20 plants (*Vitis vinifera* varieties and direct producers hybrids), and rootstock vines in number of 8 plants.

Among *Vitis vinifera* varieties, 39 are for table grapes, 3 varieties of seedless grapes, 22 for white table wines, 22 for quality white wines, 4 varieties for aromatic wines, 15 varieties for table wines and 9 varieties for red quality wines (tab. 1). At these varieties, can be added Chasselas doré variety, with two parcels, which are used to monitor various experiments, carried out in the viticultural specific research programs of the Faculty of Horticulture Iași.

Table 1

Structure of ampelographic collection of Faculty of Horticulture, Iași

Genotype	Total number of varieties	of which:													
		Table grapes varieties		seedless varieties		white table wines varieties		white quality wines varieties		Varieties for aromatic wines		red table wines varieties		red quality wines varieties	
		Old varieties	New creations	Old varieties	New creations	Old varieties	New creations	Old varieties	New creations	Old varieties	New creations	Old varieties	New creations	Old varieties	New creations
<i>Vitis vinifera</i> var.	114	21	18	3	-	16	6	18	4	3	1	12	3	7	2
Direct producers hybrids	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rootstocks	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Total</b>	<b>175</b>	<b>21</b>	<b>18</b>	<b>3</b>	<b>-</b>	<b>16</b>	<b>6</b>	<b>18</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>12</b>	<b>3</b>	<b>7</b>	<b>2</b>



Fig. 2 - Ampelography collection of Faculty of Horticulture Iași

Rootstock used is Berlandieri x Riparia Kober 5 BB. Planting distances are 2.2/1.2 m, half high leading form, bilateral cord with cutting in fruit links (stems of 2 fruitful eyes and fertile offshoots of 4-5 eyes), which ensure an average load

of 40-45 buds/stock. Soil maintenance is done in the form of "black field", and maintenance operations of vines are specific to industrial vineyard ecosystem (fig. 2).

The collection is recorded since 1994 in the International Catalogue of Ampelographic Collections, published under auspices of the European Bank of genus *Vitis* genetic resources under the code "ROM 14" and has the right of genetic material international exchange, in the form of cuttings and seeds, subjected to actual legislation (Țârdea C. et al., 1999).

## RESULTS AND DISCUSSIONS

Iasi city, is the county residence and the most important urban center in northeastern Romania. It is located in the eastern part of Moldova area, the Moldavian Plain, on the Bahlui River, a affluent of Jijia. "V. Adamachi" Farm, that including the ampelographic collection, is situated on one of the city's seven hills, Copou hill.

Temperature is specific to temperate continental lands, with some excessive nuances. Annual average temperature is 9.6°C, the highest monthly average temperatures was recorded in July, and lowest monthly average temperatures in January. Absolute minimum temperatures in winter descends to -26 to -32°C and threatening vines about two years of 10 (Mustea M., 2004). At Iasi absolute minimum was -30°C and was recorded in 1929 and 1937.

The average length of the vegetation period is 180 days and annual global radiation 115-125 Kcal/cm<sup>2</sup>. Actual amount of insolation during growing season is 1460 hours, and the sum of active temperatures is 3120°C. Average annual precipitation were 531.7 mm, of which 340 mm during the growing season. Precipitations distribution is uneven, in high-precipitations months May (June, July) was recorded 68 – 76 mm, compared with the period December - March, when it was recorded only 28 – 32 mm, monthly. The dominant winds in this area are the north-west winds, especially during the summer, to which is added during the winter the east wind (Crivăț - Chill wind). Average date of last frost is April 17th and the limit date was May 25th (Rotaru Liliana et al., 2009).

Among existing varieties of vines in the ampelographic collection, the most valuable are the table grapes varieties: Muscat Perlă de Csaba (Bronnerstraube x Muscat Ottonel), Regina viilor (Queen Elisabeth x Muscat Perlă de Csaba), Chasselas doré, Muscat de Hamburg (Frankenthal x Muscat de Alexandria), Muscat d'Adda (self-pollination seeds of Muscat de Hamburg), Coarnă neagră, Coarnă albă (considered local varieties), and seedless varieties like: Sultanină albă (sin. Kiș mis alb), Sultanină neagră (sin. Kiș miș negru), Perlette (Sultanină albă x Regina viilor),.

In the ampelographic collection exist an impressive number of romanian new creations for table grapes like: Muscat Timpuriu de București (Coarnă albă x Regina viilor), Victoria (Cardinal x Afuz ali), Timpuriu de Cluj (Crâmpoșie x Frumoasă de Ghioroc), Aromat de Iași (free insemination of Tămăioasă românească), Cetățuia (Crâmpoșie x Frumoasă de Ghioroc),

Silvania (Bicane x Chasselas doré), Napoca [Alphonse Lavallée x (Regina viilor x Muscat de Hamburg)], Gelu (free insemination of Coarnă neagră, hybrid seeds irradiated with X-ray), Paula (Bicane x Aromat de Iași), Splendid (Black rose x Regina viilor), Transilvania (Black rose x Cardinal), Someșan [self-insemination of (Regina viilor x Muscat de Hamburg x Regina viilor)], Milcov (Coarnă neagră x Muscat de Hamburg), Xenia (Bicane x Muscat de Hamburg), Tamina (Bicane x Muscat de Hamburg), Coarnă neagră selecționată (free insemination of Coarnă neagră variety).

With particular importance in wine production, can be mentioned the varieties for quality white wines like: Chardonnay, Fetească albă, Fetească regală, Frâncușă, Furmint, Grasă de Cotnari, Pinot gris, Riesling italian, Traminer roz, Furmint de Miniș, for quality red wines: Cabernet sauvignon, Fetească neagră, Merlot, Pinot noir, Negru de Drăgășani (Dobrei A. et al, 2005).

Among varieties for aromatic wines, are noted varieties: Muscat Ottonel, Tămâioasă românească and Busuioacă de Bohotin.

Old Romanian varieties for wine grapes, especially for table wines, are well represented in the ampelographic collection: Ardeleană, Braghină, Berbecel, Cioinic, Cruciuliță, Creață de Banat, Galbenă de Odobești, Gordan, Gordin, Mustoasă de Măderat, Zghiheară de Huși, Miorița, Băbească gri, Roz de Miniș. Interspecific direct producers hybrids in number of 32 varieties, romanian creations: Brumăriu, Purpuriu, Radames, Andrevit, or international creations: Moldova, Frumoasa albă, Decabriski, Strasanski, Viorica, Flacăra, Luminița, Isabelle, Perlă de Zala, Muscat de Pölöskey, Bianca, Medina, SV 12375 (Villard blanc), SV 18283 (Garonnet), SV 18315 (Villard noir), SV 18402, SV 12303, SV 39-522, Chambourcine (Joahnes Seyve 26-205), Seibel 5455 (Plantet), Salvador (Rotaru Liliana et al., 2005).

Rootstocks are present in large numbers (29), as species, hybrids and clones. Among rootstocks existing in ampelographic collection, we mention: Riparia gloire, Rupestris du Lot, Rupestris Viala, Riparia x Monticola 1 R, Riparia x Rupestris 101-14 MG, Riparia x Rupestris 3306 C, Riparia x Rupestris 3309 C, Riparia x Rupestris Brémont, Berlandieri x Riparia 420 A, Berlandieri x Riparia 33 EM, Berlandieri x Riparia Selecția Oppenheim 4, Berlandieri x Riparia Kober 5 BB, Berlandieri x Riparia Crăciunel 13, Berlandieri x Riparia Crăciunel 26, Berlandieri x Riparia 125 AA, Berlandieri x Rupestris Richter 31, Berlandieri x Rupestris Richter 57, Berlandieri x Rupestris 140 Ruggeri, Chasselas x Berlandieri 41 B, Solonis x Riparia 1616 C, Aramon x Rupestris Ganzin 1, Mourvedre x Rupestris 1202 C.

## CONCLUSIONS

1. Ampelographic collection belonging to Faculty of Horticulture, Iasi (NE Romania), is one of the most complete collections, in this area, famous for the diversity of existing varieties here.

2. Initially, comprising especially old Romanian variety, the ampelographic collection was completed over time, currently holding over 170

species, varieties, hybrids and clones of vines with different origins.

3. Established for teaching purposes, being a "laboratory" in nature where students carry out their part of practical training and scientific research, ampelographic collection is a valuable base of applied research in the field, on it territory is performed a series of experiments necessary of research contract and development of scientific papers.

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# DIFFERENTIATION OF GRAPE VINE VARIETIES FROM SCDVV IASI GENE BANK BY USING THE MAIN COMPONENT STUDY METHOD

## DIFERENȚIEREA SOIURILOR DE VIȚĂ DE VIE DIN BANCA DE GENE A SCDVV IASI PRIN UTILIZAREA METODEI DE ANALIZĂ ÎN COMPONENȚI PRINCIPALI

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**Abstract.** *The variability of morphological features in grape vine and the existence of a large number of varieties makes more difficult their description and acknowledgement. Many researchers specialized in ampelography have developed several easier identification methods based on scientific principles which are improved; a step forward is represented by the introduction of ampelometry as study method, using as basis the morphological characters of the leaf. Therefore, in order to differentiate and classify some grape vine varieties from the ampelographic collection we used the main component study, which is based on the study of co-variation or of correlation between variables, allowing the differentiation and grouping of genotypes according to size and shape of adult leaf. Studies were performed on 18 indigenous or local varieties, selected according to synonymy criterion or affinity to the same group of varieties, as well as on other five known varieties from Iasi vineyard.*

**Key words:** genotypes, indigenous, statistical methods, correlation

**Rezumat.** *Variabilitatea caracterelor morfologice la vița de vie și existența unui număr mare de soiuri, face dificilă descrierea și recunoașterea acestora. Mulți ampelografi au elaborat numeroase metode de identificare, mai ușoare, axate pe principii științifice care s-au perfecționat, un pas înainte constituindu-l introducerea ampelometriei ca metodă de studiu, bazată pe caracterele morfologice ale frunzei. În acest sens pentru diferențierea și clasificarea unor soiuri de viță de vie existente în colecția ampelografică a fost utilizată analiza în componenți principali, a cărui principiu se bazează pe studiul covarianței sau al corelațiilor dintre variabile, permițând diferențierea și gruparea genotipurilor mai ales după mărimea și forma frunzei adulte. Cercetările s-au efectuat asupra unui număr de 18 soiuri autohtone sau locale, alese după criteriul sinonimiilor sau apartenenței la același sortogrup, precum și a altor cinci soiuri cunoscute cultivate în podgoria Iași.*

**Cuvinte cheie:** genotipuri, autohtone, ampelometrie, corelații

## INTRODUCTION

Viticulture has a long history, ranging between 2000 and 7000 years. Through colonization, migrations, development of some economic routes etc., the varieties of grapevines have spread all over the world, some of them lasting until

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nowadays and others, less adapted, have disappeared. The large number of vitis genotypes existing today, with very strong phenotypic variability, renders difficult their description and recognition.

Currently, over 18,500 names and 23,000 synonyms (Erika Maul, 2003) are registered in the international catalogue of vitis species. The differentiation and description of varieties of grapevines are essential for obtaining reliable results in research, improvement and propagation of vitis, while the effective management of germplasm conservation is aimed at preventing the loss of local, valuable genetic resources which are adjusted to the ecosystem conditions. Over time, famous ampelography experts have tried several identification methods based on scientific principles, which have improved from the pre-phylloxeric period until today. One of the most advanced methods for the recognition and identification of grapevine species is that of ampelography descriptors developed by UPOV (1984), OIV (1983) and IPGRI (2004) currently Biodiversity, by means of which uniform working rules were set with the ultimate goal of standardizing the description of vitis species. The list of OIV descriptors completed with the 18 ampelographic descriptors complements the methodology of describing and differentiating the species at the same time reconsidering the ampelometric method. This method, based on the progress of informatics (Erika Dettweiler, 1987), allowed the development of new mathematical models for ampelography investigation, one of which is the principal components statistical analysis (PCA) (Liliana Rotaru, 1999, 2002). For identifying and cataloging local, native or less known grapevine species which are included in the ampelographic collection of SCDVV Iasi, we used the principal components analysis, which is the subject of this paper.

## MATERIAL AND METHOD

The studied genotypes can be found in the gene bank of the entity, which comprises about 430 varieties of *Vinifera* species, created in our country or introduced from other countries. The study used 18 less known Romanian genotypes selected according to the following criteria:

- synonymy, the Romanian White variety is synonymous with the White grapevine variety of Akermanski and the White of Belgorod, Francusa variety is synonymous with Creață variety, Om rău variety synonym with Verde variety, Coarnă roșie variety is synonym to Țața caprei neagră variety, Iordan variety synonymous to Gordan variety, Ferdinands Lesseps variety is synonymous with Ananas variety, Bătuță neagră variety synonymous to Romanian Black variety;
- belonging to the same group of varieties (Ceaș alb and Ceaș roz). Moreover, we used in this study a less known indigenous variety, Coarnă vânăta and five varieties cultivated in Iasi vineyard (Chardonnay, Băbească neagră, Muscat Ottonel, Sauvignon and Aligoté).

To differentiate the studied varieties we applied the principal components analysis with 30 variables derived from the calculation of ampelometric parameters in adult leaf, which were determined by a number of 68 measurements: length of main vein (N1, N2, N3, N4); the distance between the side sinuses and the petiole (U, O); the opening of side sinuses (SS, SI) and of petiole sinus(SP); length (ALT) and width (AN) of the lamina; outside contour of the leaf (ENS, ENM, ENI, NL); inside contour of

the leaf (DS1, DS2, DS); angles between main veins (A, B, C); angles defining the shape of the median lobe (F, AP); angle between the median vein and the end of the lower side lobe (ABE); the ratios between the length of veins (21a, 31a, 41a); the ratio between the basis of side sinuses and sinus supporting veins (UN2, ON3); the ratio between the length and width of the lamina (L-A).

The data were statistically processed by means of the Microsoft XL-STAT 2010 program.

## RESULTS AND DISCUSSIONS

The principal components analysis includes information from ampelometric matrices in graphical form (correlation circle and the plane determined by principal components), thus the closer to each other two individuals or two variables are on these graphs, the more similar they are. The use of this method involves the following stages:

Calculation of correlation matrix based on Pearson correlation coefficient, whose values range from -1 to +1 and expresses the degree of linear correlation between two variables. The closer the variables are to this value, the stronger is the correlation between them.

By analyzing the correlation matrix of studied varieties it was noticed that NL(15) and U(11) variables had the most significant positive correlation, which suggest deep lateral sinuses. The C variable, which represents the angles between main veins, had the lowest signification (2). The depth of lateral sinuses (U, O, DS1, DS2 and DS) had significant correlations between 9 (DS1) and 11 (U). The number of significant correlations was higher in the case of AN variable (12), which expresses the width of the lamina and of 10 for ALT (length of lamina). The outer contour of the lamina (ENS, ENM, ENI and NL) had significant positive correlations ranging between 9 (ENS and ENI) and 15 (NL). The shape of the median lamina had a small number of significant positive correlations 6 (AP) and 7 (F), and the angles between the veins were positively correlated with two variables (A) and three (B, C and ABE), and 11 variables (B) and nine (C) were negatively correlated. The correlations representing the ratios between the lengths of main veins, had significant positive correlations of four (21a), eight (41) and 10 (31a) and the variables U, N2 and On3 and were correlated significantly with 10 and respectively 14 of the variables. The L-A variable, which represents the ratio between the length and width of the lamina had the most numerous negative correlations.

Determination of variables' values and own vectors (based on the correlation matrix) within the space created by the main components; it was observed that among the varieties studied the percentage of inertia of the first two main components is of 64,765, nearly 65%, and respectively 37% and 28% on the first two axes, and their values decrease from component 1 (axis 1) to the 22-nd component, with the value of 0. By analyzing the first two principal components it was seen that for the principal component 1 most variables have positive vectors from 0,283 (UO) to 0,032 (SI), and negative vectors are observed for five variables (A, B, C, ABE and L-A), which in the correlations circle will be found

in quadrants 3 and 4. In the case of principal component 2 (axis 2) the positive vectors are determined by 14 variables (N1, N2, N3, N4, S4, NAM, ALT, ENS, ENM, ENI, NL, Si, B and C), which will be located in the quadrant 1 of the circle of correlations. The negative vectors of axis 2 are determined by the variables: U, A, DS1, DS2, DS, SS, F, AP, Abe, 21a, 31a, 41a, UN2, ON3 and LA, which will be found in quadrants 2 and 3 of the correlations circle;

Making correlations between variables and principal components.

The results obtained in determining these correlations in the studied varieties show that the highest correlation coefficient values of factor 1, on axis 1, were those defining the shape of leaves (depth of the sinuses): U (0.937), O (0.935), DS2 (0.919) and DS1 (0.833).The lowest correlation coefficient was that of factor SI (0.106).

On axis 2, principal component 2, the correlation coefficient had higher values for the variables that define the sizes of lamina: N1 (0.948), ALT (0.922), ENM (0.914), N2 (0.858), AN (0.753), ENI (0.697) and ENS (0.670) and the lowest correlations were found in variables that correspond to axis 1, that is U (-0.171) and O (0.176). These results are also seen in the correlation circle (figure 1) resulting from statistical and mathematical processing. It is noticed that the variables SP, SS and SI, which define the opening of sinuses are opposite to those which represent the angles between the veins (ABC), the ratio of lamina length and width (LA) and the sum total of the angles between the center vein and the upper lobe basis, so one may say that these ones contribute more to leaf shape and to a lesser extent to its size.

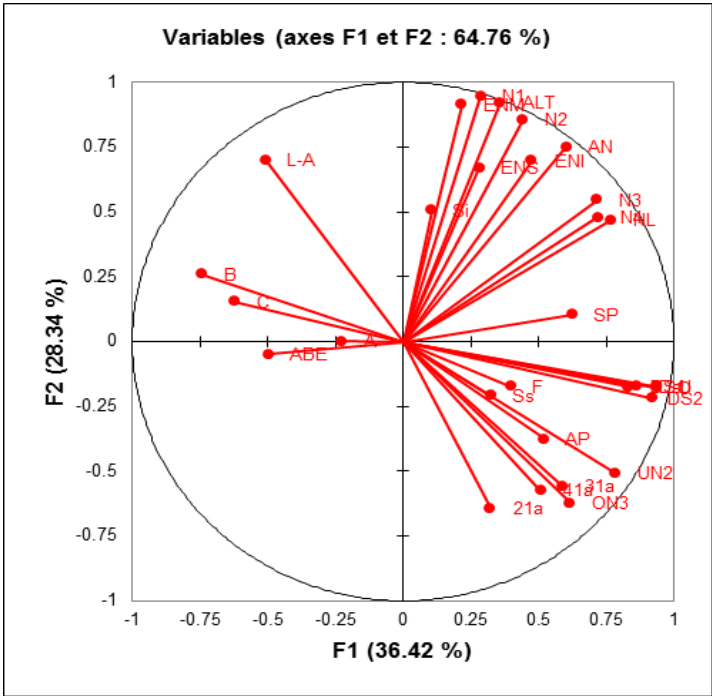


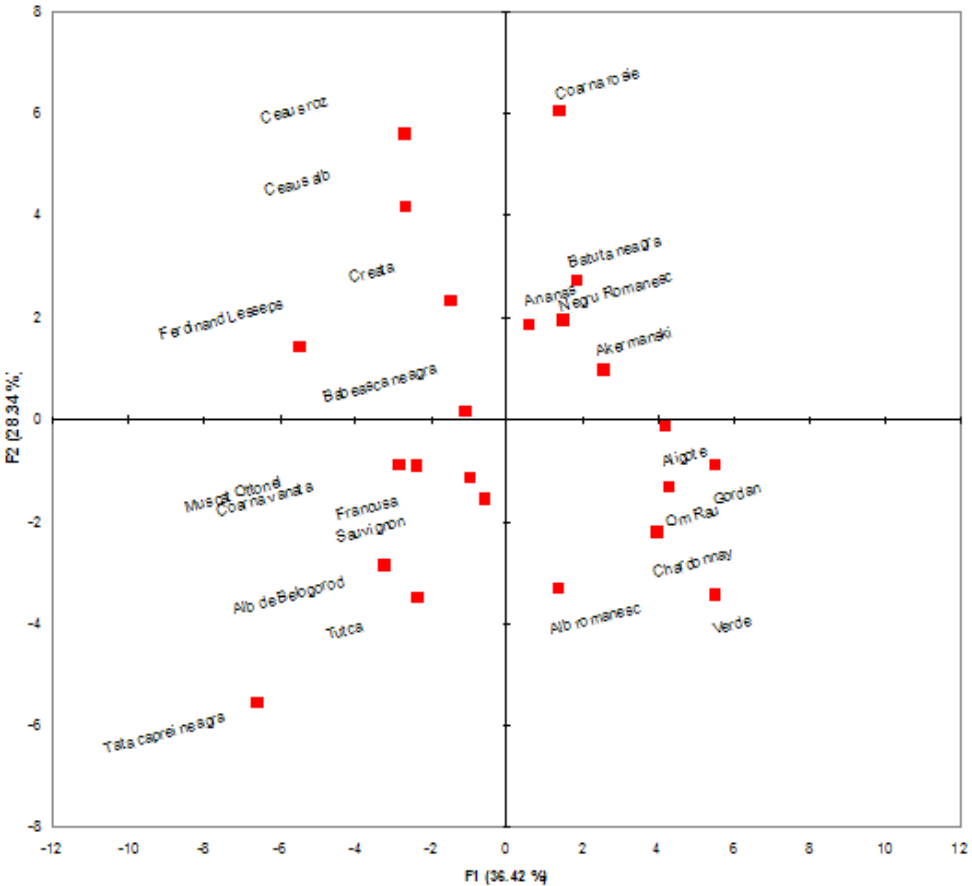
Fig. 1 - Circle of correlations between variables and the first two principal components



Higher correlations were recorded in the case of variables defining the length of the lamina (ALT) with those showing the length of veins N1, N2, the outer contour of the leaf (ENM, ENS) and between the lamina width variable (AN) and the veins length N3, N4, the distance between limit N3 and N4 (ENI).

The correlations between variables and main components are key elements that provide information about the size and shape of the leaf, the ampelographic traits which help differentiate grapevine species.

Distribution of varieties on the principal axes, is important in terms of their contribution to the definition of principal components (figure 2).



**Fig. 2 -** Coordinates of varieties in the plane determined by the first two principal components

Analyzing results we were able to see that the greatest contribution to the definition of the main component 1, was that of varieties Verde (5.4940), Gordan (5.4874), followed by Om râu (4.2927) Aligoté (4.1820) and Chardonnay (3.9518), their position being dispersed in quadrant 4 and at the opposite side we may find Țâta caprei neagră variety (-6.6307), Ferdinand de Lesseps variety (-5.4874) the smallest contribution to factor1 definition was of Ananas variety (0.5575). For the definition of component 2, the varieties Coarnă roșie (6.0763),

Ceauș roz (5.6225) and Ceauș alb (4.1935) were mainly noticed, the last two belonging to the same group, with leaves of similar size and shape, and a negative contribution was seen in the case of Țuța varieties (-3.4710) and Alb românesc (-3.2854), their position being dispersed in one direction or another one, their leaf sizes also differ: round with 3-5 lobes for the former and cuneiform, medium to large in the latter's case.

The results obtained after variety differentiation by applying principal components analysis, highlight the following varieties: Bătută neagră, Ananas, Negru românesc, as a homogeneous group, with large pentagonal leaf, Țâța caprei neagră variety has round leaf, 3-5 lobes and Coarnă roșie with mature round, large leaf, 5-7 lobes.

## CONCLUSIONS

1. Using principal components analysis in ampelometry opens new perspectives in grapevine variety differentiation, complementing the methods of ampelographic descriptors.

2. For the PCA, 68 ampelometric measurements were made on 30 mature leaves for each variety; this is the main ampelographic instrument for the differentiation of vitis genotypes.

3. The application of this method produced the following antagonistic groups: varieties Verde (5,4940), Gordan (5,4847), Om rău (4,2927) and Aligoté (4,1820) versus Țița caprei neagră (-6,6307), Ferdinand de Lesseps (-5,4874) and Ananas (0,5575), separated by factor 1 (axis 1); varieties Coarnă roșie (6,0763), Ceauș roz (5,6225), Ceauș alb (4,1935) versus Alb românesc (-3,2854), determined by factor 2 (axis 2). This antagonistic separation of varieties showed that those groups have very few common traits.

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# USE OF CLUSTER METHOD FOR THE DIFFERENTIATION OF GRAPEVINE GENOTYPES FROM SCDVV IASI GENE BANK

## UTILIZAREA METODEI CLUSTER ÎN DIFERENȚIEREA UNOR GENOTIPURI DE VIȚĂ DE VIE EXISTENTE ÎN BANCA DE GENE A SCDVV IASI

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**Abstract.** *The cluster method used for grapevine variety differentiation is based on the existence of some polythetic groups, ensuring the distribution of varieties to branches, according to their similarity or dissimilarity. This method is based on the principle of dividing a set of individuals into classes in compliance with a dendrogram-like "hierarchy" which may provide information on the number of classes existing in a population. The study was conducted on 23 varieties selected according to the criterion of synonymy or affinity to the same variety group, these varieties being also studied according to the main component method. According to the design of the hierarchical dendrogram of studied varieties, we obtained three polythetic branches of varieties, which point out the very high phenotypic variability, and the fact that their similarity is based on a small number of common features of the adult leaf.*

**Key words:** genotypes, indigenous, statistical methods, dendrogram

**Rezumat.** *Analiza cluster utilizată în diferențierea soiurilor de viță de vie se bazează pe existența unor grupuri politetice, permițând împărțirea soiurilor în ramuri, conform disimilarității sau similitudinilor existente. Principiul acestei metode constă în realizarea unei împărțiri în clase a unui ansamblu de indivizi conform unei „ierarhii” de împărțire care se prezintă sub forma unei dendrograme ce poate da informații asupra numărului de clase existente în cadrul unei populații. Au fost luate în studiu 23 de soiuri alese după criteriul sinonimiilor sau apartenenței la același sortogrup, soiuri ce au fost studiate și prin metoda analizei în componenți principali. În urma elaborării dendrogramei de clasificare ierarhică a soiurilor luate în studiu, au rezultat trei ramuri politetice de soiuri, care evidențiază faptul că variabilitatea fenotipică este foarte mare, iar asemănarea între ele se bazează pe un număr redus de caractere comune ale frunzei adulte.*

**Cuvinte cheie:** genotipuri, autohtone, ampelometrie, dendrograma

## INTRODUCTION

The genetic diversity of plants is generally put at risk due to the environment's destructive action. The species belonging to *Vitis* genus do not evade this phenomenon. It is estimated that worldwide there are about 7000

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species belonging to the genus *Vitis* L, subspecies *vinifera*, among which less than 400 are on the market (P. Galet, 2000).

Thanks to the ease with which vegetative propagation occurs, grapevine varieties by exchange of biological material between countries, were spread in many parts of the world (Fregoni, 1991).

Consequently many of the taxonomic names are known, especially according to the old varieties, lacking a consensus regarding their names (Alleweldt and Dettweiler, 1992). In this respect the clarification of synonymies, homonymy and misspellings of names of vine varieties as well as the identification of their membership in a particular group, remains an important task for ampelography experts, improvers and growers.

The identification and characterization of grapevine genotypes are mainly based on ampelographic traits. For vine variety differentiation, recent studies and the progress made in computer science led to the development of modern, computer aided statistical - mathematical analysis, which uses ampelometry. One such method is cluster analysis, which was proposed by Sokal and Sneath (1963) and applied to ampelography by Lance and Williams (1963) and quoted by Rotaru Liliana (1999).

The purpose of this paper is the differentiation of local, indigenous, less known grapevine varieties, by means of CLUSTER analysis.

## **MATERIAL AND METHOD**

The present study included researches conducted in the ampelographic collection of SCDVV Iași, comprising new, local grapevine varieties which represent the typical assortment of vineyards, local varieties less known in the literature, but also foreign genotypes introduced from other countries.

The cluster analysis was performed on a number of 18 genotypes, selected according to the principle of synonymy, as they were identified at a certain point in various international catalogues, or belonging to the same group and on five varieties grown in Iași vineyard, the objective being their differentiation and integration into a certain group of varieties.

The cluster analysis allows the division of studied varieties into branches according to the dissimilarity or similarity of the phenotypic expression exhibited by the adult leaf. For compiling the database 68 ampelometric determinations were made on 30 leaves of each variety, and the data obtained enabled the calculation of 53 ampelometric values.

For symmetrical traits both values were measured and calculated. The CLUSTER analysis (descriptive classification) refers to methods used to identify the groups of similar objects within a set of objects. Considering the large number of operating data, this method uses the electronic computer and XL-STAT-2010 software was used for statistical processing.

## **RESULTS AND DISCUSSIONS**

The principle of cluster analysis consists in dividing the individuals or objects subject to classification, or regrouping individuals according to the classification algorithm. Information regarding the number of existing classes in a

population and implicitly the varieties' belonging to different groups, the degree of their relatedness and their differentiation is provided in accordance with a hierarchy of division, taking the shape of a dendogram.

After the statistical-mathematical processing of the ampelometric sizes of studied varieties' leafs, the result obtained showed the chain index which indicates the dissimilarity between the groups.

The analysis of data from table 1, with the chain index values which show dissimilarity between groups, pointed out the following:

- Alb de Belgorod and Muscat Ottonel varieties are the most similar as architecture of the leaf, with a dissimilarity index value of 4,058;
- the next varieties with architectural similarities are Bătută neagră and Negru românesc with a dissimilarity index value of 4,848;
- on the following positions are ranked the groups Ananas, Creață (4,916), Ceauș roz, Ceauș alb (5,367) Aligoté, Chardonnay (5,951) and Țuțca, Coarnă vînătă (6,165);
- the following three dendogram nodes consist of three similar varieties each, the group Alb de Belgorod ~ Muscat Ottonel ~ Frîncușă (6,651), group Ananas ~ Creață ~ Akermanski (7,096) and the group Aligoté ~ Chardonnay ~ Gordan (9,383).

The first group consisting of five varieties is formed on node 11, by chaining node 9 (Aligoté ~ Chardonnay ~ Gordan with the index of dissimilarity of 9,383) with the Verde variety, having a dissimilarity index of 10,032. After varieties were chained according to their common features, the result was 21 nodes among which 17 varieties were aggregated with a dissimilarity index value of 124,425. Total inertia of all the varieties studied at SCDVV Iasi is 163,444.

Following the elaboration of dendogram hierarchical classification (fig. 1) of genotypes studied at SCDVV Iași, the following aspects were pointed out:

- formation of three optimal groups (branches) and the occurrence of a level break between nodes 9 and 15;
- branch A is made up of Sauvignon, Băbească neagră, Ananas, Creață, Akermanski, Ceauș roz, Ceauș alb, Coarnă roșie, Bătuta neagră and Negru românesc varieties. This is the least homogenous group, aggregation taking place at the highest value of dissimilarity index of 74,036 and includes varieties with leafs of different shapes, from orbicular and cuneiform to taper orbicular or round;
- branch B is more homogenous, with a dissimilarity index value of 30,976, and includes Țuțca, Coarnă vînătă, Muscat Ottonel, Frîncușă, Alb de Belgorod, Ferdinand de Lesseps and Țâța caprei neagră varieties with similar architecture leafs, and average values of gross ampelometric determinations;
- branch C has the highest homogeneity, with a dissimilarity index value of 13,963, including Aligoté, Chardonnay, Gordan, Verde, Alb românesc and Om rău varieties, the leafs having several common features.

Table 1

## Levels of varieties chaining in the dendogram development

Composition of the node	No. of varieties in a node	Value of the index
Alb de Belgorod ~ Muscat Ottonel	2	4,058
Bătuta neagră ~ Negru românesc	2	4,848
Ananas ~ Creață	2	4,916
Ceauș roz ~ Ceauș alb	2	5,367
Aligoté ~ Chardonnay	2	5,951
Țuțca ~ Coarnă vinătă	2	6,165
Alb de Belgorod ~ Muscat Ottonel ~ Frâncușă	3	6,651
Ananas ~ Creață ~ Akermanski	3	7,096
Aligoté ~ Chardonnay ~ Gordan	3	9,383
Țuțca ~ Coarnă vinătă ~ Muscat Ottonel ~ Frâncușă ~ Alb de Belgorod	5	10,032
Aligoté ~ Chardonnay ~ Gordan ~ Verde	4	10,799
Aligoté ~ Chardonnay ~ Gordan ~ Verde ~ Alb românesc	5	12,579
Aligoté ~ Chardonnay ~ Gordan ~ Verde ~ Alb românesc ~ Om rău	6	13,963
Sauvignon ~ Băbească neagră	2	22,231
Ceauș roz ~ Ceauș alb ~ Coarnă roșie	3	22,485
Țuțca ~ Coarnă vinătă ~ Muscat Ottonel ~ Frâncușă ~ Alb de Belgorod ~ Ferdinand de Lesseps	6	26,145
Țuțca ~ Coarnă vinătă ~ Muscat Ottonel ~ Frâncușă ~ Alb de Belgorod ~ Ferdinand de Lesseps ~ Țâța caprei neagră	7	30,976
Sauvignon ~ Băbească neagră ~ Ananas ~ Creață ~ Akermanski	5	34,841
Ceauș roz ~ Ceauș alb ~ Coarnă roșie ~ Sauvignon ~ Băbească neagră ~ Ananas ~ Creață ~ Akermanski	8	59,608
Bătuta neagră ~ Negru românesc ~ Ceauș roz ~ Ceauș alb ~ Coarnă roșie ~ Sauvignon ~ Băbească neagră ~ Ananas ~ Creață ~ Akermanski	10	74,036
Sauvignon ~ Băbească neagră ~ Ananas ~ Creață ~ Akermanski ~ Ceauș roz ~ Ceauș alb ~ Coarnă roșie ~ Bătuta neagră ~ Negru românesc ~ Țuțca ~ Coarnă vinătă ~ Muscat Ottonel ~ Frâncușă ~ Alb de Belgorod ~ Ferdinand de Lesseps ~ Țâța caprei neagră	17	124,425
<b>Total inertia</b>	<b>23</b>	<b>163,444</b>

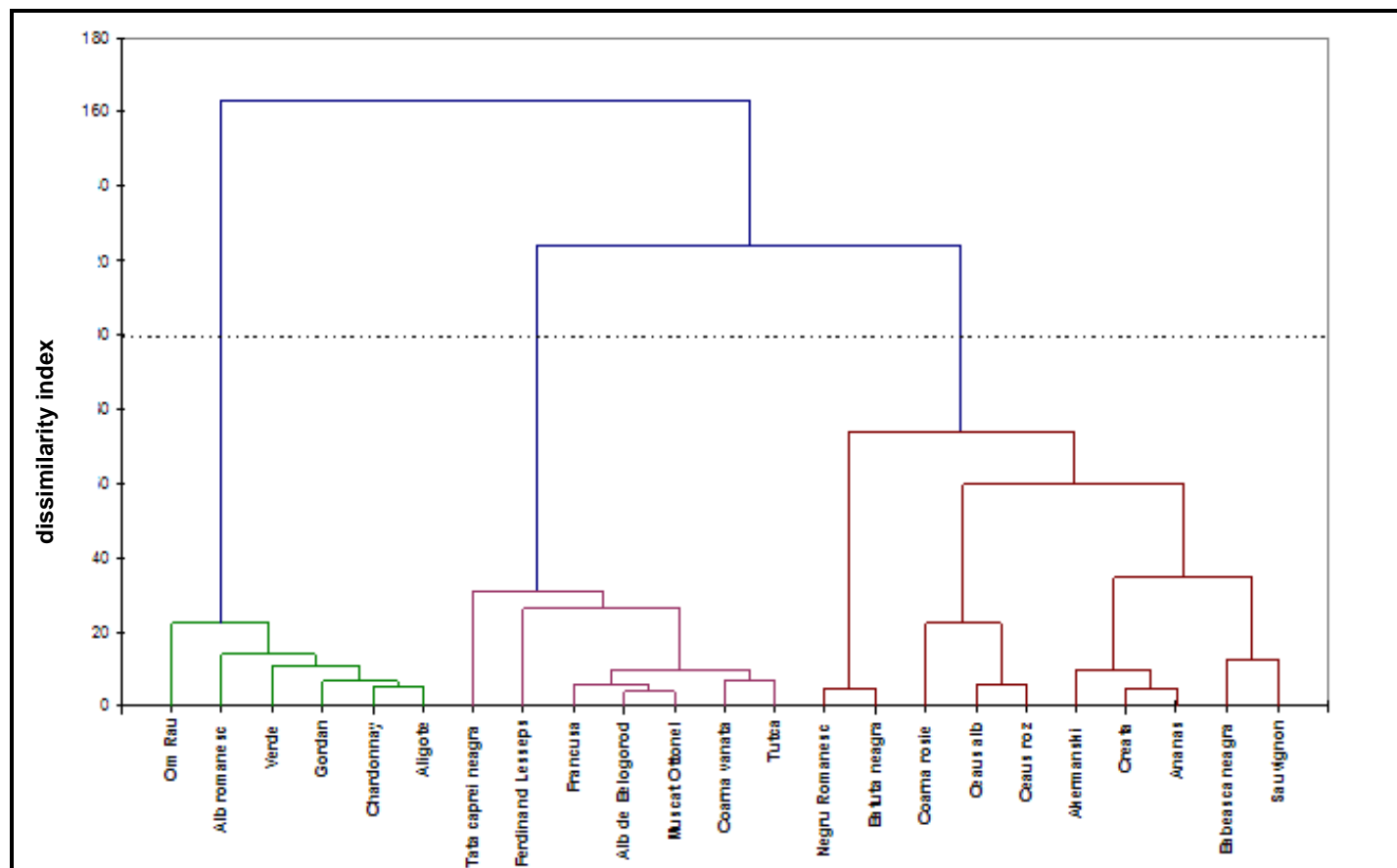


Fig. 1 - Varieties hierarchical dendrogram classification

## CONCLUSIONS

1. The application of the cluster analysis allowed the division of varieties from a group into branches according to the existing dissimilarity or similarity, thus several polythetic groups (branches) of varieties resulted, as follows:

- group A is composed of Sauvignon, Băbească neagră, Ananas, Creață, Akermanski, Ceauș roz, Ceauș alb, Coarnă roșie, Bătuta neagră and Negru românesc varieties. This is the least homogenous group, aggregation taking place at the highest value of dissimilarity index of 74,036 and includes varieties with leafs of different shapes, from orbicular and cuneiform to taper orbicular or round;
- group B is more homogenous, has a dissimilarity index value of 30,976, includes Țuța, Coarnă vînătă, Muscat Ottonel, Frâncușă, Alb de Belgorod, Ferdinand de Lesseps and Țâța caprei neagră varieties with similar architecture leafs, and average values of gross ampelometric determinations.
- group C has the highest homogeneity, with a dissimilarity index value of 13,963, including Aligoté, Chardonnay, Gordan, Verde, Alb românesc and Om rău varieties, the leafs having several common features.

2. Higher values of the dissimilarity index of leaf architecture for the studied varieties point out the fact that phenotypic variability is very high, and similarity between them is based on a small number of common traits.

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# STUDY OF THE MORPHOLOGICAL VARIABILITY OF INDIGENOUS VINE VARIETIES BY USING VARIATIONAL STATISTICS IN THE CLIMATIC CONDITIONS OF VINEYARDS DEALU BUJORULUI

## STUDIUL VARIABILITĂȚII MORFOLOGICE A SOIURILOR AUTOHTONE DE VIȚĂ DE VIE PRIN UTILIZAREA STATISTICII VARIAȚIONALE ÎN CONDIȚIILE PEDOCCLIMATICE A PODGORIEI DEALU BUJORULUI

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**Abstract.** Research has particularity targeted on existing local varieties of RDVVS Bujoru ampelography collection. Cluster analysis acknowledges the existence of similar groups, but not all characterization allows the division between varieties according to the existing degree of dissimilarity or similarity. In this case, groups are formed according to the linked affinity (kinship), and congestion or placing in the group was hierarchical. Distance (dissimilarity) and similarity complement each other, maximum similarity corresponds to short and vice versa and for every individual belonging to the group to the specified distance from its neighbors in the same group of neighbors to the superiors of the group.

**Key word:** Cluster analysis, vineyard, ampelometry,

**Rezumat.** Cercetările efectuate au vizat în mod deosebit soiurile autohtone existente în colecția ampelografică a SCDVV Bujoru. Analiza Cluster admite existența unor grupuri similare, dar nu pentru toate caracterele și permite, divizia între soiuri în funcție de gradul de disimilaritate existente sau similaritate. În cazul de față, grupurile formate sunt legate între ele în funcție de afinitate (înrudire), iar aglomerarea sau așezarea în cadrul grupului s-a făcut ierarhic. Distanța (disimilaritatea) și similitudinea se completează reciproc, adică distanță mică corespunde la similitudine maximă și invers și pentru fiecare individ care aparține grupului se precizează distanța față de vecinii săi din cadrul aceluiași grup și față de vecinii care aparțin grupului ierarhic superior.

**Cuvinte cheie:** metoda cluster, viță de vie, ampelometrie

## INTRODUCTION

Cluster analysis classifies a set of observations into two or more unknown groups based on mutually exclusive combination of variables. The aim is to group classification of vine varieties depending on the similarities and differences between them, thus providing a summary of their description.

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The term cluster refers to a set of objects (elements) similar to each other and dissimilar from other clusters, while the term involves the application of cluster analysis algorithms, resulting classes as a result of a suite of operations performed recursively or repetitive. Cluster analysis, also known as segmentation analysis or taxonomy is to identify a set of homogeneous groups by grouping items so as to minimize variation within the group and maximize the variation between groups. It is therefore a unit or multivariate analysis technique that includes a number of algorithms for classification of objects or individuals into homogeneous groups (Babucea, 2003; Indreaş A., 2004; Rotaru L., 2000). The Cluster approach will be achieved in this work, created from hierarchical cluster analysis of the studied varieties.

## **MATERIAL AND METHOD**

The ampelometry expressed some characters ampelographic by numerical expressions, considering that each variety can be defined by an eigen value, characteristic. Research conducted within the work focused particularly in the collection of indigenous varieties of RDVVS Bujoru ampelography (Astra, Azur, Babeasca neagră, Blasius, Brumăriu, Cetăţuia, Cioinic, Coarnă neagră selecţionată, Codană, Negru aromat, Selenia, Silvania, Transilvania).

Cluster analysis was performed using the variables of the leaf ampelometry adult characters. Were carried out a series of measurements taken from the following list of characters ampelometryc OIV descriptors. Were collected every 20 leaves from the middle third of the shoot, during the first fruits of the grape. Shoots showed the same stage of development and had the same level of insertion. There have been a number of 68 ampelometryc direct measurements and data obtained allowed the calculation of 53 ampelometryc values. Measurements ampelometryc analyzed the leaves of vines were: length of main ribs (N1, N2, N3, N4) distance between lateral petiole sine point (U, A), lateral sinus opening (SS, Si) and petiole sine (SP), length (ALT) and width (AN) languages, the outer leaf (ENS, ENM, ENI, NL), the inside of the leaf (DS1, DS2, DS), the angles between the main veins (A, B, C) angles that define the shape of median lobe (F, AP), median fins and the tip angle of the lower side lobe (EBA), the relationship between the length of ribs (21a, 31a, 41a), the ratio of the lateral sinus and veins that resting sinus (UN2, ON3), ratio of leaf length and width (LA).

## **RESULTS AND DISCUSSIONS**

Appealing to the desired cluster analysis classification of vine varieties studied depending on the variables considered in the assumption that each of them have certain common characteristics. Cluster analysis enables the study of their phenotypic expressions of genotypes manifested through the leaves of the vine. Varieties studied as part of Proles pontica and orientalis. Hierarchical cluster analysis was performed - using the Hierarchical Cluster farthest neighbor with Squared Euclidean distance as a method of calculating distances with available software package SPSS for Windows. Was chosen to display the output of all combinations of each iteration, distances etc. option "Agglomeration schedule", showing distances or similarities between elements with „Proximity matrix „, and display in one or more iterations of „Cluster Membership„, - the Statistics module.

Also, we opted for the graphical representation of cluster-type chart in the dendrogram. The dendrogram representation, the distances between the elements that unite are processed on a scale of 0-25 (fig. 1), while maintaining the ratio of distances. Given the set of indicators considered to characterize the varieties were found three clusters as shown in tables 1 and 2. *Cluster 1*: 1- Astra;3-Selene; 4- Băbească neagră; 9 - Coarna albă; 14- Blasius; *Cluster 2*: 2- Brumăriu; 5- Azur; 7- Silvania; 10- Negru aromat; 11- Coarnă neagră selecționată; *Cluster 3*: 6- Transilvania; 12- Codană; 13- Cetățuia, Cioinic.

Table 1

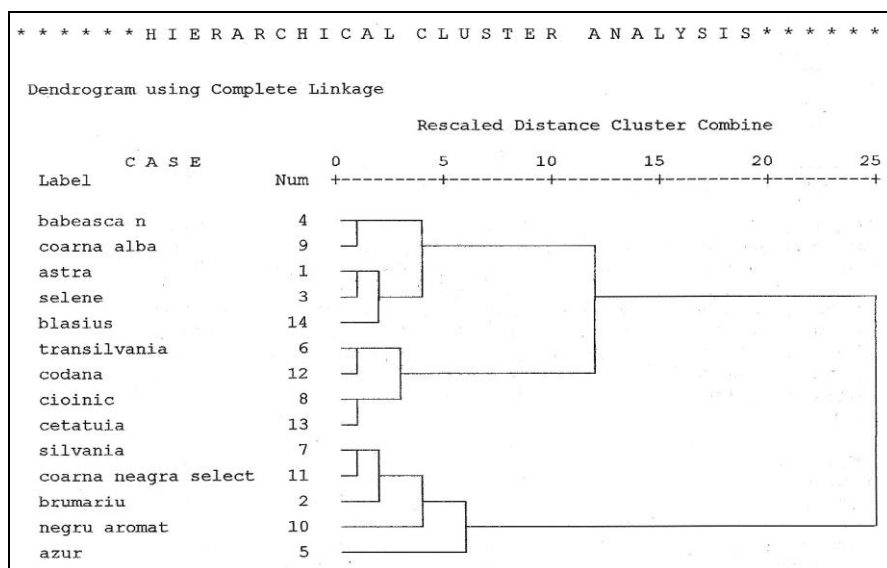
Cluster Membership		
Case	Varieties	Cluster
1	Astra	1
2	Brumăriu	2
3	Selene	1
4	Băbească neagră	1
5	Azur	2
6	Transilvania	3
7	Silvania	2
8	Cioinic	3
9	Coarnă albă	1
10	Negru aromat	2
11	Coarnă neagră s.	2
12	Codană	3
13	Cetățuia	3
14	Blasius	1

Table 2

Agglomeration Schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	4	9	135,286	0	0	8
2	6	12	272,311	0	0	6
3	1	3	279,647	0	0	5
4	7	11	343,682	0	0	7
5	1	14	493,638	3	0	8
6	6	13	518,168	2	0	11
7	2	7	665,162	0	4	9
8	1	4	1187,502	5	1	11
9	2	10	1192,040	7	0	10
10	2	5	1542,693	9	0	12
11	1	6	3321,838	8	6	12
12	1	2	6845,630	11	10	0

As a result of the algorithm is obtained classification tree (dendrogram) which is actually a summary of classification. Dendrogram cluster agglomeration schedule shows: the amount for which classes were merged. Analyzing the dendrogram in fig. 1, that the iterative process starts with 7 groups of somewhat homogeneous classes. At a level of aggregation under 5, restricted to three groups which are represented by the three clusters. In the clusters formed, they comprise variants are similar sizes ampelometryc after some consideration, and segregation is quite small. Varieties have similar leaf shape (orbicular, orbicular-cuneiform). Differentiation is given by the size and length of leaves. Cluster 3 is somewhat different from the other two clusters structure. Cluster 2 cluster 3 adheres to the degree of aggregation between 10 and 15. In light of the indicators considered, differs from the structure considered, it fits in a homogeneous class only in the last step of the algorithm.



**Fig. 1** - Dendrogram for the classification of indigenous vine varieties

## CONCLUSIONS

1. Analysis multivariate, descriptive classification (cluster analysis) divided the varieties under study in a lot shared three clusters: - cluster 1: 1- Astra;3-Selene; 4- Băbească neagră; 9 - Coarna albă; 14- Blasius; cluster 2: 2-Brumăriu; 5- Azur; 7- Silvania; 10- Negru aromat; 11- Coarnă neagră selecționată; cluster 3: 6- Transilvania; 12- Codană; 13- Cetățuia, Cioinic.

2. The distances at which unite the three clusters show similarity between varieties. Variants that compose it are similar sizes ampelometrycs after some consideration.

**Acknowledgements.** *The research was supported by financial resources of no. 52116/2008, Collection, conservation and monitoring of the wine-growing indigenous genetic resources in Eastern and South-East of the country.*

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# THE INFLUENCE OF LENGHT PRUNING ELEMENTS ON THE QUANTITY AND QUALITY OF FETEASCĂ NEAGRĂ GRAPEVINE VARIETY CULTIVATED IN COTNARI VINEYARD

## INFLUENȚA LUNGIMII ELEMENTELOR DE ROD ASUPRA CANTITĂȚII ȘI CALITĂȚII PRODUCȚIEI DE STRUGURI LA SOIUL FETEASCĂ NEAGRĂ CULTIVAT ÎN PODGORIA COTNARI

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**Abstract.** *In this paper the authors presents the experimental data have obtained from the practice of cutting different lengths fruition at the Fetească neagră variety grown in the vineyard Cotnari. First cutting short pruning system was applied (stems of 2-3 fruitful eyes), and second cutting on the long pruning system (fertile offshoots of 8-10 eyes). The research envisages obtained production levels, production and quality of grapes made from the use of two types of cut: Speroni Girdles and Guyot on arms with periodic replacement.*

**Key words:** Cotnari, Fetească neagră, short pruning system, long pruning system

**Rezumat.** *În lucrare autorii prezintă datele experimentale obținute în urma practicării tăierii de rodire cu diferite lungimi de rod la soiul Fetească neagră cultivat în podgoria Cotnari. Pe de o parte s-a practicat tăierea în elemente scurte de rod (cepi de 2-3 ochi), dar și tăierea în elemente lungi de rod (coarde de 8-10 ochi). S-a urmărit evidențierea nivelului de producție obținut, dar și calitatea producției de struguri realizate în urma folosirii celor două tipuri de tăiere: cordonul speronat și Guyot pe brațe cu înlocuire periodică.*

**Cuvinte cheie:** Cotnari, Fetească neagră, sistem de tăiere scurt, sistem de tăiere lung.

### INTRODUCTION

Cotnari region is placed in a transitional area between the two biggest relief units, profound different of Moldova: the High plateau of Suceava – represented here by the eastern unit Dealul Mare - Hârlău and the Hill plain of Moldova (Cotea D.V. and al., 2006). This contact between two relief units starts a long series of very important differences both in climate as well in vegetation and land distribution.

Inside Cotnari region the relief is fragmented, so that we can distinguish in its general slope towards south-east a series of isolated or grouped prominent, remains of structural surfaces once much more extended: The Cătălina hill (395 m), The Rock hill (360 m), The Cancer foot hill (337 m), The Liteanca hill (330 m), Vodă hill (347 m) e.g (Barbu N., Cotea V.V., 2002).

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The growing centers are: Cotnari 206 m, Hârlău 237 m, Cucuteni 169 m, Tg. Frumos 145 m from Iași county and Frumușica 187 m from Botoșani county.

The general climate is hilly steppe, characterized by an active heat balance of 3167<sup>0</sup>C, which 1219<sup>0</sup>C represents the useful temperature. The determining factor is the local air masses hot dry wind phenomenon arrived from the Northwest side reaching the area only as hot dry winds (Țârdea C., Dejeu L., 1995). Those effects are much more favorable for vine growing: vegetation period over 200 days, real heatstroke 1400-1500 hours, rainfall during the growing season 369 mm. As a local factor the warm long, drought, no rainfall autumn determines the positive to the vine growing and the noble rot development on grapes. The absolute minimum temperatures reach sometimes -28,3<sup>0</sup>C, often put in danger the unprotected vine culture.

The use vineyards soils are: cambic chernozem, ash soils, rend sine limestone and rend sine limestone rich in humus. The geological deposits on which these soils were formed are made of loess clays, calcareous sandstone, calcareous oviform (Rotaru L., 2009).

The specific vine assortment varieties for Cotnari vineyard are: Grasă de Cotnari, Fetească albă, Frâncușă and Tămâioasă românească (Țârdea C. and al., 2010). Due to improve the thermal regime from the last few years now wine varieties can be cultivated with satisfying results. *Fetească neagră*, a red wine variety, shows a good act.

## MATERIAL AND METHOD

Inside COTNARI Stock Company, the surveys were held in No.4 farm, in vineyards cultivated with the *Fetească neagră* variety grown established in 1988, located in similar conditions of soil and slope position and aimed: elements of fertility and productivity, production levels, sugar accumulation and total acidity of grape production of specific 2010.

The rootstock used is Berlandieri x Riparia Kober 5 BB. Planting distances are 3,0/1,2 m and vine branches positioning vertical. On the one hand it was seen to the wine variety reaction driven form of bilateral cordon with cuts in short rod rings (replacement spigot 2 eyes + 2-3 eyes plug production), allowing ensuring average loads of 40-42 vine eyes/vine vine (V1), and on the other it was seen to the wine variety reaction driven form of Guyot on arms with periodical replacement, with cuts in bearing rings (replacement spigot 2 eyes + 10 eyes rope vine), allowing a fruit load around 50-52 eyes/vine vine (V2). The ground maintenance system is made of black field and the maintenance works applied vine is specific for industrial vineyard ecosystem.

## RESULTS AND DISCUSSIONS

The *Fetească neagră* variety grown is one of the oldest Romanian varieties, resulted from the popular selection practiced by anonymous growers (*Vitis silvestris* Gmel.). The place of origin is supposed to be the Prut River Valley, somewhere around Uricani, Iași County. Therefore the variety is well adapted to the eco-pedoclimatic conditions specific on the North East part of the wine region Moldova Hills, where is otherwise the Cotnari vineyard situated too.

**Fertility and productivity of the variety** (tab. 1). Fertility varieties, expressed by percentage of fertile shoots express a much larger biological potential for *Fetească neagră variety grown* to which the practice of cutting in short rod elements 39% fertile shoots, while cutting long rod elements, the fertile shoots formed on vine vine are around 36%. Fertility coefficient values indicate that the average number of inflorescence formed on a fertile vine shoot is 1,33 for V1 and only 1,14 for V2. As for fertility is found relatively quite low because of large number of the sterile shoots that forms on the vine vine.

Table 1

**Fertility and productivity of the Fetească neagră variety grown**

Variant	Fertile shoots (%)	Absolute fertility coefficient	Relative fertility coefficient	Average weight of a grape (g)	Absolute Productivity index	Relative Productivity index
V1	39	1,33	0,52	222	295,3	115,4
V2	36	1,14	0,45	216	246,3	97,2

The variety productivity is conditioned, on the one hand, by the number of grapes that is formed and on the other conditions by the average weight of those. The productivity index values are bigger in the situation of cutting in short rod elements, but the average weight of one grape is bigger too in this case. The smallest relative productivity index value is that registered in the situation of cutting in long rod elements.

In conclusion, the Fetească neagră variety grown capitalize in a higher level the biological potential of fertility and productivity, in terms of culture from the growing center Cotnari, in the situation of cutting in short rod elements.

**Grape production** (tab. 2). The productive potential of the variety we have studied was expressed by the average number of grapes formed on the vine vine, the average weight of a grape, the achieved production on a vine vine and that one calculated per hectare. The average density is 2777 vine vine/ha.

The grape production, decisive element for the technological appreciation value of a variety, indicates the fact that *Fetească neagră variety grown* has a great productivity potential, in the situation of cutting in short rod elements obtaining 13,56 tones of grapes/ha, while cutting in long rod elements the production levels are smaller than 10,19 tones grape/ha.

Table 2

**Grape production on Fetească neagră variety grown**

Variant	Grape production (kg/vine vine)	Production per hectare (t/ha)	Average number of grape per vine vine	Average weight of a grape (g)
V1	4,89	13,56	22	222
V2	3,67	10,19	17	216

**The quality of grape production** (tab.3). The quality of grape production, expressed by the sugar accumulation and total acidity values of grape, proving that in both cases the differences is not so big. In the first case, the *Fetească neagră variety grown* accumulates bigger quantities of sugar 205 g/l, but in cutting in long rod elements the *Fetească neagră variety grown* has accumulated 202g/l sugar. The total grape acidity has values over 5 g/l H<sub>2</sub>SO<sub>4</sub> in the case of cutting in short rod elements, but we can say that in qualitative aspect the differences are not so big between the two variant.

Table 3

**The grape quality production harvesting the *Fetească neagră variety grown***

Variant	Weight for 100 grains (g)	Sugar Content (g/l)	Acidity Content (g/l H <sub>2</sub> SO <sub>4</sub> )	Alcoholic potential (%vol.)	Glico-acidimetric Index
V1	225	205	5,42	11,38	37,82
V2	209	202	4,91	11,22	41,14

## CONCLUSIONS

1. The *Fetească neagră variety grown*, cultivated in Cotnari vineyard, fully exploits the eco-climate conditions of the area, being able to obtain red wines of good quality with special organoleptic qualities.

2. In terms of fertility and productivity, the *Fetească neagră variety grown* is the best exploited when cutting in short rod elements, the fertility and the productivity index are much more bigger than in case of cutting long elements.

3. The grape quantity production is superior then in the case of rod cuttings in vine shoots for *Fetească neagră variety grown* versus lower levels registered in cutting long rod elements.

4. The production quality is less influenced, in both cutting systems for *Fetească neagră variety grown*, in Cotnari vineyard being able to obtain wines of good quality.

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# LA VALEUR AGROBIOLOGIQUE ET TECHNOLOGIQUE DU NOUVELLES CREATIONS POUR RAISINS DE TABLE DANS LE VIGNOBLE DE IASI

## VALOAREA AGROBIOLOGICĂ ȘI TEHNOLOGICĂ A UNOR CREAȚII NOI PENTRU STRUGURI DE MASĂ ÎN CONDIȚIILE PODGORIEI IASI

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**Résumé.** La zone du Nord-Est de la Roumanie se caractérise par des conditions restrictives climatiques (hivers froids et des étés chauds et secs), le type de vigne pour les raisins de table ont le moins favorabilité, étant cultivate surtout du Chasselas doré. Pour à la fois en Roumanie les unités de recherche viticole centré leurs recherches sur l'amélioration de la vigne pour obtenir de nouveaux génotypes qui ont la meilleure capacité d'adaptation aux facteurs de ces restrictive et la plus courte période de croissance. Parmi les créations roumaines qui ont confirmé leur comportement dans le méritoire areales septentrionale de la Roumanie imposées cépages pour les raisins de table de Gelu, Paula, et Splendid Someșan. Dans ce travail ont présente le comportement de ces cépages dans les conditions écoclimatiques du vignoble de Iasi, ont été suivies: la résistance au gel, la phénologie des cépages, la fertilité et la productivité, la quantité et la qualité des productions des raisins

**Mots- clé:** variétés de raisin de table, nouvelles variétés de vignes créée, la fertilité, la productivité

**Rezumat.** În zona de nord est a României, caracterizată prin condiții restrictive (ierni reci, veri secetoase și călduroase), cultura soiurilor de viță de vie pentru struguri masă are o favorabilitate mai redusă, fiind cultivat cu predilecție soiul Chasselas dore. Unitățile de cercetare viticolă din România și-au canalizat însă rezultatele în ameliorarea viței de vie și pe obținerea de soiuri care să aibă perioadă scurtă de vegetație și rezistență bună la ger. Dintre acestea au dovedit o bună comportare în podgoria Iași soiurile Gelu, Paula, Splendid și Someșan. În această lucrare sunt prezentate rezultatele obținute în podgoria Iași privind rezistența la ger, fenologia soiurilor, fertilitatea și productivitatea, cantitatea și calitatea producției de struguri.

**Cuvinte cheie:** struguri de masă, soiuri de viță de vie nou create, fertilitate, productivitate

## INTRODUCTION

Parmi les créations roumaines qui ont confirmé leur comportement méritoire dans les aires viticoles septentrionales de Roumanie se sont imposés les cépages de raisins de table Gelu et Paula (SCDVV Iași) (I Andreăș A., Vișan L., 2000), Splendid et Someșan (SCH Cluj) (Rotaru L. et al., 2002).

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Dans la zone de NE de Roumanie, caractérisée par des conditions de climat restrictives (hivers rigoureux et étés torrides et secs), les cépages de raisins de table ont une moindre favorabilité (Cotea D.V. et all., 2000), y étant cultivé surtout le Chasselas doré, tout comme dans d'autres zones à climat septentrional d'Europe (Țârdea C., Rotaru L., 2003). Par conséquent, les unités de recherche viticole de Roumanie ont axé leurs efforts d'amélioration dans le but d'obtenir de nouveaux génotypes appartenant à l'espèce *Vitis vinifera* L. qui possèdent une meilleure adaptabilité à ces facteurs limitatifs et à la période de végétation plus courte (Dobrei A. et all., 2008).

On présente dans notre ouvrage leur comportement dans les conditions éoclimatiques du vignoble de Iași (2008-2010), y étant suivis: la résistance au grand froid, la fertilité et la productivité, la quantité et la qualité de la production de raisins.

## MATERIAU ET METHODES

On a effectué l'étude dans le cadre de la collection ampélographique de la Faculté d'Horticulture, comparativement au cépage témoin Chasselas doré. On a planté les cépages en 1999, les greffant sur le porte-greffe Berlandieri x Riparia Kober 5 BB, à des distances de plantation de 2,2/1,2 m. La forme de conduite cordon bilatéral sur demi-tige, avec la taille en anneaux de fructification (pousses à 2 oeil + sarment à de 5-6 oeil), la charge moyenne étant de 40-43 oeil/souche. Le matériau biologique soumis à l'étude est présentée dans la table 1.

Table 1

Matériel génétique analysée	
Cépage	Origine
Paula	A été créé à la SCDVV Iași par hybridation sexuée intra-spécifique des cépages Bicane x Aromat de Iași. Auteurs Gh. Calistru et Doina Damian, le cépage étant homologué en 1997
Gelu	Issu de semences résultées de la pollinisation libre du cépage Coarnă neagră irradié avec des rayons X. Obtenu à la SCDVV Iași, auteurs Gh. Calistru et Doina Damian, homologué en 1998
Splendid	A été obtenu à la S.C.P.P. Cluj-Napoca, par hybridation sexuée contrôlée entre les cépages Black rose x Regina Viilor (St. Oprea <i>et al.</i> ). L'homologation en a été faite en 1984.
Someșan	A été obtenu par auofocondation en F1 de la combinaison hybride des cépages: Muscat de Hambourg x Regina viilor, à la S.C.P.P. Cluj-Napoca, auteurs Șt. Oprea et Olar B. On l'a homologué en 1987

## RESULTATS ET DISCUSSIONS

Le vignoble de Iași est situé au centre de cette zone, et le cadre écologique satisfait les exigences biologiques des variétés pour les raisins de table à maturation précoce (époques I-II) et moyenne (époques III-IV), seulement certaines années étant assurées les conditions pour les cépages à maturation tardive (époques V-VI).

La zone viticole de NE de la Moldavie, située entre les coordonnées géographiques de 46°31' – 47°35' latitude nord et 27°28' – 27°36' longitude est,

se caractérise par un climat tempéré continental de silvo-steppe aux hivers rigoureux, aux étés chauds et secs. Les indicateurs écologiques, sont: durée de la période de végétation 170–180 jours; température moyenne annuelle 9,3–9,6°C; bilan thermique global 3700–3800°C; bilan thermique actif 3200–3250°C; bilan thermique utile 1400–1450°C; insolation réelle 1450–1500 heures; somme des précipitations annuelles 530–550 mm, dont pendant la période de végétation 350 mm. Les valeurs des températures minimas absolues en hiver des 10 dernières années ont été de –26,4°C/18.II.2006 et de -25,3°C/25.I.2010.

**Résistance aux grands froids.** De l'analyse de la table 2 il résulte que chez le cépage Gelu la viabilité des bourgeons principaux a été la plus grande, pourcentage de 78%, le même taux élevé de bourgeons viables étant enregistré chez les secondaires (81%) et les tertiaires (95%). En effet, le cépage Gelu se comporte le mieux aux températures négatives de l'hiver, ayant les moindres pertes de bourgeons de tous les cépages soumis à l'étude.

Table 2

**Viabilité des oeils d'hiver chez les cépages soumis à l'étude**

Cépage	Nr. d'oeils analysés	Bourgeons principaux		Bourgeons secondaires		Bourgeons tertiaires	
		Nr.	%	Nr.	%	Nr.	%
Chasselas doré (Témoin)	150	113	75	120	80	132	88
Gelu	142	111	78	115	81	135	95
Paula	133	97	73	106	80	102	77
Splendid	138	91	66	102	74	110	80
Someşan	121	81	67	96	79	108	89

Une bonne résistance au grand froid comporte aussi le cépage Paula, chez lequel le taux de bourgeons principaux viable est de 73%, respectivement plus de 80% des secondaires.

Le cépage Splendid manifeste une tolérance moyenne aux grands froids, le pourcentage de bourgeons principaux étant de 66% et plus grand chez les bourgeons secondaires 74%, respectivement 80% des tertiaires.

Le cépage Someşan, quoique cépage de raisins de table plus tardif, a eu la viabilité des bourgeons principaux de 67%. Chez les bourgeons secondaires et tertiaires on constate une bonne viabilité, le taux d'oeils viables étant de 79%, respectivement de 89%.

On constate donc que, chez tous les cépages soumis à l'étude, les pertes de bourgeons principaux ont été assez grandes, étant situées entre 34% chez le cépage Splendid et 23% chez le cépage Gelu, ce qui impose qu'on exécute, les années d'accidents climatiques, des tailles de compensation. Comparativement au cépage témoin Chasselas doré, un comportement meilleur ayant le cépage Gelu, le taux d'oeils viables étant supérieur chez toutes les trois catégories de bourgeons.

**Fertilité et productivité des cépages** (table 3). En général, les cépages étudiés ont une fertilité moyenne, excepté le cépage Gelu, chez lesquels le taux de pousses fertiles est 74%, les autres cépages ayant une moyenne entre 62,9–69,3%

pousses fertiles. Les coefficients de fertilité ont des valeurs grandes chez les cépages Paula c.f.a. = 1,26; c.f.r. = 0,95 et Splendid c.f.a. = 1,15; c.f.r. = 0,72. En échange, les indices de productivité sont plus grands chez les cépages ayant également le poids d'une grappe plus grande, tels les cépages Splendid i.p.a. = 394,5; i.p.r. = 289,1; Gelu i.p.a. = 368,0; i.p.r. = 275,3 et Someșan i.p.a. = 377,7; i.p.r. = 253,0. Tous les cépages ont pourtant les valeurs des indices de productivité supérieures au cépage Chasselas doré.

Table 3

**Fertilité et productivité des cépages de raisins de table dans le vignoble de Iași**

Cépage	% pousses fertiles			Coef. de fert. absolu	Coef. de fert. relatif	Indice de prod. absolu	Indice de prod. relatif
	%	Dif. vis-à-vis du témoin	Signif.				
Chasselas doré (martor)	85,7	-	-	1,31	1,12	266,8	230,0
Gelu	74,0	-11,7	-	1,00	0,74	368,0	275,3
Paula	69,3	-16,4	0	1,26	0,95	354,3	236,8
Splendid	62,9	-22,8	00	1,15	0,72	394,5	289,1
Someșan	67,2	-18,5	0	1,09	0,73	377,7	253,0

DL 5% = 13,0%;

DL 1% = 18,9%;

DL 0,1% = 28,3%

Table 4

**Quantité et qualité de la production des cépages de raisins de table dans le vignoble de Iași**

Cépage	Poids moyen d'une grappe.			Masse 100 grains (g)	Production de raisins				Sucres (g/l)	acidité totale (g/l H <sub>2</sub> SO <sub>4</sub> )	indice glucoacidimétrique
	(g)	Dif.	Signif.		kg/souche	t/ha	% marchande	t/ha			
Ch. doré (tm)	203	-	-	342	6,20	22,9	62,3	14,3	176,0	4,7	37,7
Gelu	368	+165	**	330	7,10	26,2	84,2	22,0	166,5	4,5	37,0
Paula	282	+79	-	604	3,90	14,4	69,1	9,95	154,5	5,5	28,1
Splendid	346	+143	**	285	7,00	25,9	77,7	20,1	156,0	4,4	35,9
Someșan	296	+93	*	285	6,30	23,3	66,5	15,5	175,0	4,4	39,7

DL 5% = 92,8 g;

DL 1% = 134,9 g;

DL 0,1% = 202,4 g

*Quantité et qualité de la production de raisins* (table 4). Le poids moyen d'une grappe a été supérieur chez tous les cépages et assuré

statistiquement de façon significative chez les cépages Someșan et distinctement significatif chez les cépages Gelu et Splendid.

Les productions les plus grandes sont réalisées par le cépage Gelu de 7,10 kg/souche, suivi de très près par Splendid 7 kg/souche. La production calculée à l'hectare qui a dépassé les 20 tonnes a été enregistrée par les cépages Gelu 26,2 t/ha, Splendid 25,9 t/ha, et Someșan 23,3 t/ha.

Le taux le plus grand de production marchande est celui du cépage Gelu 84,2% suivi des cépages Splendid 77,7%, et le plus bas celui du cépage Someșan 66,5%. Malgré cela, les cépages soumis à l'étude ont dépassé le témoin, qui n'a eu que 62,3% pour taux de production marchande.

Qualitativement, les accumulations de sucres ne s'approchent du cépage Chasselas doré que dans le cas du Someșan, les limites de variation étant comprises entre 154,5 g/l chez Paula et 166,5 g/l chez Gelu. L'acidité totale du moût, à la pleine maturation a été équilibrée, étant comprise entre 4,4 g/l H<sub>2</sub>SO<sub>4</sub> chez les cépages Splendid et Someșan, respectivement 5,5 g/l H<sub>2</sub>SO<sub>4</sub> chez Paula. Malgré cela, les valeurs de l'indice glucoacidimétrique sont spécifiques aux cépages de raisins de table, harmonieux du point de vue du goût étant les cépages Someșan (39,7), Gelu (37,0), Splendid (35,9), qui ont un indice glucoacidimétrique proche de la valeur optimale de 40.

## CONCLUSIONS

1. Sous l'aspect de la résistance aux grands froids, dans la zone septentrionale de Roumanie le meilleur comportement a été prouvé par les nouvelles créations, les cépages Gelu et Paula, les pertes de bourgeons principaux pendant l'hiver étant moindres ou égales à celles du témoin, le cépage Chasselas doré.

2. La fertilité des cépages est, en général, moyenne, à l'exception du cépage Gelu qui a le taux de pousses fertiles de 74,0%. Sous l'aspect de la productivité tous les cépages ont eu les valeurs des indices de productivité supérieurs au témoin Chasselas doré.

3. Les productions de raisins obtenues sont, en général, grandes, les cépages Gelu, Splendid et Someșan dépassant le témoin. S'imposent les cépages Gelu, et Splendid qui ont le taux le plus élevé de production marchande.

4. Les accumulations de sucres sont spécifiques aux cépages de raisins de table, mais inférieures au cépage Chasselas doré, excepté le cépage Someșan, de sorte que les valeurs de l'indice glucoacidimétrique sont proches de l'optimum, assurant un équilibre gustatif apprécié par les consommateurs.

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# UPGRADING THE TECHNOLOGY OF CULTIVATING GELU AND PAULA TABLE GRAPES IN ACCORDANCE WITH THE REQUIREMENTS OF EUREPGAP QUALITY SYSTEM

## MODERNIZAREA TEHNOLOGIEI DE CULTIVARE A SOIURILOR PENTRU STRUGURI DE MASA, GELU ȘI PAULA ÎN CONFORMITATE CU CERINȚELE SISTEMULUI DE CALITATE EUREPGAP

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**Abstract.** Taking into account the increasingly high demand of grapes for fresh consumption, in the context in which the areas covered by vine growing diminished significantly and large part of the grapes existing on the Romanian market come from import, it is of utmost importance to take the measures necessary for: improving the range of varieties of table grapes by creating and introducing varieties which meet the increasingly high demands of consumers, upgrading their cultivation technology to allow higher as well as constant, qualitative and economically efficient yields. In order to meet these requirements, during 2008 – 2010 at Research and Development Institute for Viticulture and Wine making we designed a modern technology for obtaining and selling table grapes in accordance with European quality systems (EUREPGAP).

**Key words:** table grapes, technology, quality

**Rezumat.** Având în vedere cerințele tot mai mari de struguri pentru consum în stare proaspătă, în contextul în care suprafețele ocupate cu plantații viticole s-au redus simțitor și o bună parte din strugurii existenți pe piața românească sunt din import, se impune cu prioritate luarea unor măsuri cu privire la: îmbunătățirea sortimentului varietal al soiurilor pentru struguri de masă prin crearea și introducerea în cultură a unor soiuri care să satisfacă cerințele mereu crescânde ale consumatorilor, modernizarea tehnologiilor de cultură a acestora care să permită obținerea unor recolte mari, constante, calitative și eficiente economic. Pentru a răspunde la aceste deziderate, în perioada 2008 – 2010 la Stațiunea de Cercetare Dezvoltare pentru Viticultură și Vinificație Iași s-a elaborat o tehnologie modernă de obținere și valorificare a strugurilor de masa prin implementarea sistemelor de calitate europene (EUREPGAP).

**Cuvinte cheie:** struguri de masă, tehnologie, calitate

## INTRODUCTION

Improving the varietal conveyer of the table grapes variety from the North – East of the country was a permanent preoccupation of the researchers within SCDVV Iasi, materialized in the creation and homologation of two table grape varieties Paula and Gelu (Gh Calistru et al, 1998 - 1999). The two varieties are characterized by earliness in grape maturity, ensuring a distribution of

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consumption of fresh grapes, when there are few on the market or imported, large and constant productions, with a high commercial value, between 85 and 95% representing the production of goods, grapes are large, in different colors, (green-yellowish, pruinose) crunchy pulp, franc taste or discrete flavor, having a high alimentary and dietetic value (Doina Damian et al, 2006). The importance of cultivating table grapes varieties comes from the productivity reflected in large productions (over 20 t/ha) and their exploitation in a fresh condition without supplementary expenses for processing, the production expenses being recovered in a shorter time. At the moment, when the competition in all the fields of activity is very acerbic, one of the efficient instruments that determine the competitiveness of the products all over the world is the level of the quality / price ratio. An efficient mechanism for the promotion of a qualitative viticulture in the actual stage is represented by the quality management system of fruits and vegetables GLOBALGAP / EUREPGAP. This system also entails the modernization of the technology for the production and valorization of table grapes in Romania, also taking into consideration the fact that these varieties are cultivated in areas with different favorability depending on the ecosystem conditions

## **MATERIAL AND METHOD**

During the period 2008 -2010 at Viticulture and Vinification Research and Development Center of Iasi was elaborated and experimented an improved technology for the production and valorization of table grapes, Paula and Gelu varieties, by respecting the quality system EUREPGAP for ensuring the traceability and growth of the alimentary safety and consumers' trust in the viticultural products.

The experimental plantations, cultivated with varieties taken into consideration in this study are placed on a cernozomic soil at the planting distance of 2.2 / 1.2 m, semi-high distance, bilateral cordon, system of maintaining the soil that was cultivated, semi-protected culture with safety vine stocks at the basis of the grape vines. The varieties are grafted on the parent stock Berlandieri x Riparia Kober 5BB.

## **RESULTS AND DISCUSSIONS**

Creating an internal control system for producing table grapes, based on the traceability principle for a certain vineyard represents a major request of the quality system EUREPGAP. The main stages passed through within this system were the following: identifying the representative plots and drawing up the inventory file; elaboration of technology specific for the area (vineyard) and to the direction of production, so that the finite product (grapes) shall be considered as obtained in the traceability system; monitoring the application of the production technology and controlling the traceability by drawing up and completing the production files, application files of the annual treatments and of the cropping file; controlling the water quality used at the treatment of phytosanitary control and herbicidation.

In order to establish the authenticity of varieties there were completed the inventory files that consist of: plot number, holder, location, variety, year of foundation, direction of production, planting density, expressed numerically and in percents, number of gaps. The elaboration of the technology implied the drawn up of



the framework technological file for maintaining the viticultural plantations (table 1). The cutting system used within the two varieties was in vine stocks of leaf buds or the portion that produces the fruit, ensuring a charge of 30-35 buds / grape vine, therefore creating normal growth and fructification conditions reflected in quality, but especially in the quality of the crop. In order to ensure an adequate nutrition space for growth, development and normal maturation of grapes, a special attention was assigned to pruning grapes in the summer, which meant the reduction of the number of inflorescences, ensuring 1-2 grapes per branch, the elimination of a part of the inflorescence (upper side and segments), operations which contributed to the growth of grapes. During vegetation there were interventions of thinning out and cutting leaves, ensuring a better aeration of the grape vine, a corresponding lighting of grapes with positive influence upon maturation and of a homogenous color of grapes, implicitly of the commercial quality and value of the studied varieties, recording the cross of the phenologic spectrum in direct correlation with the climatic factors for applying treatments of phytosanitary control and fertilization, data with which was drawn up the production file for variety and plot.

In order to highlight the phytosanitary treatments and herbicidation there was drawn up the application record for the two types of interventions, which consists of: plot number, the pathogenic agent or pest, the modality of application, number of treatment, date of application, surface where it was applied, the manner that was used (commercial labeling), the active substance, the supplier, batch number from the package, the concentration that was used and the applied quantity per ha, the volume of solution used per surface and the number of days that are necessary until the harvesting of grapes. In order to comply with quality conditions required by EUREPGAP system, for performing treatments for maladies and pest control, there were used less aggressive substances, kind to the people and to the environment, as follows: for rust Folpan 80 WDG concentration 0,15%, Ridomil 68 WG 0,25%, Champion 50 WG 0,5%, instant bordolese solution 0,5%; for mildew sulfocalcic solution 2%, Kumulus (80% sulf) 0,3%, Vectra 10 SC 0,025%, Karathane 0,1%; for grey rot Teldor 500 SC 0,1%, Rovral 0,1%. Water quality control used in the technological process consisted of sampling and analyzing water samples at the moment of performing disease and pests control treatments and herbicidation. Analyses were performed by specialized laboratories that issued laboratory reports in which were stated: water provenience (source), sampling date, physical, chemical and microbiological parameters.

Maturation and harvesting of the studied varieties produced during the period August 6th – 20th, being marked by Paula variety, followed by the second variety, Gelu (August 12th – 30th). There were taken some organizational and technical measures for harvesting, with regard to the production evaluation, ensuring the necessary materials, establishing the moment when harvesting began, separately for soils and plots etc.

Also, there was noticed the harvesting date for each variety, grapes quality by marking the contents of sugar, total acidity, as well as other indices that define the qualitative characteristics of a variety (table 2).

Table 1

**FRAMEWORK TECHNOLOGICAL RECORD**  
for maintaining fruitful 1 ha grape vines– average production of 15 000 kg/ha

## Plantation features:

**Slope of land** → 3 %  
**Cultivation system** → semi-protected  
**Planting distance** → 2,2 x 1,2 m  
**No. of grape vines / ha** → 3787

**Gaps** → 0 %  
**Distance** → bilateral cordon  
**Sustaining system** → vine espalier with 5 wires

No. crt.	Activities during the technological flow	MANUAL ACTIVITIES						
		Category of the activity	M.U.	Norm	Consumption z.o.		Volume of activity	Observations
					M.U.	per ha		
0	1	2	3	4	5	6	7	8
1	Prune grapevines in the winter	IV	th. vines	0,20	5,00	18,94	3,787	
2	Remove hills and dig up reserve cords	II	th. vines	0,51	1,96	7,42	3.787	cords are dug out from the safety vine stocks
3	Remove cords resulted from pruning at the alley	I	ha	0,27	3,70	3,7	1,0	
4	Burning cords from the alley	I	ha	1,95	0,51	0,51	1,0	
5	Review espalier and lengthening wires	II	ha	0,30	3,33	3,33	1,0	the fallen beams are anchored and the broken ones are replaced
6	Manufacturing vine props	I	th. pieces	0,60	1,67	2,50	1,5	
7	Distributing vine props	I	th. pieces	1,20	0,83	1,24	1,5	
8	Beat down vine props	II	th. pieces	0,50	2,0	3,0	1,5	
9	Chaining up stalks of vine props, circle and tie them	III	th. vines	0,35	2,86	10,83	3,787	
10	Fixing and cutting branches from grapevines	II	th. vines	0,65	1,54	5,83	3,787	execution and covering hooks are included in the activity
11	Use a large hoe on the line	III	ha	0,350	7,40	7,40	1,0	
12	Guide, weed and tie branches thrice	III	th. vines	0,45	2,22	25,22	6,928	
13	Reducing the number of inflorescences	II	th. vines	0,65	1,54	5,83	3,787	

14	Cutting branches	III	th. vines	0,30	3,3	12,50	3,787	
15	Removing a part of the bunch	II	th. vines	0,60	1,67	6,32	3,787	
16	Preparing solution for sprinkling against pests	IV	th. litres	10,0	0,1	0,6	6,0	the solution is prepared in special reservoirs or directly in the reservoirs of the facilities
17	Hoeing thrice with the hoe on the line	III	ha	0,175	5,71	17,13	3,0	
18	Manually mowing alleys and return areas, thrice	IV	ha	0,2	5,0	3,00	0,6	cutting branches
19	Cutting branches	III	th. vines	0,70	1,43	5,42	3,787	
20	Unleave	I	th. vines	0,83	1,20	4,54	3,787	
21	Harvesting table grapes with large grape berries for internal consume	III	t	0,325	3,08	46,2	15,0	
22	Sorting, chiselling and packing table grapes for internal consume	I	t	0,20	5,0	75,0	15,0	
23	Disembroid cords at the basis	I	th. vines	0,35	2,86	10,83	3,787	
24	Earth the grapevine with 2-4 cords	III	th. vines	0,25	4,0	15,15	3,787	
<b>TOTAL</b>						292,44		

<b>MECHANIC ACTIVITIES</b>						
<b>No. crt.</b>	<b>Activities during the technological flow</b>	<b>M.U.</b>	<b>Volume of activity</b>	<b>Norm</b>	<b>hours/ha</b>	<b>Diesel fuel (L/ha)</b>
1.	Spring furrow + dragging	ha	1,0	3,3	2,42	9,7
2.	Hoeing and dragging twice	ha	2,0	4,7	3,40	11,2
3.	Sprinkle the grapevine with solution every two intervals	ha	1,0	5,7	1,40	4,8
4.	Sprinkle the grapevine with solution with 600- 900 l, 6 times	ha	6,0	2,7	17,77	58,8
5.	Mechanic mow thrice	hours	6,0	8,0	2,00	10,5
6.	Loading and shipping the muck	t	40	2,25	20	100
7.	Deal with the muck	hours	2,0	3,28	2,00	9,0
8.	Autumn furrow	ha	1,0	3,3	2,42	9,7
9.	Shipment materials	hours	16,0	8,0	16,0	48,0
<b>TOTAL</b>					<b>67,41</b>	<b>261,7</b>

Table 2

**Agrobiological attributes of Paula and Gelu varieties achieved within the modernized technology, in comparison with the classical one**

Elemente cercetate	Modernized technology		Classical technology	
	Paula	Gelu	Paula	Gelu
Average weight of the grape, g	264	337	226	302
Weight of 100 grape berries, g	438	480	313	410
Sugars in must, g/L	146	148	129	132
Total acidity, g/L H <sub>2</sub> SO <sub>4</sub>	4,2	2,6	4,6	2,8
Glucoacidimetric index	3,5	5,7	2,8	4,7
Color of epidermis	green-yellowish	blue-violet pruinose	green-yellowish	blue-violet irregular
Core consistency	succulent	crunchy	succulent	crunchy
Taste	discrete flavor	franc	discrete flavor	franc
Detachment force (N)	3,18	1,85	-	-
Cracking force	16,1	5,3	-	-
Keeping quality per grape vine (days)	-	30-35	-	-
Production of grapes - effective/grape vine, kg	6,64	5,7	7,8	6,9
- calculated at ha, t	25,14	21,58	29,5	26,13
Production of goods, %	85	95	78	89

## CONCLUSIONS

1. Modernizing the production technology of table grapes has benefic implications upon alimentary safety and increases consumer's trust in the quality of autochthonous products.

2. Grapes obtained as a result of the application of the modernized technology can easily find an outlet in the European Union, income sources of the manufacturers being therefore much higher.

3. Quality of the obtained product through modernized technology EUREPGAP/GLOBALGAP is definitely superior to the classical one, without implying special financial costs on the part of the viticultural manufacturers.

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# L'INFLUENCE DU SULFITAGE SUR LA FERMENTATION MALOLACTIQUE DES VINS ROUGES DE QUALITÉ DU VIGNOBLE DEALUL BUJORULUI

## INFLUENȚA SULFITĂRII ASUPRA DESFĂȘURĂRII FERMENTAȚIEI MALOLACTICE LA VINURILE ROȘII DE CALITATE DIN PODGORIA DEALUL BUJORULUI

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**Résumé.** Au cours de l'automne 2010, afin de déterminer l'impact du  $SO_2$  sur le déroulement de la fermentation malolactique (FML), dans la cave expérimentale de la SCDVV Bujoru, cinq doses de sulfitage ont été testées sur deux cépages représentatifs du vignoble „Dealul Bujorului”: Cabernet Sauvignon et Fetească neagră. Les résultats obtenus ont mis en évidence le mode comme la dose de sulfitage influence sur la durée totale de la FML, ainsi que sur la période de latence.

**Mots- clé:** acide malique, acide lactique, fermentation malolactique.

**Rezumat.** În toamna anului 2010, pentru a urmări impactul  $SO_2$  asupra desfășurării fermentației malolactice, în crama experimentală a SCDVV Bujoru, au fost testate cinci nivele de sulfitare, pe două soiuri reprezentative pentru podgoria „Dealul Bujorului”: Cabernet Sauvignon și Fetească neagră. Rezultatele obținute au scos în evidență modul cum nivelul de sulfitare al mustuielii influențează durata totală a FML, precum și durata de latență a acesteia.

**Cuvinte cheie:** acid malic, acid lactic, fermentație malolactică.

### INTRODUCTION

Étape technologique indispensable, la fermentation malolactique modifie profondément la composition et la qualité des vins rouges (Vivas N., 2007). Étant influencée par de nombreux paramètres, son déclenchement peut intervenir à différents moments. L'utilisation de bactéries malolactiques, type *Oenococcus*, a résolu une grande partie des problèmes liés à son déclenchement et à son déroulement (Bateyron Lucile et colab., 2002; Bateyron Lucile et colab., 2008). Cependant, les vinificateurs continuent à faire face à de nombreuses difficultés dans la maîtrise de ce processus très utile à l'obtention de vins rouges de qualité supérieure. Dans l'objectif de trouver un moyen efficace d'optimiser le déclenchement et le déroulement de la FML, le SCDVV Bujoru a étudié les principaux facteurs technologiques, qui pourraient influencer cette étape. Par cette étude, nous souhaitons présenter l'influence majeure du sulfitage initial du marc sur la FML des vins rouges.

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## MATÉRIEL ET MÉTHODE

Les recherches ont été réalisées au cours de l'automne 2010, sur deux cépages: Cabernet Sauvignon et Fetească neagră. Deux protocoles ont été étudiés: la FML spontanée et la FML dirigée par l'inoculation de bactéries lactiques commerciales. Les raisins de ces deux cépages ont été vinifiés en suivant un processus standard, dans la cave expérimentale de SCDVV Bujoru. L'inoculum a été implanté après l'écoulage (densité 1,01 – 1,015) avec Biolact Acclimée BM, 10 mg/L. La FML a été conduite dans des bouteilles de 1,5 L, à 20°C. À la fin de chaque étape, les analyses suivantes ont été effectuées: sucres réducteurs, alcool, acidité totale, acidité volatile, SO<sub>2</sub> total, SO<sub>2</sub> libre, pH, acid malique, acid lactique. Le suivi de la FML a été fait par dosage enzymatique de l'acid malique, tous les 3 jours. Les variantes expérimentées sont: V<sub>1</sub> - 0 mg/L SO<sub>2</sub>, V<sub>2</sub> - 30 mg/L SO<sub>2</sub>, V<sub>3</sub> - 50 mg/L SO<sub>2</sub>, V<sub>4</sub> - 80 mg/L SO<sub>2</sub>, V<sub>5</sub> - 100 mg/L SO<sub>2</sub>.

## RÉSULTATS ET DISCUSSIONS

En analysant les principaux paramètres physico-chimiques des mouts (tableau 1), nous constatons qu'ils existent des conditions favorables au déclenchement de la FML, qui apparaissent dans la majorité des variantes étudiées: un potentiel alcoolique autour de 13 % vol., un pH entre 3,39 et 3,74 et une concentration en acid malique initiale entre 1,02 et 2,35 g/L. Le seul facteur limitant est le niveau de sulfitage du marc, qui en fonction du protocole, varie entre 0 et 100 mg/L.

Tableau 1

Caractéristiques analytiques des mouts

Cépage	Variante	Sucre, g/L	Acidité totale, g/L H <sub>2</sub> SO <sub>4</sub>	SO <sub>2</sub> total, mg/L	SO <sub>2</sub> libre, mg/L	pH	Acid malique, g/L
Cabernet-Sauvignon	V <sub>1</sub>	212,0	4,55	-	-	3,40	2,35
	V <sub>2</sub>	212,0	4,56	30,0	3,2	3,41	2,35
	V <sub>3</sub>	215,0	4,56	50,0	16,0	3,39	2,35
	V <sub>4</sub>	212,0	4,55	80,0	35,2	3,39	2,35
	V <sub>5</sub>	212,0	4,55	100,0	48,0	3,39	2,35
Fetească-neagră	V <sub>1</sub>	223,0	3,58	-	-	3,73	1,02
	V <sub>2</sub>	226,0	3,58	30,0	9,6	3,74	1,02
	V <sub>3</sub>	226,0	3,58	50,0	12,6	3,74	1,02
	V <sub>4</sub>	223,0	3,61	80,0	22,4	3,73	1,02
	V <sub>5</sub>	223,0	3,58	100,0	38,4	3,73	1,02

Les principales caractéristiques des vins, au moment de l'écoulage sont présentées dans le tableau 2. L'étude des résultats obtenus permet de constater une diminution de l'acidité totale, suivie d'une précipitation des sels de tartre au cours de la fermentation alcoolique et de la dégradation d'une partie de l'acid malique par les levures *Saccharomycetaceae*. Il est à noter les quantités importantes de SO<sub>2</sub> total se retrouvant dans les vins à la fin de la fermentation alcoolique.

Tableau 2

## Analyse chimique des vins à l'écoulage

Cépage	Variante	Alcool, % vol.	Sucres réduct, g/L	Acid.totale, g/L H <sub>2</sub> SO <sub>4</sub>	Acid volatile, g/L acid acétique	SO <sub>2</sub> total, mg/L	SO <sub>2</sub> libre, mg/L	pH	Acid maliq, g/L	Acid lactiq, g/L
Cabernet-Sauvignon	V <sub>1</sub>	12,50	3,00	4,31	0,44	15,5	-	3,38	2,10	0,12
	V <sub>2</sub>	12,40	4,50	4,32	0,34	22,0	-	3,37	2,10	0,15
	V <sub>3</sub>	12,40	4,50	4,34	0,33	30,4	9,60	3,35	2,20	0,14
	V <sub>4</sub>	12,30	6,50	4,35	0,33	51,6	12,80	3,33	2,20	0,12
	V <sub>5</sub>	12,20	8,00	4,35	0,31	62,8	15,10	3,31	2,10	0,13
Fetească-neagră	V <sub>1</sub>	13,10	4,00	3,45	0,42	15,0	-	3,68	1,00	0,21
	V <sub>2</sub>	13,00	5,50	3,46	0,39	20,8	-	3,67	0,90	0,22
	V <sub>3</sub>	13,00	6,00	3,47	0,36	29,0	9,60	3,67	0,90	0,21
	V <sub>4</sub>	12,90	7,00	3,47	0,36	49,8	12,10	3,67	0,90	0,25
	V <sub>5</sub>	12,80	9,00	3,49	0,33	60,8	14,90	3,64	0,90	0,20

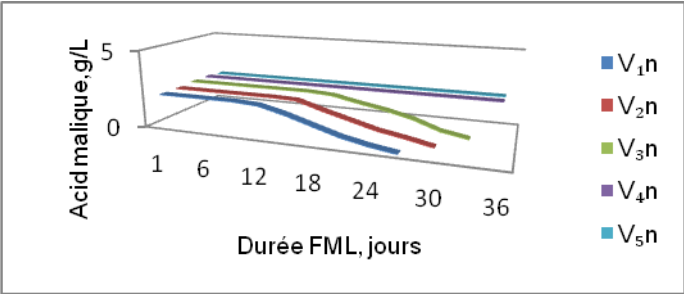
Tableau 3

## Analyse chimique des vins après la FML

Cépage	Variante	Acool, %. vol.	Sucres réduct, g/L	Acid.totale, g/L H <sub>2</sub> SO <sub>4</sub>	Acid volatile, g/L acid acétique	SO <sub>2</sub> total, mg/L	SO <sub>2</sub> libre, mg/L	pH	Acid maliq, g/L	Acid lactiq, g/L
Cabernet Sauvignon	V <sub>1n</sub>	12,50	-	3,52	0,49	15,0	-	3,53	0,15	1,42
	V <sub>2n</sub>	12,50	-	3,54	0,45	20,0	-	3,52	0,15	1,45
	V <sub>3n</sub>	12,60	-	3,54	0,42	30,0	9,50	3,50	0,20	1,48
	V <sub>4n</sub>	12,50	-	4,32	0,35	50,6	12,70	3,33	2,10	0,18
	V <sub>5n</sub>	12,40	1,50	4,35	0,32	61,8	15,00	3,31	2,10	0,13
	V <sub>1i</sub>	12,50	-	3,47	0,46	15,0	-	3,55	-	1,52
	V <sub>2i</sub>	12,50	-	3,54	0,45	20,0	-	3,53	0,15	1,45
	V <sub>3i</sub>	12,50	-	3,52	0,43	30,2	9,40	3,51	0,15	1,51
	V <sub>4i</sub>	12,60	-	3,55	0,42	50,4	12,60	3,48	0,20	1,46
	V <sub>5i</sub>	12,50	2,00	4,35	0,33	62,0	14,90	3,31	2,10	0,13
Feteascăneagră	V <sub>1n</sub>	13,20	-	3,05	0,53	15,0	-	3,83	-	0,88
	V <sub>2n</sub>	13,30	-	3,14	0,45	19,5	-	3,81	-	0,82
	V <sub>3n</sub>	13,30	-	3,17	0,42	28,0	6,40	3,80	0,15	0,71
	V <sub>4n</sub>	13,20	-	3,47	0,36	48,8	12,00	3,67	0,90	0,25
	V <sub>5n</sub>	13,20	1,5	3,49	0,36	60,5	14,60	3,64	0,90	0,20
	V <sub>1i</sub>	13,20	-	3,00	0,56	15,0	-	3,85	-	0,88
	V <sub>2i</sub>	13,30	-	3,12	0,47	19,6	-	3,85	-	0,82
	V <sub>3i</sub>	13,30	-	3,17	0,45	27,5	6,20	3,86	0,15	0,71
	V <sub>4i</sub>	13,20	-	3,17	0,45	48,6	11,90	3,84	0,15	0,75
	V <sub>5i</sub>	13,20	-	3,21	0,44	60,0	14,20	3,81	0,20	0,67

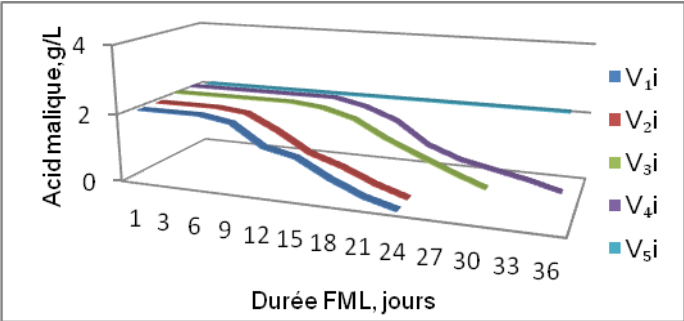


La cinétique de la fermentation malolactique est grandement influencée par le niveau du sulfitage du marc (fig. 1, 2, 3, 4). Plus le niveau de sulfitage de la vendange est significatif, plus la durée de la fermentation malolactique sera longue. Cela confirme la sensibilité des bactéries lactique au SO<sub>2</sub>, même sous forme combinée.

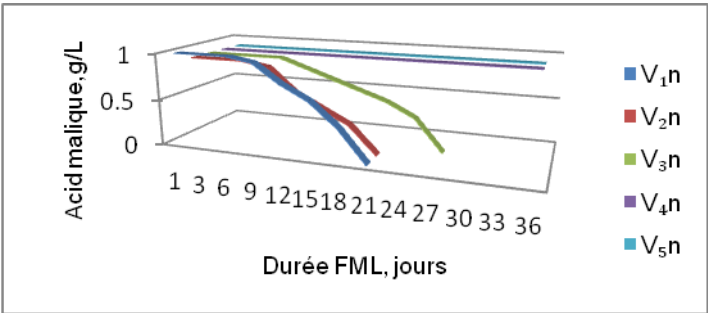


**Fig. 1** – Déroulement de la FML spontanée au cépage Cabernet Sauvignon

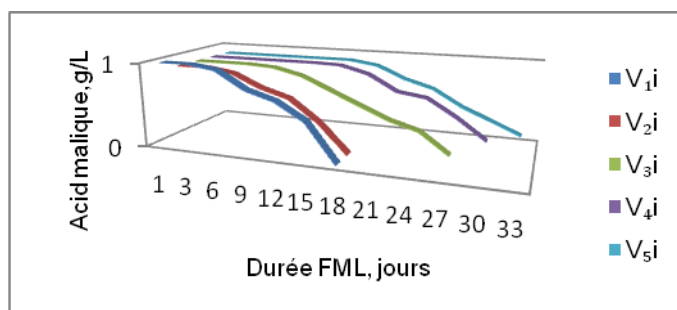
Les valeurs plus grandes que 50 mg/L (V<sub>4</sub> și V<sub>5</sub>) inhibe l'enclenchement de la fermentation malolactique pour les variantes non inoculées avec des bactéries lactiques commerciales, autant pour le Cabernet Sauvignon que pour la Feteasca neagră.



**Fig. 2** – Déroulement de la FML dirigée au cépage Cabernet Sauvignon



**Fig. 3** – Déroulement de la FML spontanée au cépage Fetească neagră



**Fig. 4** – Déroulement de la FML dirigée au cépage Fetească neagră

La durée de latence de la FML est corrélée à la dose de  $\text{SO}_2$  utilisée lors de la macération, aux caractéristiques du vin et à la capacité de croissance des *Oenococcus oeni*. La durée de latence de la Fetească neagră, à la même dose, est plus courte de 3-6 jours que le Cabernet Sauvignon. D'autres différences sont à noter entre les variantes inoculées ou pas. Dans les cas d'utilisation de levain de bactéries lactiques, la FML a lieu, quelles soient les conditions, même à des doses de sulfite comprises entre 80 – 100 mg/L. La fermentation malolactique est suivie d'une chute de l'acidité totale comprise entre 0,37-1,08 g/L  $\text{H}_2\text{SO}_4$  une augmentation du pH de 0,06-0,15 unités et un accroissement de l'acidité volatile de 0,02-0,11 g/L acid acétique (tableau 3).

## CONCLUSIONS

1. Le  $\text{SO}_2$  apporte au marc, par sa capacité à bloquer le développement des bactéries lactiques, influencer directement la cinétique de la fermentation malolactique. Plus la dose de  $\text{SO}_2$  sera élevée, plus le déclenchement de la FML sera difficile et la durée totale du processus plus longue;
2. Les doses de  $\text{SO}_2$  supérieures à 50 mg/L empêchent le déclenchement et le bon déroulement de la fermentation malolactique des vins de Cabernet Sauvignon et de Fetească neagră, non inoculés par des levains;
3. L'utilisation de levain de bactéries lactiques raccourcit la période de latence et la durée totale de la FML des vins rouges du vignoble „Dealul Bujorului” de 3 à 6 jours.

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# ASPECTS REGARDING THE TECHNOLOGY AND CHARACTERISTICS OF BLANC DE NOIR WINES OBTAINED FROM BĂBEASCĂ NEAGRĂ BLACK GRAPES VARIETY

## ASPECTE PRIVIND TEHNOLOGIA ȘI CARACTERISTICILE VINURILOR BLANC DE NOIR OBTINUTE DIN SOIUL BĂBEASCĂ NEAGRĂ

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**Abstract.** White wines are generally obtained from white grapes variety. There are certain situations when white wines may be obtained from the uncolored must of black grapes, wines known under the French name of blanc de noir (white from black). Such wines are used first of all as raw materials for the production of sparkling wines but they may also be characterized as wines *stricto sensu*. In this study, we obtained wines of blanc de noir type from the black grapes of Băbească neagră variety, harvested from certain vineyards of Moldavia. We focused on the turning to good use of the oenological potential of this variety for the production of blanc de noir wines since in the conditions of year 2010 Băbească neagră had a relatively high content of sugars and an acidity proper for the obtaining of high quality white wines characterized by freshness and fragrance. The physical-chemical characteristics of the obtained wines highlight the adequacy of obtaining such wines from Băbească neagră variety.

**Key words:** Băbească neagră, blanc de noir wines, oenological potential.

**Rezumat.** Vinurile albe se obțin, în principiu, din soiuri cu struguri albi. Există și unele situații când vinurile albe se pot obține din mustul necolorat al strugurilor negri, vinuri cunoscute sub termenul francez blanc de noir (alb din negru). Asemenea vinuri sunt utilizate în primul rând ca materii prime pentru producerea vinurilor spumante, dar pot fi și comercializate ca vinuri *stricto sensu*. În prezentul studiu s-au realizat vinuri de tip blanc de noir din strugurii negri ai soiului Băbească neagră, recoltați din unele podgorii ale Molovei. Valorificarea potențialului oenologic al soiului în direcția elaborării vinurilor de tip blanc de noir s-a urmărit deoarece în condițiile anului 2010 strugurii soiului Băbească neagră au avut un conținut relativ mare în zaharuri și o aciditate corespunzătoare obținerii vinurilor albe de calitate înzestrate cu multă prospețime și fructuozitate. Caracteristicile fizico-chimice ale vinurilor obținute reliefează pretabilitatea obținerii acestor tipuri de vinuri din soiul Băbească neagră.

**Cuvinte cheie:** Băbească neagră, vinuri blanc de noir, potențial oenologic.

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## INTRODUCTION

Băbească neagră variety, an old Romanian variety occupying the highest surface of all autochthonous black variety may contribute to the improvement of the wine assortment in a certain viticultural region through the multiple possibilities of turning grapes to good use (Cotea Victoria, Cotea V.V., 1996). For this purpose, depending on the harvest year and the production purposes, we may obtain a wide range of wines (white, rosé and red) from the grapes of this variety; moreover, due to the moderate content of alcohol and high acidity, grapes may represent an excellent raw material for sparkling wines (Cotea D.V. et al., 2000).

The processing of the black grapes of Băbească neagră variety to obtain wines of *blanc de noir* type represents a solution when grapes fail to accumulate certain years a sufficient quantity of colour substances in order to obtain high quality red wines, or the grapes were attacked in a high percentage by the grey mold or when we want to diversify the wine assortment through this production direction.

## MATERIAL AND METHOD

In the elaboration of this study we used black grapes from the autochthonous Băbească neagră variety, the 2010 harvest, from the vineyards of Iași, Dealu-Bujorului, Nicorești, Odobești and Panciu. Harvesting was made manually and the grapes were put in wooden cases. The grapes were then transported and processed at the pilot Station for vinification of the Faculty of Horticulture, Iași. Table 1 presents the compositional characteristics of the grapes during harvest.

Table 1

Compositional characteristics of grapes at harvest

No.	Vineyard	Harvest date	Reductive sugars (g/L)L	Total acidity g/L C <sub>4</sub> H <sub>6</sub> O <sub>6</sub>
1	Iași	23.09.2010	204,24	8,74
2	Dealul Bujorului	16.09.2010	198,35	9,15
3	Nicorești	16.09.2010	181,62	10,41
4	Odobești	16.09.2010	201,82	9,03
5	Panciu	17.09.2010	214,11	8,62

The experiment was carried out as follows: the whole grapes without being mashed or detached from bunches, were pressed by means of a hydraulic press, and the working pressure was limited to 2 atm. in order not to improve the wine with phenolic compounds. We determined total acidity and reducing sugars for the freshly obtained must.

To avoid the improvement with tannins and polyphenoloxidases (Cotea D.V. et al., 2009), only the must obtained without pressing the grapes and the one from the first pressing was inoculated with selected yeasts *Saccharomyces cerevisiae*, in proportion of 20 g/100 kg (without administration of pectolytic enzymes) and then transferred into stainless steel containers where it finished its alcoholic fermentation (Pomohaci N. et al., 2000). We took measures during the

alcoholic fermentation so that temperature should not exceed 20°C. the process of malolactic fermentation did not take place since these types of wines must meet the sensorial characteristic of white wines (Cotea D.V., 1985). Wines were improved and subsequently bottled.

We determined the alcoholic concentration, the reducing sugars, the relative density, total acidity, volatile acidity, pH, non-reducing extract, total dry extract for the variants of wines obtained. We also calculated the values of the chromatic parameters, the content in phenolic compounds and the anthocian content.

The physical-chemical tests were run on the basis of the methods indicated by the international and state standards and the specialized literature as well.

## RESULTS AND DISCUSSIONS

The main composition characteristics of the wines obtained from Băbească neagră variety are given in table 2. The alcoholic concentration of the analysed wines ranges between 10.54% vol. (Nicorești vineyard) and 12.41 (Panciu vineyard). As for wines' content in reducing sugars, we may notice that all analysed wines are dry (max. 4g/L).

The non-reducing extract expressed in g/L had the following values: the wine obtained from grapes harvested from Nicorești vineyard had the lowest value of 18.56 g/L, and the wine obtained from grapes harvested from Panciu vineyard had the highest value of 22.05 g/L. Total acidity of wines, expressed in g/L  $C_4H_6O_6$ , had different values depending on the maturation stage of grapes at the moment of harvesting; thus, *blanc de noir* wine harvested from Nicorești vineyard registered the highest value of 8.07 g/L, whereas the lowest value of 6.43 g/L was registered by the wine obtained from grapes harvested from Panciu vineyard.

As for the wines' pH, this varied between 3.11 for the wine obtained from grapes harvested from Nicorești vineyard and 3.49 for the wine obtained from grapes harvested from Panciu vineyard.

As for the wines' content in anthocians, we may notice that this ranged between 22.71 mg/L (Nicorești vineyard) and 29.38 mg/L (Iași vineyard) (tab. 3).

Table 3

**Anthocyan content in blanc de noir wines**

Nr. crt.	Vineyard	Anthocyan (mg/L)
1	Dealul Bujorului	28,71
2	Iași	29,38
3	Nicorești	22,71
4	Odobești	26,93
5	Panciu	28,48

Table 2

Compositional characteristics of blanc de noir wines obtained from the black grapes of Romanian variety Băbească neagră

No.	Vineyard	Alcohol conc. (% vol.)	Reductive sugars (g/L)	Relative density at 20°C	Total dry extract (g/L)	Non reductive extract (g/L)	Total acidity g/L $C_4H_6O_6$	Volatile acidity g/L $C_2H_4O_2$	pH	SO <sub>2</sub> free mg/L	SO <sub>2</sub> total mg/L
1	Dealul-Bujorului	11,42	1,96	0,9930	21,1	19,14	7,51	0,35	3,32	20,61	62,21
2	Iași	12,15	1,15	0,9928	22,9	21,75	6,57	0,29	3,42	22,40	69,21
3	Nicorești	10,54	1,34	0,9936	20,1	18,76	8,07	0,20	3,11	20,15	62,37
4	Odobești	11,98	3,14	0,9929	22,70	19,56	7,51	0,26	3,38	24,69	72,59
5	Panciu	12,41	1,65	0,9929	23,7	22,05	6,43	0,36	3,49	19,22	57,71

Table 5

Values of the chromatic parameters of blanc de noir wines obtained from Băbească neagră

No.	Vineyard	Clarity L	Color coordinates		Saturation C	Tonality H	Luminosity	Hue
			a red(+) - green(-)	b yellow(+) - blue(-)				
1	Dealul Bujorului	96,58	-0,79	8,04	11,25	63,22	0,34	1,29
2	Iași	96,39	-0,82	4,42	2,55	71,86	0,33	1,32
3	Nicorești	98,04	-0,64	6,95	7,22	74,18	0,28	1,45
4	Odobești	96,88	-0,76	2,11	4,72	71,45	0,31	1,35
5	Panciu	95,78	-0,94	7,05	9,28	79,47	0,47	1,09

In terms of wines' content in phenolic compounds, we may see that the content in anthocians had the minimal value of 174.53 mg/L (Nicorești vineyard), and the maximal value of 228.62 mg/L (Iași vineyard) (tab. 4).

By comparing the vineyards, we may conclude, in general, that *blanc de noir* wines obtained from the black grapes of Băbească neagră variety harvested from Iași vineyard had the highest values in terms of the phenolic compounds. This aspect shows the influence of the stage of phenolic maturation (the grapes from Iasi vineyard were harvested one week later as compared to the other vineyards) when harvesting the grapes over the content of total phenolic compounds of the obtained wines.

Table 4

**Phenolic compounds content in blanc de noir wines**

Nr crt.	Vineyard	Total phenolic compounds (mg/L)	D <sub>280</sub>	I <sub>FC</sub>
1	Dealul Bujorului	55,39	5,12	3,68
2	Iași	61,62	4,89	3,76
3	Nicorești	49,84	4,91	3,51
4	Odohești	52,15	6,11	4,36
5	Panciu	58,73	6,25	4,87

In table 5 we present the values of the chromatic parameters for the wines obtained by *blanc de noir* technology.

Among the colour components measured through CIE Lab 76 method, L clarity and the values of modifications of *a* and *b* parameters were more important. L clarity characterizes the visual aspect more or less "bright" of wine colour and it may range between zero for a black-opaque sample and 100 for transparent colorless samples. More precisely, it varies between 95.78 (Panciu vineyard) and 98.04 (Nicorești vineyard).

"a" red-green colour component (Tab. 5) represents the coordinate of complementary red-green colours and, as it is natural, it has negative values for the white wines (the value is -0.64 for the wine harvested from Nicorești vineyard) where the green hues are preponderant as compared to the red ones.

"b" yellow-blue colour component represents the coordinate of complementary yellow-blue colours. In wines, the values of this parameter are usually positive since the yellow hues are preponderant as compared to the blue ones, the minimal value of 2.11 being registered by the wine obtained from grapes harvested from Odohești vineyard and the maximal value being of 8.04 being registered by the wine obtained from grapes harvested from Dealul-Bujorului vineyard.

## CONCLUSIONS

1. *Blanc de noir* wines obtained from the harvest of 2010 might be classified into the category of DOC – CMD wines (wine having a controlled

origin denomination – grapes harvested at full maturity), except the ones obtained from the grapes harvested from Nicorești vineyard which may be classified into the category of wines with geographical indication (IG) – Dealurile Moldovei.

2. The most balanced wines were obtained from the grapes of Băbească neagră variety harvested from Iași vineyard.

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# ASPECTS REGARDING THE INFLUENCE OF GELATIN TREATMENT ON THE PHYSICAL-CHEMICAL COMPOSITION OF WINES PRODUCED IN THE COTNARI VINEYARD

## ASPECTE PRIVIND INFLUENȚA TRATAMENTULUI CU GELATINĂ ASUPRA COMPOZIȚIEI FIZICO-CHIMICE A VINURILOR DE COTNARI

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**Abstract.** *This paper presents data on the influence of gelatin on the physical-chemical composition of Cotnari wines evidenced by: main compositional characteristics (alcoholic concentration, reducing sugars content, total acidity, pH, relative density, total dry extract, non-reducing extract, free and total sulphur dioxide), index of total polyphenols, Folin-Ciocalteu index and chromatic characteristics. For this study, white wines made from Francusa, Feteasca alba, Grasa de Cotnari grape varieties from Cotnari vineyard.*

**Key words:** Cotnari, gelatin, white wine

**Rezumat.** *În această lucrare sunt prezentate date referitoare la influența tratamentului cu gelatină asupra compoziției fizico-chimice a vinurilor de Cotnari evidențiată prin: principalele caracteristici de compoziție (concentrația alcoolică, conținutul în zaharuri reducătoare, aciditatea totală, pH-ul, densitatea relativă, extractul sec total, extractul nereducător, dioxidul de sulf liber și total), indicele de polifenoli totali, indicele Folin-Ciocalteu și caracteristicile cromatice. Pentru acest studiu s-au utilizat vinuri albe obținute din soiurile: Frâncușă, Fetească albă, Grasă de Cotnari și Tămâioasă românească din podgoria Cotnari.*

**Cuvinte cheie:** Cotnari, gelatină, vinuri albe

### INTRODUCTION

Gluing with gelatine is a very old practice. In time, it has been tried to replace it with other techniques of clearing, such as filtering and centrifugation. It is true that, from the point of view of clearing the wines, these latest techniques are irreplaceable. Yet, during the latest years, the specialists rediscover the gluing, since it has been noticed that it is not only a simple procedure of clearing.

Apart from clearing, the gluing with gelatine has the property to involve momentarily soluble substances, however with the risk to precipitate also the

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unclear form subsequently, phenomenon that can be extremely serious when it appears in the bottle. These substances are generically called “colloids.” Even though these molecules have high molecular weight, they are not eliminated by filters (Barbara Scotti, Poinsaut P, 1997).

Gluing with gelatine also has the property to react with the tannins in the wine and thus influence positively the taste, by eliminating the substances responsible by astringent and bitter tastes (Cotea V. D. et al., 2009).

By this study, it was followed the way the treatment with gelatine influences the physical and chemical composition of the white wines obtained from the varieties Francusa, Feteasca white, Grasa de Cotnari and Romanian Tamaioasa in the Cotnari vineyard.

## **MATERIAL AND METHOD**

This study was done on a variety of four white wines produced from the Cotnari vineyard, namely: Francusa (dry wine), Feteasca white (semisweet wine), Grasa de Cotnari (semisweet wine) and Romanian Tamaioasa (semisweet wine). The treatment with gelatine was done in industrial regime, being necessary a previous enrichment of the wine with oenological tannin, knowing the fact that white wines are poor in tannin. Thus, firstly the tannin was introduced (Tanvin W1) in quantity of 8 g/hL, dispersed in the white in proportion of 1:10, and after homogenization, it was also added the gelatine in quantity of 12 g/hL. After 21 days, it was separated the deposit formed by filtering, afterwards the wines were analyzed physically and chemically.

In the variants thus obtained, it was analyzed the main physical and chemical parameters (based on the methods indicated in the international and national standards, and also in the specialty literature): the alcoholic concentration, the content in reducing sugars (R.S.), volatile acidity (V.A.), total acidity (T.A.), pH, relative density, total dry extract (TDE), non-reducing extract (NE), dioxide of sulphur free and total. Also, it was calculated the index of total poly phenols ( $D_{280}$ ), index Folin-Ciocalteu (IFC) and chromatic parameters.

The chromatic parameters were calculated according to the methods CIE Lab 76, according to the spectre of transmittance recorded for each wine. The latter was obtained with a spectre photometer SPECORD S200 coupled with a computer. Thus, it was realized the automatic numbering and recording of the spectre of transmittance in a file. To minimize the errors of analysis, at determining the transmittances it was used some vats with optic itinerary, appropriate for each wine sample, 0.2 and 1 cm respectively. The spectres were treated with a programme realized in the frame of the research team, in view of obtaining the chromatic parameters (**L, a, b, C, H**), luminosity and hue. The analysis of the physical and chemical parameters of the variants taking for study was done in the Laboratory of Oenology of the University of Agricultural Sciences and Veterinary Medicine “Ion Ionescu de la Brad” of Iasi.

## **RESULTS AND DISCUSSIONS**

The main physical and chemical characteristics of the witness variants, as well as the ones obtained following the treatment with gelatine, are presented in table 1.

Table 1

## Influence of gelatin on physicochemical characteristics of wines Cotnari

Variety	Var.	Alc. % vol.	Z.R. g/L	A.V. g/L	A.T. g/L	pH	D. rel.	EST g/L	EN g/L	SO <sub>2</sub> mg/L	
										free	Total
Francusa	Witness	11,90	2,10	0,22	7,12	3,47	0,9934	23,70	21,60	37	115
	Treat	11,85	2,08	0,20	7,08	3,45	0,9934	23,50	21,42	33	108
Feteasca white	Witness	11,75	28,00	0,28	7,27	3,35	1,0038	50,10	22,10	43	164
	Treat	11,64	28,00	0,30	7,42	3,33	1,0036	49,40	21,40	31	149
Grasa de Cotnari	Witness	11,72	43,00	0,35	7,35	3,30	1,0112	69,40	26,40	47	149
	Treat	11,74	43,00	0,32	7,57	3,28	1,0110	68,90	25,90	25	143
Romanian Tamaioasa	Witness	11,65	64,20	0,32	7,35	3,30	1,0189	89,10	24,90	46	197
	Treat	11,82	64,20	0,30	7,50	3,26	1,0188	89,40	25,20	44	189

Table 2

## Influence of gelatin on total polyphenol content (IPT) and anthocyanins (IFC) in wines Cotnari

Variety	Var.	A280	Total phenol g ac. galic/L	A750	IPT/ IFC	IFC g/L ac galic	$\Delta$ IFC treat/ witness %	IPT g/L ac galic	$\Delta$ IPT treat/ Witness %
Francusa	Witness	3,4994	105,68	3,1305	1,12	4,14	-	0,106	-
	Treat	3,3677	101,81	3,0165	1,12	3,99	-3,64	0,102	-3,66
Feteasca white	Witness	3,423	103,44	3,516	0,97	4,65	-	0,103	-
	Treat	3,4803	105,12	3,3325	1,04	4,41	-5,22	0,105	1,62
Grasa de Cotnari	Witness	3,494	105,52	2,4164	1,45	3,20	-	0,106	-
	Treat	3,5389	106,84	2,3296	1,52	3,08	-3,59	0,107	1,25
Romanian Tamaioasa	Witness	3,5541	107,29	3,1049	1,14	4,11	-	0,107	-
	Treat	3,457	104,44	3,4938	0,99	4,62	12,52	0,104	-2,66

Following the analysis of the information obtained, it has been noticed that the treatment with gelatine did not influence significantly the main physical and chemical indexes. Thus, the alcoholic concentration suffered slight diminishing in the varieties Francusa (11.85% vol. comparing with the witness with 11.90% vol.) and Feteasca white (11.75% vol. comparing with the witness that recorded the value of 11.64% vol.).

In the other two varieties, the alcoholic concentration recorded an increase, namely: 11.74% vol. comparing with the witness variant (11.72% vol.) in the variety Grasa de Cotnari and 11.82% vol. comparing with the witness (11.65% vol.) in the variety Romanian Tamaioasa.

Regarding the content of reducing sugars, it has been noticed that it did not suffer any modifications, except for the variety Francusa, where it was noticed a minor decrease (2.08 g/L comparing with the witness sample with 2.10 g/L). The treatment of wine with gelatine did not influence significantly the values of volatile acidity and the pH.

Another parameter taking in the study was the total acidity, which suffered the biggest variations, respectively an increase of its values, in the varieties Feteasca white, Grasa de Cotnari and Romanian Tamaioasa and a decrease in the variety Francusa. The non-reducing extract recorded a minimum of 21.40 g/L in the variety Feteasca white and the maximum value in the variety Grasa de Cotnari (25.90 g/L). The values of the content of phenol compounds in the variants studied are presented in table 2.

The content in phenol compounds is expressed in this case, by characteristic indexes:  $D_{280}$  and  $F_C$ .

The index  $D_{280}$  expresses the content in total phenol compounds (phenol acids, tanning and colouring substances) and it is expressed by the optical density or the absorbance measured for the wavelength of 280 nm. The lowest values were recorded in the variety Francusa (0.102 g/L gallic acid), and the maximum value in the variety Grasa de Cotnari (0.102 g/L gallic acid). This fact is explained by the fact that in the variety Grasa de Cotnari it is necessary a slight pre-fermentative maceration in the process of wine making and thus, a part of the poly phenols from the grapes migrated in the wine.

The index Folin-Ciocalteu ( $F_C$ ) is specific only to the phenol compounds with reducing characteristics. The values of this index had minimum value at the variety Grasa de Cotnari (3.08 g/L gallic acid) and maximum one at the variety Romanian Tamaioasa (4.62 g/L gallic acid). The influence of the treatment with gelatine on the parameters of colour in the Cotnari wines is presented in table 3.

Table 3

## Influence of gelatin on the color parameters of wines Cotnari

Variety	Var.	Clari-ty L	Color coordonates		Satu- ration C	Tone H	Brightness	Tempt	$\Delta E$	$\Delta H$
			a	b						
Francusa	Witness	98,7	-0,33	4,45	4,46	-85,66	0,09	3,68	-	-
	Treat	98,8	-0,45	3,97	3,99	-83,5	0,08	3,75	0,5	0,14
Feteasca white	Witness	97	-0,43	6,86	6,87	-86,4	0,17	2,81	-	-
	Treat	97,3	-0,74	5,71	5,76	-82,55	0,15	2,97	1,23	0,44
Grasa de Cotnari	Witness	97,7	-0,56	7,59	7,61	-85,77	0,15	3,57	-	-
	Treat	97,8	-0,48	7,07	7,08	-86,07	0,14	3,49	0,54	0,03
Romanian Tamaioasa	Witness	97,5	-0,62	8,88	8,9	-85,95	0,17	3,66	-	-
	Treat	98,4	-0,95	6,5	6,57	-81,63	0,12	4,54	2,57	0,6

The chromatic characteristics of the samples studied are expressed by luminosity (psychometric clarity) **L**, colour coordinates **a** and **b**, chromaticity (chrome or colour saturation) **C** and tonality **H**. It was noticed that parameter **L** had an increase at all the four varieties taken in the study, this fact being due to the better clarity of the wine after the treatment with gelatine. The values of the parameter **a**, were diminished, reflecting obviously the preponderance of the green tonalities comparing with the red ones.

The chromatic parameter **b**, situated on the coordinate of the colours blue-yellow, presents a similar evolution to the one of the parameter **a**. The chromaticity **C** of the samples analysed, being calculated based on the chromatic parameters **a** and **b** corresponding to each wine, presents decreasing values after the treatment with gelatine.

## CONCLUSIONS

The treatment with gelatine proved to have great importance in the process of wine making, assuring clear wines without influencing negatively the other characteristics of the physical and chemical composition.

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# TANNIN CORRECTION USED FOR OBTAINING WINES FROM IAȘI VINEYARD

## CORECȚIA CONȚINUTULUI DE TANIN UTILIZATĂ LA OBȚINEREA VINURILOR DIN PODGORIA IAȘI

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**Abstract.** Tannins have an important role in defining wines quality. They are responsible for astringency, slightly bitter taste and phenolate character of the wine. The tannin give the stability and the antioxidant activity of wine. If their quantity is too low, the wine is disharmonious, vulnerable to micro-organisms, low resistance storage. The corrections with tannins are often used to obtain white wines and red wines too. In this study the tannin it has been added to the must and wine at the Aligote variety. After applying these corrections it have been made a series of determinations such as: physical-chemical parameters, IFC, D280, Cielab, total tannins by Bate-Smith method with methyl cellulose, to see the influence of these corrections on the existing quantity value of tannin in wines.

**Keywords:** tannins, phenolic compounds, astringency;

**Rezumat.** Taninurile au un rol important în definirea calității vinurilor. Ele sunt responsabile de astringență, gustul ușor amar și caracterul fenolat al vinului, conferind stabilitate și activitate antioxidantă. Insuficiența lor face ca vinul să fie neharmonios, vulnerabil la microorganism și slab rezistent la păstrare. Corecțiile de compoziție cu taninuri sunt frecvent utilizate atât la obținerea vinurilor albe, dar și cele roșii. În cadrul acestui studiu s-au realizat adaosuri de taninuri la vinuri albe atât la must cât și la vinul din soiul Aligote. După aplicarea acestor corecții s-au efectuat o serie de determinări cum sunt: parametri fizico-chimici, IFC, D280, Cielab, determinarea cantității totale de tannin prin metoda Bate-Smith cu metilceluloză, pentru a vizualiza influența acestor corecții și valoarea cantitativă de tannin existent în vinuri.

**Cuvinte cheie:** tanin, compuși fenolici, astringență;

## INTRODUCTION

Tannins corrections are usually applied in wines already finished, but can also be applied to musts, giving them, among astringency also a velvety taste, stability and antioxidant protection. Tannins corrections are done at the moment when the musts or wines have an insufficient quantity of tannin substances, which is due to lack of full maturity or the stopping of the maceration process because of different reasons as: spoiled harvests with molds (Cotea D.V. 2009, Cotea V.V., 2006). In the production of white wines, it is recommended that tannins be used in

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combination with potassium metabisulphite in order to prevent malolactic fermentation and to ensure an antioxidant protection (Gayon 2006, Cotea 1985).

Tannins addition is necessary due to many reasons as color stabilisation, increasing the ageing potential, adjuvant to protein precipitation and wine stabilisation, inhibition of lacase activity, being also a medium for micro-oxygenation (Keulder D.B., 2006, Croitoru C., 2009) and acting as a redox buffer.

## MATERIAL AND METHOD

For this study, correction of tannins at must and wine from the Aligoté grape variety, harvested from V. Adamachi farm, Iași, were used. The additions were made according to technological instructions of the producing company Sodinal. The wines used for correcting were obtained by applying specific technologies for white wines production. 3 variants were realised, treated with three types of tannins: V1-Noxitan, V2- Taniblanco and V3- ProtanPepin, applied both to must and wine.

After the wine samples were obtained, a series of analytical analysis were made, such as: physical-chemical analyses, color determination using Cielab 76, total polyphenolic index (IPT) or D280, determination of total tannins by Bate-Smith method with methyl cellulose and Folin-Ciocalteu index, specific to phenolic compounds with reductive properties. Analyses were realised according to OIV standards.

## RESULTS AND DISCUSSIONS

After the analysis of the physical-chemical parameters of the Aligoté wines, to which tannins were added in the must (table 1), it was registered that the specific values do not have major variations.

*Table 1*  
**Physical-chemical characteristics of Aligoté wines, after tannin corrections in must**

Sam ple	Alco holic conc. % vol.	Total acidity. g/L C <sub>4</sub> H <sub>6</sub> O <sub>6</sub>	Volatile acidity .g/L C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	Relative density	pH	Cond. μS	Reductive sugars g/L	E.S.T g/L	E.S.N g/L
Cont	11,05	7,00	0,32	0,99410	3,12	1675	2,20	22,90	20,70
V1	11,02	7,10	0,29	0,99450	3,12	1656	3,05	23,70	20,65
V2	11,07	7,22	0,31	0,99480	3,12	1670	1,86	24,80	22,94
V3	11,05	7,15	0,30	0,99450	3,12	1672	2,20	24,20	22,00

V1- Noxitan; V2- Taniblanco; V3- ProtanPepin – correction of tannin content in must;

Slight fluctuations were noticed at the alcoholic concentrations between 11,02, in the case of sample V1 and 11,07 at sample V2. Total acidity has values between 7,00 (control sample) and 7,22 g/L C<sub>4</sub>H<sub>6</sub>O<sub>6</sub> (V2), fact that confirms that tannins slightly change the wine's acidity. Regarding density, in the samples where an increase in tannins addition was used, its specific values also grew compared to the control, between 0,9945 and 0,9948. The reductive sugars



content is low, the wines being dry. The non-reductive dry extract varies from 20,70 g/L in the case of the control sample up to 22 g/L in the case of the sample where ProtanPepin was used.

Regarding the physical-chemical analyses of the wines where tannins correction were done after the alcoholic fermentation, the constant of the alcoholic concentration is observed as well as small changes in the total acidity: 0,08 units in V1, 0,01 in V2 and 0,03 in V3. The relative density has small fluctuations, while the non-reductive dry extract has values between 18,02 in the control and 8,83 g/L in V3' (table 2).

Table 2

**Physical-chemical characteristics of Aligoté wines, after tannin corrections in wine**

Sample	Alcohol conc. % vol.	Total acidity. g/L C <sub>4</sub> H <sub>6</sub> O <sub>6</sub>	Volatile acidity. g/L C <sub>2</sub> H <sub>4</sub>	Relative density	pH	Cond. µS	Reductive sugars g/L	E.S.T g/L	E.S.N g/L
Contr	11,47	6,83	0,29	0,99210	3,13	1544	0,97	19,00	18,02
V1'	11,47	6,91	0,27	0,99220	3,11	1544	0,97	19,30	18,33
V2'	11,47	6,84	0,28	0,99228	3,12	1544	0,97	19,60	18,63
V3'	11,47	6,86	0,28	0,99236	3,12	1544	0,97	19,80	18,83

V1 - Noxitan; V2 - Taniblanco; V3 - ProtanPepin correction of tannin content in wine;

Table 3 presents the quantitative values of epicatechin equivalent in mg/L in the wines where the tannins corrections were done before the alcoholic fermentation and after the alcoholic fermentation.

Table 3

**Values of total tannins obtained with the Bate-Smith method with methyl cellulose**

Sample	Abs. control sample	Abs. MC sample	Absorbency	Epicatechin equivalent mg/L	Austral curve
Control	1,7600	1,6020	0,1580	30,09	23,00
V1	2,4726	2,4353	0,0373	33,88	3,53
V2	2,2496	2,2068	0,0428	59,76	4,42
V3	2,3403	2,2969	0,0434	62,59	4,52
Control'	2,9680	2,9311	0,0369	32,00	3,47
V1'	3,1779	2,9877	0,1902	37,67	28,19
V2'	2,9411	2,6606	0,2805	58,92	42,76
V3'	3,0901	3,0448	0,0453	71,53	101,27

Significant values are present in V3 and V2, of 62,59 and 59,76 mg/L, while in V1 the lowest quantity of tannins is found, of 33,88 mg/L, due to the potassium metabisulphite found in the used Noxitan product. Regarding the wine

samples where tannin treatment was done after the alcoholic fermentation, the tannins quantity was quoted in epicatechin equivalent and is slightly higher than the one found in the wine samples treated before the alcoholic fermentation. The values are between 37,6 mg/L in V1' and 71,53 in V3'. Tannins addition after the alcoholic fermentation is used when a certain quantity of tannins is wanted, but when tannins correction is done before the alcoholic fermentation leads to the obtaining of a more harmonious and well-defined wine.

The chromatic parameters of wines where tannins corrections were done before and after the alcoholic fermentation can be found in table 4. Parameter **L** is very close to 100, which proves that the wines are white, very light in color. Parameter **a** has negative values, proving the lack of red and green compounds, while parameter **b** proves the existence of yellow compounds. The values vary according to the type of tannin used, with a maximum in V3 and V3' , namely 3,7230 and 4,2980. The chroma fluctuates in the same direction as the presence of yellow compounds, with minimal values in V1 and V1'.

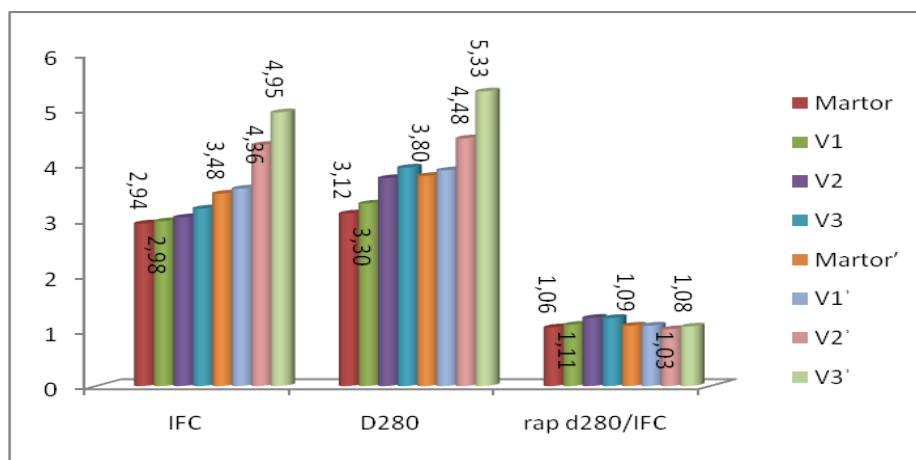
Table 4

Chromatic parameters ofAligoté wines

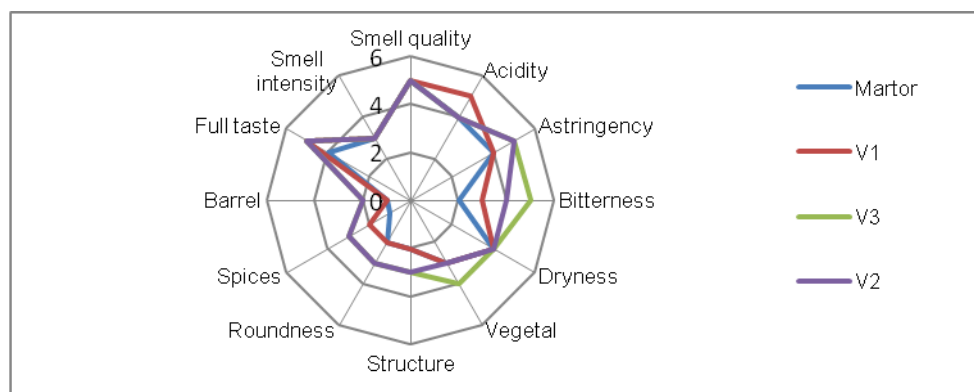
Sample 2010	Luminosit y L	Chromaticy		Chroma C	Tonality H	Luminosit ity	Hue
		a	b				
Martor	99,7323	-0,2926	1,3979	1,4282	-78,1770	0,0263	6,0612
V1	99,5962	-0,3167	1,9406	1,9662	-80,7287	0,0365	5,3137
V2	99,4780	-0,3278	2,0594	2,0853	-80,9534	0,0431	4,6538
V3	99,3972	-0,3411	2,3048	2,3300	-81,5814	0,0476	4,4829
Martor'	98,7590	-0,6571	3,7230	3,7806	-79,9903	0,0848	3,7404
V1'	98,7887	-0,5567	3,7604	3,8014	-81,5786	0,0825	3,8088
V2'	98,5802	-0,0955	4,9152	4,9162	-88,8868	0,0982	3,2062
V3'	99,0198	-0,6667	4,2980	4,3494	-81,1830	0,0797	4,6534

Figure 1 presents the D280 index and the FolinCiocâlțeu index, specific only for phenolic compounds with reductive properties. The values are specific for white wines and vary according to the type of tannin used. Therefore, the wine sample treated with Noxitan, the values are the lowest, namely 2,98 and 3,30, while the samples obtained with Taniblanc and ProtanPepin, the phenolic compounds have slightly higher values, namely 4,95 and 5,33.

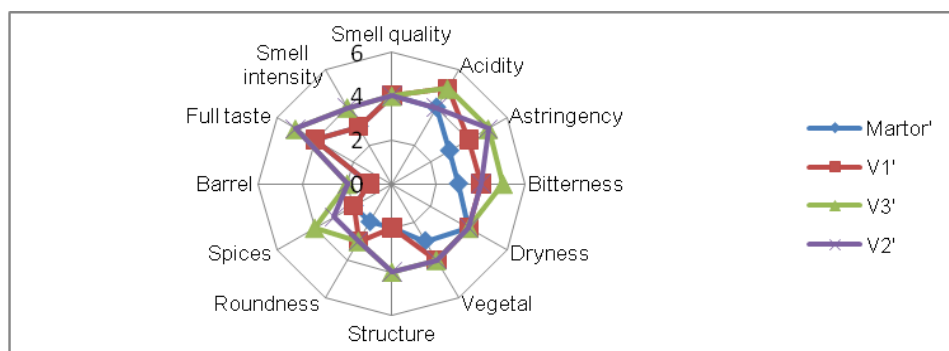
Figures 2 and 3 represent the graphics of sensorial analyses of the wines where tannin corrections were used in must and in wine. In the first case, samples V1, V2 and V3, the sensorial characteristics are superior to those of the control sample, the obtained wines being more astringent and harmonic. Samples V1', V2' and V3', the values of the descriptors are higher than those of the control sample, the obtained wines having a more pronounced astringency and a bitter note.



**Fig.1-** Variation of indexes IFC and D<sub>280</sub> and their ratio in Aligoté wines



**Fig. 2-** Sensorial characteristics of Aligoté wines obtained through tannin addition in must



**Fig. 3-** Sensorial characteristics of Aligoté wines obtained through tannins addition in wine

## CONCLUSIONS

1. The total tannin quantity has significant values in the case of the samples treated with ProtanPepin and Taniblanç.

2. The color parameters vary according to the used tannin, while parameter b has higher values in the wine samples where tannins were added.

3. Total phenolic compounds present higher values in samples with tannin addition, while the values of the Folin-Ciocalteu index grow according to the type of tannins used.

4. The treated wines have superior sensorial characteristics compared to the control samples, the tannins having a positive influence on wine's quality.

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# CONTRIBUTIONS TO THE DETERMINATION OF PYRAZINIC FLAVOURS IN SAUVIGNON BLANC WINE – BLAJ VITICULTURAL CENTRE, TARNAVE VINEYARD

## CONTRIBUȚII LA DETERMINAREA AROMELOR PIRAZINICE DIN VINURILE DE SAUVIGNON BLANC - CENTRUL VITICOL BLAJ

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**Abstract.** *Sauvignon Blanc variety accumulates pyrazinic compounds in the grain husks and these give the wine vegetal flavors of pepper. The aromatic character of the pyrazines is a result of their low basicity and their resistance to oxidation. Methoxy-izobutilpirazina (IBMP) and methoxy-izopropilpirazina (IPMP) of Sauvignon blanc wine, the crop of 2008, have been determined. Depending on the duration of the maceration of the grape seeds with husks, the quantities are as follows: 20.978 to 35.848 5.096 to 15.254 ppm ppm IBMP and IPMP.*

**Key words:** pyrazines, metoxipirazine, pellicular maceration

**Rezumat.** *Soiul Sauvignon blanc, acumulează în pielețele boabelor compuși pirazinici, care imprimă vinului arome vegetale de ardei iute. Caracterul aromat al pirazinelor rezultă din bazicitatea lor redusă și rezistența la oxidare. Au fost determinate, metoxi-izobutilpirazina (IBMP) și metoxi-izopropilpirazina (IPMP) din vinurile de Sauvignon blanc, recolta anului 2008. În funcție de durata procesului de macerare a mustului cu pielețele boabelor, cantitățile sunt următoarele: 20,978-35,848 ppm IBMP și 5,096-15,254 ppm IPMP.*

**Cuvinte cheie:** pirazine, metoxipirazine, macerație peliculară

### INTRODUCTION

The aromatic character specific to Sauvignon Blanc variety is due to the pyrazinic and thiolic compounds that are present in wine (Marais J. 1994, Tardea C, 2007). In cool climates, such as Tarnava vineyard, the pyrazinic flavors dominate to the detriment of the thiolic flavors. The former gives some typical characteristics to the wines produced in these areas. The high temperatures during the ripening period of the grapes determine a decrease in the pyrazinic content.

The main pyrazinic compounds in Sauvignon blanc wines are 3-isobutyl-metoxipirazine (IBMP) and 3-isopropyl-2-metoxipirazine (IPMP). These are to be found in grain husks and they give vegetal and green peeper flavors to the wine. Pre-fermentative pellicular maceration optimizes the pyrazinic aromatic character (Maggu M. et al. 2007).

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## MATERIAL AND METHOD

The research was carried out in 2008. The grapes originated from a Sauvignon Blanc plantation from S.C.D.V.V. Blaj (Research and Development Station for Viticulture and Vinification Blaj). We devised 3 experimental variants in micro-vinification conditions.

V1 – grape crushing, grape debunching and must separation

V2 - grape crushing, grape debunching 16 hours pellicular maceration and must separation

V3 - grape crushing, grape debunching 24 hours pellicular maceration and must separation

The must has suffered a static clearing through decantation at a low temperature. This process has been carried out through administration of pectolytic enzyme preparations. Alcoholic fermentation has taken place through the action of yeasts from the spontaneous flora, under a controlled temperature (16-18°C). After 14 days from the onset of alcoholic fermentation we have carried out the first decantation and sulphitation at a level of 40 mg/L free SO<sub>2</sub>.

The wines have also been administered sodium bentonite in a dose of 0.8 g / L. In 20 days after administration of bentonite, there was performed the filtering operation using sterile plates and this was followed by bottling.

The variants were analyzed through physico-chemical procedures, organoleptic procedures and through the approved official methods. Afterwards the IBMP and IPMP pyrazinic compounds were dosed using gas chromatography.

## RESULTS AND DISCUSSIONS

The year 2008 may be characterized as a normal year for Research and Development Station for Viticulture and Vinification Blaj, with slightly higher temperatures in the summer months (+1.7 to +2.8) and a higher rainfall regime (table 1).

Table 1

Climatic data in RDSVV Blaj, 2008

Month	Monthly average temperature (°C)			Rainfall amount (mm)		
	recorded	normal	dif.+/-	recorded	normal	dif.+/-
January	-1,7	-2,7	+1,0	9,1	26,3	-17,2
February	2,3	-0,1	+2,4	10,5	21,2	-10,7
March	6,4	4,7	+1,7	31,5	23,9	+7,6
April	11,4	10,4	+1,0	69,0	68,3	+0,7
May	16,3	15,2	+1,1	78,3	80,2	-1,9
June	21,1	18,3	+2,8	100,8	93,6	+7,2
July	21,5	19,8	+ 1,7	105,5	99,0	+6,5
August	22,0	19,3	+2,7	22,7	64,0	-41,3
September	14,9	15,1	-0,2	62,1	56,7	+5,4
October	12,1	9,5	+2,6	90,7	36,6	+54,1
November	5,4	3,8	+1,6	40,7	36,5	+4,2
December	2,4	-1,1	+3,5	65,8	33,3	+32,5
Yearly values	11,1	9,4	—	686,7	639,6	—

The physico-chemical composition parameters that characterize the quality of Sauvignon blanc wines from the RDSVV Blaj are: alcohol - 11.35 to 11.70% vol, total acidity from 4.26 to 4.71 g/L sulphuric acid, volatile acidity 0.32-0.38 g/L acetic acid, dry non-reducing extract from 19.00 to 20.80 g/L, sugars.

*Table 2*

**The physico-chemical parameters of the composition of Sauvignon blanc wines – RDSVV Blaj, 2008**

The analyzed parameter	Alcoholic titre (%vol)	PH	Total acidity g/L H <sub>2</sub> SO <sub>4</sub>	Volatile Acidity g/L CH <sub>3</sub> COOH	Reducing Sugars g/L	Non-reducing dry extract g/L	S02 total mg/L	S02 Free mg/L
V1	11,35	3,12	4,71	0,32	9,90	19,00	94,0	25,4
V2	11,65	3,32	4,26	0,38	5,52	19,48	1.11,0	25,8
V3	11,70	3,33	4,50	0,36	5,50	20,80	108,0	26,4

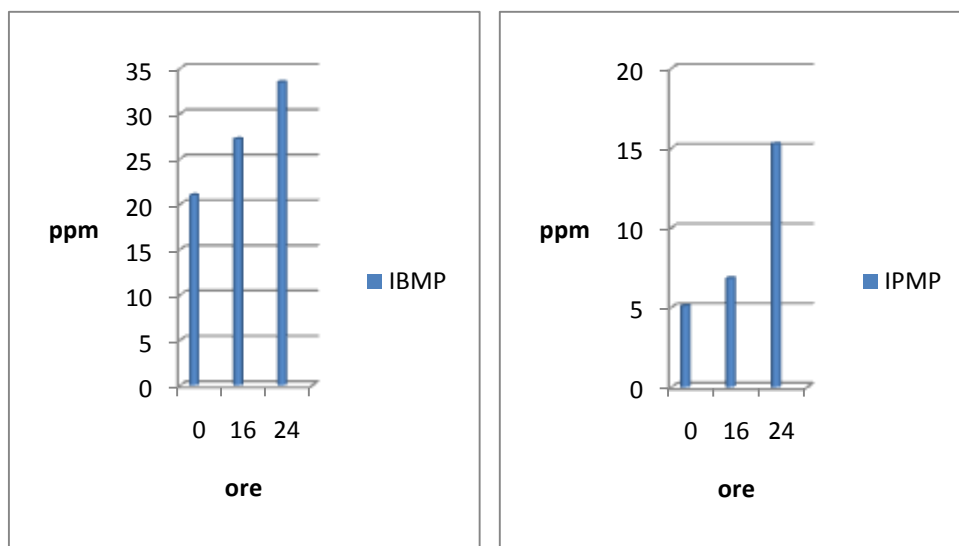
From the analysis of IBMP and IPMP pyrazinic compounds, which determine the flavor of Sauvignon blanc wines, we found concentrations above the limit of sensory perception in all experimental variants (table 3). The lowest values of 20.97 ppm IBMP and 5.09 ppm IPMP were in variant V1, while the highest values were found in V3 - 33.44 ppm IBMP and 15.25 ppm IPMP, with a 16-24 hours pellicular maceration period.

The conclusion is that Sauvignon wines produced in RDSVV Blaj contain a high quantity of pyrazinic aromatic compounds, something that gives them their specific characteristics, typical to Sauvignon blanc. Pre-fermentative pellicular maceration facilitates the extraction of pyrazines from the husks of grains. This process is correlated with the duration of contact between the solid and liquid phase of the pulp (figure 1). As this time increases, the IBMP and IPMP levels in wines are higher.

*Table 3*

**IBMP and IPMP concentration values in Sauvignon wines, RDSVV Blaj**

Experimental values	IBMP		IPMP	
	Determined value ppm	Sensory perception threshold ppm	Determined value ppm	Sensory perception threshold ppm
V1	20,97	2	5,09	2
V2	27,17	2	6,83	2
V3	33,44	2	15,25	2



**Fig. 1** - The evolution of IBMP and IPMP concentrations according to the duration of the pre-fermentative pellicular maceration period in the case of Sauvignon Blanc wines

## CONCLUSIONS

1. The pre-fermentative pellicular maceration process technology used in the preparation of Târnave Sauvignon blanc wines is necessary to highlight the semi-flavored potential of this wine variety. The quantity of pyrazines in the wine varies depending on the duration of contact between the husks of grains and the must: IBMP concentrations between 20.97, and 33.44 ppm, and IPMP between 5.09, and 15.25 ppm.

2. We recommend a 16-24 hours pre-fermentative pellicular maceration in order to process the Sauvignon blanc variety. This should be carried out at temperatures of 16-18°C so that one might obtain wines with vegetal/pyrazine flavors characteristic to this variety.

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# STUDIES ON THE IMPROVEMENT OF ANTHOCYANIN EXTRACTION FROM GRAPE SKINS

## STUDII PRIVIND OPTIMIZAREA PROCESULUI DE EXTRAȚIE A ANTOCIANILOR DIN PIELIȚELE DE STRUGURI

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**Abstract.** Anthocyanins, besides the fact that they are a source of natural coloring, represent a very complex subject of research due to their antioxidant, antibacterial and anticancer features. Thanks to the structural features specific to anthocyanins and by performing the extraction of raw material by solvents in static conditions we evaded the use of mechanical and magnetic stirring of samples to prevent oxidation of active substances. Extracts obtained after 24, 48, 72 and 96 hours from solvent addition, were separated from residues by decantation and/or filtration and further subjected to centrifugation for 5 – 10 minutes at a speed of 4000 – 8000 rpm and were stored in a cold place for additional tests. To assess the efficiency of the extraction process according to the vegetal origin we used grape skins of Fetească neagră, Băbească neagră, Arcaș, Negru de Drăgășani, Cabernet Sauvignon, Merlot and Chambourcine varieties for each extract, the anthocyanin content (mg/L) being determined in each case.

**Key words:** extract, anthocyanins, grape, skins.

**Rezumat.** Antocianii, pe lângă faptul că reprezintă o sursă de coloranți naturali, constituie un subiect amplu de cercetare datorită proprietăților antioxidante, antibacteriene și antineoplazice. Datorită caracteristicilor structurale specifice ale antocianilor, prin efectuarea extracției materiei prime cu solvenți în condiții statice, s-a evitat utilizarea agitării mecanice și magnetice a probelor pentru a nu favoriza procesele de oxidare ale substanțelor active. Extractele obținute la 24, 48, 72 și 96 ore de la adăugarea solventului, au fost separate de reziduuri prin decantare și /sau filtrare și supuse ulterior centrifugării timp de 5 – 10 min la viteza de 4000 – 8000 rotații pe minut și păstrate la rece pentru analizele ulterioare. Pentru aprecierea eficienței procesului extractiv funcție de proveniența vegetală au fost utilizate pielițe de struguri aparținând soiurilor Fetească neagră, Băbească neagră, Arcaș, Negru de Drăgășani, Cabernet Sauvignon, Merlot și Chambourcine, pentru fiecare extract fiind determinat conținutul în antociani (mg/L).

**Cuvinte cheie:** extract, antociani, struguri, pielițe

## INTRODUCTION

The anthocyanins from grapes are located in the cell vacuoles of skins' epidermis and hypodermis as well as in the cells near to the pulp. From chemical

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perspective anthocyanins (pigments) are heterocyclic, polyhydroxilic and/or metoxylic compounds characterized by a phenyl-benzopyril nucleus to which is attached one or two molecules of sugars (glucose, galactose, rhamnose). By acid hydrolysis anthocyanins release the sugarless colored component (aglycone), called anthocyanidine or anthocyanidol. This is the reason why grape pigments are recently called anthocyanidols (Colette Navarre, 2002). In the skin of grapes we identified 8 flavonoid monoglucosides and three diglycosides among the group of flavonoid compounds.

Anthocyanin extraction from vegetal materials depends on the chemical, structural features, the extraction method used, the sizes of vegetal material particles as well as on the presence of interfering substances. By correlating all data we have till now, we may draw the conclusion that the best procedure of anthocyanin extraction for all vegetal sources is not yet available. Usually, anthocyanin extraction from vegetal materials is carried out using methanol as dissolving agent also adding small amounts of hydrochloric acid. Considering the future biological applications of vegetal extracts, ethyl alcohol was selected as final extraction medium. Moreover, the dissolvent chosen was not acetous to prevent anthocyanin degradation (Escribano-Bailon M. et al, 2003; Mazza G. et al., 1983, Ribereau – Gayon P., 1965).

Previous studies pointed out the fact that the extraction process in a stable discontinuous system is the most effective for obtaining vegetal anthocyanic extracts as the temperature necessary is of only 30°C and does not trigger oxidation of active substances by lack of stirring the extraction system (Savin C. et al., 2007).

The objective of this study was to determine the optimum duration of the extraction process necessary for the depletion of vegetal material as far as anthocyanin content is concerned.

## **MATERIAL AND METHOD**

Anthocyanic extraction from the skins of grape varieties such as Fetească neagră, Băbească neagră, Arcaș, Negru de Drăgășani, Cabernet Sauvignon, Merlot and Chambourcine was performed by means of the discontinuous method, in stable context. The extraction processes were carried out in bottles with ground glass stopper and flat bottom, inside which the vegetal materials – grape skins were inserted also adding the dissolvent ethylic alcohol heated to 40°C. The extractions were performed at a temperature of 30°C observing the solid material / dissolvent ratio of 1/10. The anthocyanic extracts obtained after 24, 48, 72 and 96 hours since adding the dissolving agent were separated from deposits by decanting and/or filtration and were further subjected to centrifugation for 5-10 min at a speed of 4000–8000 revolutions per minute. For the tests the anthocyanic extracts obtained were stored in dark bottles at a temperature of 4°C, thus determining anthocyanin content (mg/L) by R. Gayon and Sonestreet method – 1965.

## **RESULTS AND DISCUSSIONS**

Anthocyanic compounds have some features which influence the techniques of separation, analysis and conditioning of extracts. To assess the efficiency of the extraction process according to the vegetal origin we used the

skins of both local and international grape varieties (Fetească neagră, Băbească neagră, Arcaș, Negru de Drăgășani, Cabernet Sauvignon, Merlot and Chambourcine).

The vegetal extracts obtained by discontinuous extraction, in stable context, were analyzed from the perspective of anthocyanin content. The data obtained are shown in the diagram from figure 1.

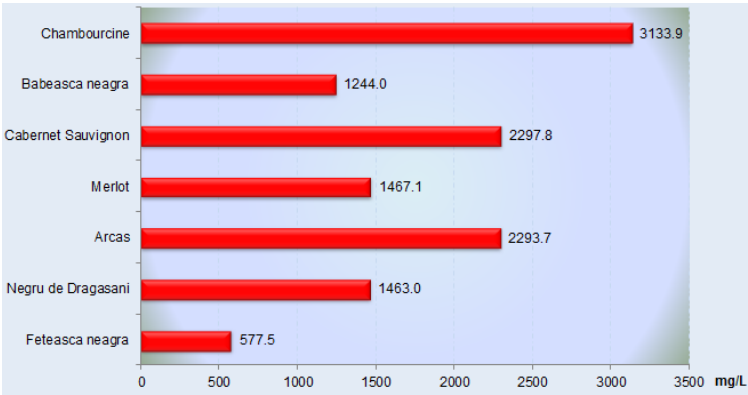


Fig. 1 - Anthocyanin content of vegetal extracts obtained

We noticed that among the vegetal materials tested the extracts obtained from the skins of Chambourcine variety have the highest anthocyanin content (3133.0 mg/L), being followed by Cabernet Sauvignon with 2297.8 mg/L and Arcaș with 2293.7 mg/L. The very similar anthocyanic content of Cabernet Sauvignon and Arcaș varieties, may be explained by the genetic origin of the latter, which is obtained by means of sexual hybridization between Cabernet Sauvignon and Băbească neagră varieties.

The lowest anthocyanin content was found for Fetească neagră variety with only 577.5 mg/L. The extracts obtained from the skins of Negru de Drăgășani and Merlot varieties had almost similar values of anthocyanic content, namely 1463.0 and 1467.1 mg/L, being followed by Băbească neagră variety with 1244 mg/L.

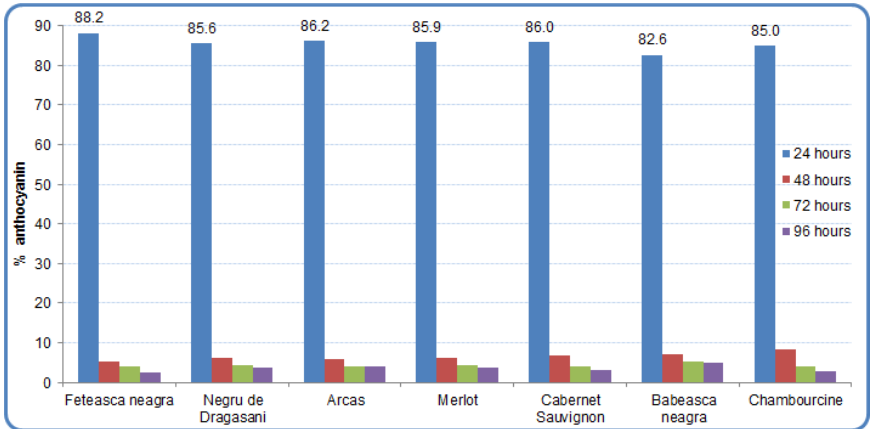


Fig. 2 - Degree of anthocyanin extraction during the interval of 24, 48, 72 and 96 hours

The extraction process carried out in discontinuous stable system was studied in dynamics, taking samples at various times (figure 2). According to the graphical representation of data the extracts obtained after 24 hours of contact between vegetal materials and dissolving agent had the highest anthocyanin content, over 82.6% of anthocyanins being extracted during this time period.

The low percentage of anthocyanins extracted in dissolvent after 48 hours (5.4 – 8.3%), 72 hours (3.9 – 5.2%) and respectively 96 hours (2.5 – 5.0%) does not justify the continuation of the extraction process. Moreover the high contact time between the vegetal material and the dissolvent may support the oxidation of active substances from extracts.

The extraction of anthocyanins from vegetal materials is not complete, this conclusion being also supported by data from literature. The probable explanation consists in the different solubility of anthocyanins but also the oxidative degradation during the extraction process.

## CONCLUSIONS

1. We noticed that among the vegetal materials tested the extracts obtained from the skins of Chambourcine variety have the highest anthocyanin content (3133.0 mg/L), being followed by Cabernet Sauvignon with 2297.8 mg/L and Arcaş with 2293.7 mg/L.

2. The extracts obtained after 24 hours of contact between vegetal materials and dissolving agent had the highest anthocyanin content, over 82.6% of anthocyanins being extracted during this time period.

3. By means of stable discontinuous extraction method the vegetal material is not completely depleted as far as anthocyanin content is concerned.

***Acknowledgments:** This work was cofinanced from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/I.89/1.5/S62371 "Postdoctoral Schole in Agriculture and Veterinary Medicine area".*

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# HPLC DETERMINATION OF OCHRATOXIN A IN BREAD AND CORN FLOUR

## DETERMINAREA OCHRATOXINEI A DIN PÂINE ȘI MĂLAI PRIN METODA HPLC

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**Abstract.** *Ochratoxin A is a mycotoxin produced by different species of Aspergillus and Penicillium fungi. Ochratoxin A has been found in peanuts, cereals, coffee, bread, flour, corn, peas, beans, beer, wine. The aim of this paper is to determine ochratoxin A in bread and corn flour. The samples purchased from markets and agro - food markets were processed and then analyzed by high performance liquid chromatography (HPLC) with fluorescence detection.*

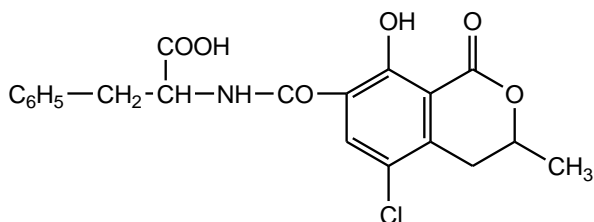
**Key words:** ochratoxin A, bread, corn flour, HPLC

**Rezumat.** *Ochratoxina A este o micotoxină produsă de diferite specii de fungi din genurile Aspergillus și Penicillium. Ochratoxina A a fost identificată în alune, cereale, cafea, pâine, făină, mălai, mazăre, fasole, bere, vin. Scopul lucrării este de a determina ochratoxina A din probe de pâine și mălai. Probele achiziționate din rețeaua comercială și piețe agro-alimentare au fost prelucrate și apoi supuse analizei prin cromatografie de lichide de înaltă performanță (HPLC) cu detecție în fluorescență.*

**Cuvinte cheie:** ochratoxina A, pâine, mălai, HPLC

### INTRODUCTION

Ochratoxin A (fig. 1) is a toxic metabolite produced by species of *Aspergillus* genus in tropical and subtropical areas and species of *Penicillium* genus in temperate zones (Eskola M., 2002). For the first time, ochratoxin A was isolated from cultures of *Aspergillus ochraceus* by Van der Merwe et al. in 1965 while testing the toxin ability of fungal strains isolated from cereals and vegetables (Van der Merwe K.J. et al., 1965).



**Fig.1** – Chemical structure of ochratoxin A

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*Penicillium verrucosum* is frequently isolated from cereal samples while *Aspergillus ochraceus* contaminates green coffee beans, spices, cocoa beans, soybeans and peanuts (Kuiper-Goodman T. et al., 1987).

Experimental studies demonstrated toxic effects of ochratoxin A: immunotoxic (Harvey R. B. et al., 1992), nephrotoxic (Vrabcheva T. et al., 2004), teratogenic (Wangikar P.B. et al., 2005). Due to the carcinogen action, shown on experimental animals, ochratoxin A has been included by the International Agency for Research on Cancer (1993) among the possible carcinogenic substances - 2B (IARC, 1993).

The aim of this study is to determine the content of ochratoxin A in two categories of food, bread and corn flour, given the high consumption of these foods by the population of Romania and reporting data obtained with the regulations set by the EU regarding the maximum limits permitted. Thus, the European legislation sets the maximum limits for ochratoxin A: 5 µg / kg for cereals and 3 µg / kg for cereal product (Commission Regulation, 2006).

## MATERIAL AND METHOD

### Reagents:

- Ochratoxina A from *Aspergillus ochraceus* (Sigma);
- Methanol Chromasolv® min 99,9% (Sigma-Aldrich) ;
- Acetonitrile R Chromasolv® min 99,8% (Riedel-de Haën);
- Glacial acid acetic 100% (Sigma-Aldrich);
- Purified water (resistivity 18,2 MΩ);
- Analytical balance Adam;
- Magnetic stirrer type AG-3;
- Filter Millipore 45 µm;
- Liquid chromatograph type HP 1090 Series II, equipped with a fluorescence detector type HP 1046 A;
- Phenomenex column, type Luna C18(2) 100Å (150 x 4,6 mm, 5µm).

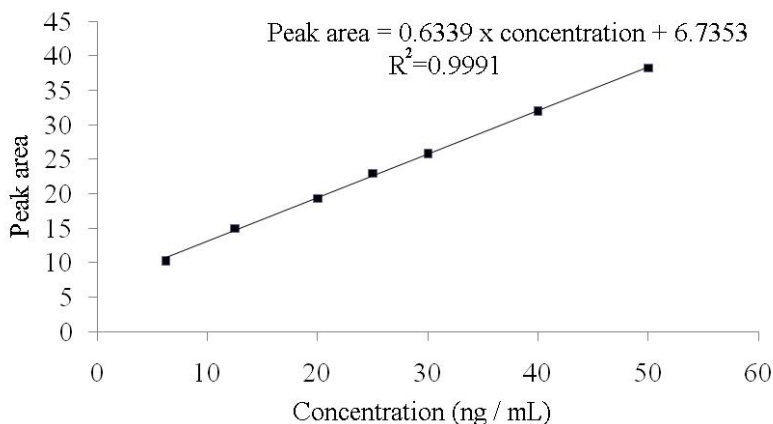
### Working procedure:

Analyzed samples (bread, corn flour) are subject to liquid-liquid extraction in acid medium to separate the ochratoxin A. Thus, 20 g of sample is shaken for 30 minutes with a magnetic stirrer in 100 mL mixture of chloroform and 10 mL phosphoric acid 0.1 M solution; filtered through the quantitative filter paper and the organic phase is evaporated to dryness. The residue is restarted with a volume of 0,5 mL methanol and subjected to analysis by high performance liquid chromatography (Langseth W. et al., 1989; Muscarella M. et al., 2004).

HPLC analysis was performed on high performance liquid chromatograph type HP 1090 Series II equipped with fluorescence detector type HP 1046 A. The analysis was performed at a Phenomenex column, Luna C18(2) 100Å (150 x 4,6 mm, 5µm) with a mobile phase formed by a mixture of acetonitrile : water : acetic acid (99 : 99 : 2), a flow of 0.7 mL/min; in the column compartment temperature was set at 25° C. For detection, the wavelength of excitation was 228 nm and for emission was 423 nm.

The method was validated by establishing the linearity on concentration range 6.25 - 50 ng / mL (fig. 2) (regression line equation is Peak area = 0.6339 x concentration + 6.7353), the system precision (RSD = 0.9645 %, n = 10, RSD = relative standard deviation, n = number of determinations), method precision (RSD = 2.4975%, n = 9, where RSD = relative standard deviation, n = number of determinations), accuracy (mean

recovery 100.1%), limit of detection (LD = 1.6 ng/mL) and limit of quantification (LQ = 4.6ng/mL).



**Fig. 2** – The calibration curve for ochratoxin A

The validated HPLC method was applied with good results in the determination of ochratoxin A in bread and corn flour samples.

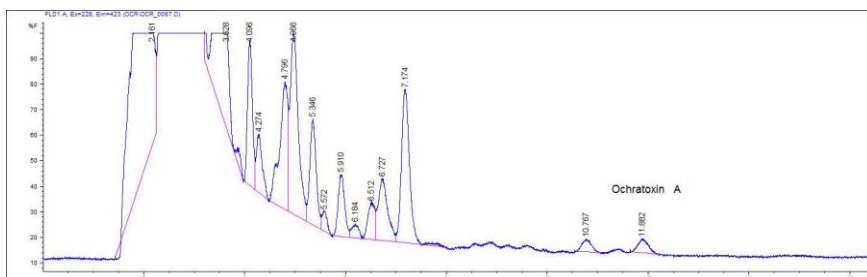
Bread samples were purchased from commercial network of the Iasi area. We have analyzed 20 samples of bread of various kinds, from different manufacturers: 12 samples of white bread, 3 samples of graham bread, a sample of black bran bread, a rye black bread sample, 2 samples of rye bread and a sample wholemeal bread.

Samples of corn flour were purchased from open markets in the town of Pașcani (Iasi county), from private producers. 20 samples were analyzed.

## RESULTS AND DISCUSSIONS

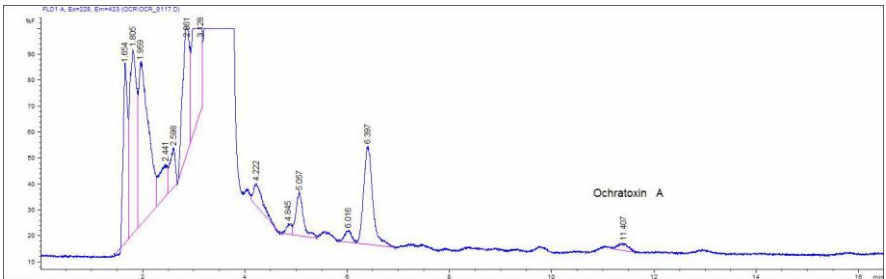
As a result of the analysis by high performance liquid chromatography chromatogram, the chromatograms that were obtained were processed and then the area of the peaks corresponding to ochratoxin A was established. The identification of ochratoxin A peak was done according to the retention time.

Figures 3 show a chromatogram obtained from the analysis of bread samples.



**Fig. 3** – Chromatogram obtained from analysis of bread samples (sample n° 4)

Figure 4 show a chromatogram obtained from the analysis of corn samples.



**Fig. 4** - Chromatograms obtained from analysis of corn flour samples (sample n° 14)

Using the regression line equation ( $\text{Area peak} = 0.6339 \times \text{concentration} + 6.7353$ ) ochratoxin A content in bread and maize flour samples was calculated. The values obtained are shown in the tables below (table 1 and table 2).

*Table 1*

**The content of ochratoxin A in bread samples**

N° sample	Sample name	Ochratoxin A (µg/Kg)
1.	Sliced graham bread	1,13
2.	Sliced graham bread	2,67
3.	Sliced graham bread	absent
4.	Sliced black bran bread	1,46
5.	Sliced black rye bread	absent
6.	Sliced rye bread	absent
7.	Sliced wholemeal bread	1,45
8.	Sliced white bread	absent
9.	Sliced white bread	trace
10.	Sliced white bread	trace
11.	Sliced white bread	1,20
12.	White bread	trace
13.	Sliced white bread	1,74
14.	Rye bread for sandwich	trace
15.	White bread for sandwich	absent
16.	White bread	trace
17.	Sliced white bread	1,15
18.	White bread	trace
19.	White bread	1,99
20.	Sliced white bread	1,46



Table2

The content of ochratoxin A in corn flour samples

N° sample	Ochratoxin A (µg/Kg)	N° sample	Ochratoxin A (µg/Kg)
1.	trace	11.	trace
2.	absent	12.	1,21
3.	trace	13.	9,08
4.	1,73	14.	2,41
5.	absent	15.	trace
6.	trace	16.	1,07
7.	1,69	17.	absent
8.	1,39	18.	1,13
9.	1,56	19.	trace
10.	1,45	20.	1,38

The analysis of the data obtained from the determination of ochratoxin A in the 20 bread samples has determined that no sample contains a higher level of ochratoxin A than the maximum permitted by applicable law (3 µg/kg); ochratoxin A is present, but within limits, in 45% of the samples, traced in 30% of the samples and absent in 25% of them (fig.5).

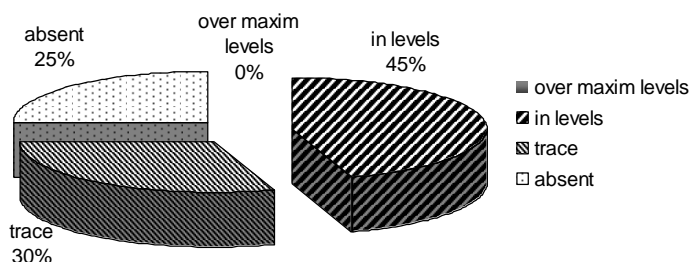


Fig. 5 -The content of ochratoxin A in bread samples

In corn flour samples ochratoxin A is present in a single sample in excess of the maximum level allowed by applicable law (5 µg/kg); in 50% of samples, ochratoxin A is within the maximum allowed limits, in 30% as trace and in 15% of the samples it is absent (fig. 6).

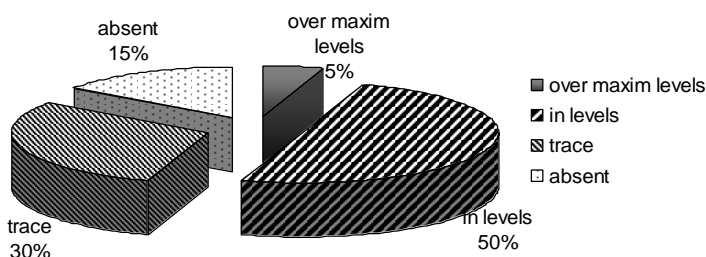


Fig. 6 - The content of ochratoxin A in corn flour samples

## CONCLUSIONS

1. A validated HPLC method was applied for determination of ochratoxin A in bread and corn flour samples.

2. This paper contributes to the evaluation of the ochratoxin A present in agricultural products commercialized in open markets (maize flour) and food stores (bread) in the county of Iasi.

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# FRUIT'S PHYSICO-CHEMICAL CHARACTERISTICS OF TWO BITTER CHERRY CULTIVARS

## CARACTERISTICI FIZICO-CHIMICE ALE FRUCTULUI LA DOUĂ SOIURI DE CIREȘ AMAR

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**Abstract.** Bitter cherry cultivars are particularly important for both industrial and home conditions processing in jams, liqueurs or syrups. Evaluation of the physico-chemical characteristics of fruit was carried out on samples from harvest years 2007-2010 at two bitter cherry cultivars (Galata and Maxut) created at Fruit Growing Research Station Iasi. Were observed and determined the ripening period, fruit size, stone percentage, soluble solids content, reducing sugars, total acidity, the sugar/acidity ratio, humidity percentage, content of both phenols and anthocyanins. Galata is a bicolor cultivar with great fruits (17.2 mm fruit equatorial diameter and 4.2 g fruit weight) valuable for gems processing. Maxut is a valuable cultivar for its both fruit and flesh dark brown almost black, with great bitterish taste valuable for liqueurs, syrups and jams.

**Key words:** *Prunus avium*, fruit processing, jam, sugars, acidity, fenols.

**Rezumat.** Soiurile de cireș amar prezintă o importanță deosebită pentru prelucrarea industrială sau în condiții casnice sub formă de dulcețuri, lichioruri, siropuri. Evaluarea însușirilor fizico-chimice ale fructelor a fost realizată pe probe din recolta anilor 2007-2010 la două soiuri de cireș amar (Galata și Maxut) create la Stațiunea de Cercetare-Dezvoltare pentru Pomicultură Iași. S-au observat și determinat epoca de recoltare, mărimea fructelor, ponderea sâmburelui (%), conținutul în substanță uscată solubilă, glucidele reducătoare, aciditatea totală, raportul zahăr/aciditate, umiditatea fructului, conținutul în fenoli și antociani. Soiul Galata este un soi bicolor cu fruct mare (17.2 mm în diametru și 4.2 g în greutate), foarte valoros pentru dulcețuri, iar soiul Maxut este un soi cu fructul și pulpa de culoare brun închis spre negru, cu gust amar accentuat, valoros atât pentru dulcețuri, dar mai ales pentru lichioruri și siropuri.

**Cuvinte cheie:** *Prunus avium*, prelucrare fructe, dulceață, zaharuri, aciditate, fenoli.

## INTRODUCTION

Sweet cherries are valuable raw materials to obtain traditional and ecological products such as jam and liqueurs (Vieru et al., 1981 <sup>\*\*\*</sup>, 1992, Peter et al., 2007, b; Beceanu, 2009).

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Internationally, liqueurs and syrups from bitter cherry are the subject of many research investigations (Bretaudiu & Faure, 1991; Hui, 2006, Webster & Looney, 1998; Nikolić et al., 1998), but jam have been less investigated (Jamba & Carabulea, 2002).

Knowledge of physico-chemical properties of fruit to bitter cherries are an important element in defining their quality and their establishment for industrial use (Beceanu, 2009; Beceanu & Chira, 2003; Budan & Grădinariu, 2000; Gherghi et al., 2001; Coşofreţ et al., 2006; Petre, 2007; Webster & Looney, 1998).

By their chemical content in fenols, sweet cherries are a valuable natural source to reduce the risk of many diseases caused by oxidative processes (Jakobek et al., 2009; Chaovanalikit & Wrolstad, 2004).

In this paper we have investigated the physical and chemical properties of fruits from two bitter cherry cultivars grown in the NE of Romania area, to determine their possible recovery in the form of organic products and promoting traditional culture expansion of these cultivars in organic plantations.

## MATERIAL AND METHOD

For experimentation were used fruit samples from two bitter cherry cultivars (Galata and Maxut) existing in the experimental plot of Fruit Growing Research Station Iasi, during 2007-2010.

They made observations, measurements and analysis of: fruit size, stone weight, soluble solids content, reducing sugar content, total acidity, sugar/acidity ratio, humidity (%) and phenols content. To determine the fruit size were weighed and measured 10 whole fruit and 10 dried seeds in three repetitions, using a precision electronic balance Radwag type, with 0.01 g sensitivity and a mechanical caliper and then based on these determinations was calculated pulp / stone ratio.

Titrateable acidity was determined by neutralization with sodium hydroxide solution 0.1 N, to the point of equivalence, using thymolphthalein as an indicator. Soluble solids content was determined using a hand refractometer (Zeiss). Reducing sugar content was determined by the method of Schoorl (Ghimicescu, 1977). The principle is to reduce alkaline cuppertartrique solution by reducing sugars in hot medium to cuprous oxide. Excess of divalent copper oxidizes iodine potassium to elemental iodide and than free iodine is titrated with sodium thiosulfate. Depending on the amount of thiosulfate consumed, the amount of reduced copper is quantify and then from the tables, the amount of reducing sugars (expressed as glucose, fructose etc.) is also quantify (Ghimicescu, 1977). Fruit humidity (%) was determined by drying samples to constant mass in an oven at 105°C and calculating the difference between the fresh product under analysis and dry product.

**Identification of phenolic compounds.** For a more complete characterization of bitter cherry cultivars taken under study was performed to determine individual phenolic compounds by liquid chromatography with diode array detector (HPLC - DAD). Fruit samples were centrifuged with a Hettich centrifuge, GmbH & Co. KG, Germany (6000 rotations per minute) and then filtered through membranes with 0.45 mm porosity. Then were used analytical standards to identify specific compound retention time and were drawn curves characteristic of each phenolic compound. Separation method involves using

HPLC Shimadzu LC 20 and the column used was a sequence of two Cromolith Performance 100x4, 6 mm from Merck, Romania (Castellar et al., 2002).

## RESULTS AND DISCUSSIONS

The average ripening period of Galata and Maxut was between 18 and 28 June with a number of days from full bloom to maturity between 70 and 98 (table 1).

Table 1

**Maturation period of bitter cherry Galata and Maxut (average 2007-2010)**

Characteristics	Cultivar	
	Galata	Maxut
Flowering period	1-25.04	10-26.04
Fruit ripening	22-28.06	18-22.06
Number of days from bloom to fruit ripening	83-98	70-74

Physico-chemical characteristics of the fruit from the two bitter cherry cultivars are presented in table 2.

Table 2

**Physico-chemical properties of fruit at bitter cherry cultivars Galata and Maxut (average 2007 - 2010  $\pm$  SD)**

Characteristics	Cultivar	
	Galata	Maxut
Equatorial diameter of fruit (mm)	17.20 $\pm$ 0.34	16.10 $\pm$ 0.50
Fruit weight (g)	4.08 $\pm$ 0.33	3.60 $\pm$ 0.56
Stone size (g)	0.26 $\pm$ 0.04	0.28 $\pm$ 0.03
Fruit/stone ratio (g/g)	16.00 $\pm$ 1.04	12.67 $\pm$ 0.66
Soluble solids content (Brix)	18.63 $\pm$ 1.06	18.30 $\pm$ 1.11
Reducing sugar content (g/100 g fresh fruit)	8.45 $\pm$ 0.37	13.25 $\pm$ 2.07
Titrateable acidity (g malic acid /100 g fresh fruit)	0.77 $\pm$ 0.06	0.99 $\pm$ 0.16
Reducing sugars content / titrateable acidity ratio	11.07 $\pm$ 0.45	13.72 $\pm$ 4.25
Humidity (%)	81.65 $\pm$ 0.36	81.99 $\pm$ 0.21

Galata registered 17.2 mm in average equatorial diameter and 4.0g in fruit weight, fruit / stone ratio being 16.

Fruit size of Maxut was smaller, fruit/stone ratio being 12.67 (table 2). Sugar/acidity ratio was greater in Maxut (13.72) compared with Galata (11.07) (table 2).

Making bitter cherry chromatograms of samples taken to study indicated the presence of protocatehic acid which is the phenolic compound with the highest proportion of both Galata and Maxut cultivars and also of Boambe de Cotnari, the sweet cherry cultivars taken as control. The highest proportions were identified syringic, p-cumaric and chlorogenic acids and also epicatechin.

Table 3

The main phenolic compounds identified in some sweet and bitter cherry cultivars (2009)

Phenolic compounds	Cultivar (mg/L)			
	Galata	Boambe de Cotnari	Maxut	±SD
Protocatehic acid	15.41	15.45	15.83	0.23
Vanillic acid	0.31	1.85	0.42	0.86
Rutin	nd	nd	3.43	-
Gallic acid	1.13	1.07	1.10	0.03
Catechin	1.93	1.83	2.54	0.38
Siringic acid	3.08	1.74	5.68	2.0
Epicatechin	6.01	5.53	4.59	0.72
Salicylic acid	nd	0.21	nd	-
Gentisic acid	1.29	1.03	0.98	0.16
Chlorogenic acid	3.93	4.52	4.05	0.31
P-cumaric acid	4.68	5.00	5.09	0.22
Trans resveratrol	nd	nd	2.52	-

In small proportions were identified: catechin, gallic acid, ferulic acid (table 3). Maxut is a bitter cultivar with darkish to brown skin color, so trans-resveratrol and rutin (quercetin-3-rutinoside) was identified in a proportion of 3.43 mg/L, respectively 2.52 mg/L. This phenolic compounds wasnt identified in the fruits composition of Galata which has bicolored skin color or at Boambe de Cotnari also with bicolored skin color but with sweet taste (table 3). Trans-resveratrol and rutin (quercetin-3-rutinoside) are role in body health. Resveratrol prevents the development of skin cancer, have an antinflammator effect and can treat arthritis diseases in high doses (Chaovanalikit & Wrolstad, 2004). Rutin has a role in protecting blood vessels, improves circulation and acts as an antioxidant (Chaovanalikit & Wrolstad, 2004, Budan, 2008). Compared with sweet cherry cultivar Boambe de Cotnari as control, bitter cherry cultivars have been a large quantities of syringic acid as follows: 3.08 mg/L at Galata and 5.68 mg /L to Maxut.

During maturation, the fruit has an uniform growing at Galata from one phase to another (table 5), while at Maxut the fruit has a slower growth in the last stage of maturation mean in the last 6 days before harvesting, from 2.17 g to 2.72 g.

Table 5

**Dynamics of fruit size during maturation of bitter cherry cultivars Galata and Maxut (2009)**

Characteristics	Cultivar (average on 3 repetitions $\pm$ SD)							
	Galata				Maxut			
	Stage I	Stage II	Stage III	Stage IV	Stage I	Stage II	Stage III	Stage IV
Equatorial diameter (mm)	12,27 $\pm$ 0,10	15,63 $\pm$ 0,45	17,07 $\pm$ 0,03	17,37 $\pm$ 0,69	10,95 $\pm$ 0,29	12,37 $\pm$ 0,29	14,33 $\pm$ 0,15	15,73 $\pm$ 0,46
Fruit weight (g)	1,57 $\pm$ 0,05	2,74 $\pm$ 0,01	3,46 $\pm$ 0,05	4,23 $\pm$ 0,02	1,08 $\pm$ 0,07	1,53 $\pm$ 0,05	2,17 $\pm$ 0,03	2,72 $\pm$ 0,20

In terms of sensory, Galata has bicolored skin color with yellowish flesh color and a moderate bitter taste (table 6). Maxut has dark brown skin and flesh color, with intensely bitter taste and pronounced flavor.

Table 6

**Sensory characteristics of fruit at bitter cherry cultivars Galata and Maxut**

Characteristics	Cultivar	
	Galata	Maxut
Skin color	Bicolor	Dark brown
Flesh color	White yellow	Dark brown
Bitter taste	Medium	Intense
Aroma	Medium	Intense

## CONCLUSIONS

Galata and Maxut are bitter cherry with valuable potential for organic farming on small surfaces.

In terms of physico-chemical composition, bitter cherry cultivars studied have a high content in phenolic compounds, representing a significant antioxidant source.

Galata is valuable for processing into jams compared to other cultivars because of pulp and skin fruit color and higher fine bitterness. Maxut has value in processing into liquors, syrups and jams but also in food colorants industry due to the intense color of the fruits with intense bitter taste, high in carbohydrate content and enhanced flavor.

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# THE CADASTRAL CHANGES THAT OCCURRED IN TIME OVER THE PARCELS OF THE VINEYARD UNIT VINIFRUCT COPOU COMPANY – LIMITROPHE TO THE INSIDE OF THE CITY OF IASI

## SCHIMBĂRILE CADASTRALE SURVENITE ÎN TIMP ASUPRA PARCELELOR DIN UNITATEA VITICOLĂ SOCIETATEA COMERCIALĂ VINIFRUCT COPOU – LIMITROFĂ INTRAVILANULUI MUNICIPIULUI IAȘI

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**Abstract.** *Key objectives for the vineyard unit Vinifruit Copou Company are drawing the location and cadastral delimitation plan and achieving the database of agricultural cadastre, based on topographic measurements and cadastral documentations, accordingly with the standard of the Cadastre and Land Registration Office Iasi. The update of the existing cartographic documents for the studied area is required in order to observe the changes that occurred in time over the parcels cadastral situation. For example, the most obvious changes have occurred since the inclusion of the vineyard unit in the inside of the city of Iasi, due to the process of urbanization of the area.*

**Key words:** agricultural cadastre, cadastral plan, cadastral parcels.

**Rezumat.** *Obiectivele principale pentru unitatea viticolă societatea comercială Vinifruit Copou constau în întocmirea planului de amplasament și delimitare cadastrală și realizarea bazei de date a cadastrului agricol, pe baza măsurătorilor topografice și a documentațiilor de carte funciară, avizate de Oficiul de Cadastru și Publicitate Imobiliară Iași. Actualizarea documentelor cartografice existente pentru zona de studiu este necesară pentru a se putea observa modificările survenite în timp asupra situației cadastrale a parcelelor. De exemplu, transformările cele mai evidente au apărut din momentul includerii unității viticole în intravilanul Municipiului Iași, datorită procesului de urbanizare al zonei.*

**Cuvinte cheie:** cadastru agricol, plan cadastral, parcele cadastrale.

## INTRODUCTION

The case study is the vineyard unit Vinifruit Copou Company, with an area of 111 hectares. The unit is located in the North-West of the City of Iasi, between Viticultori Street at North, Didactic Resort Adamachi Farm Iasi at North-East, the former buildable area of Iasi at East, South and South-West, the commune Valea Lupului at South-West and the former pasture of The Cooperative Farm at West and North-West. The form of management and organization was still preserved after the privatization of the Copou State Agricultural Enterprise, because it has

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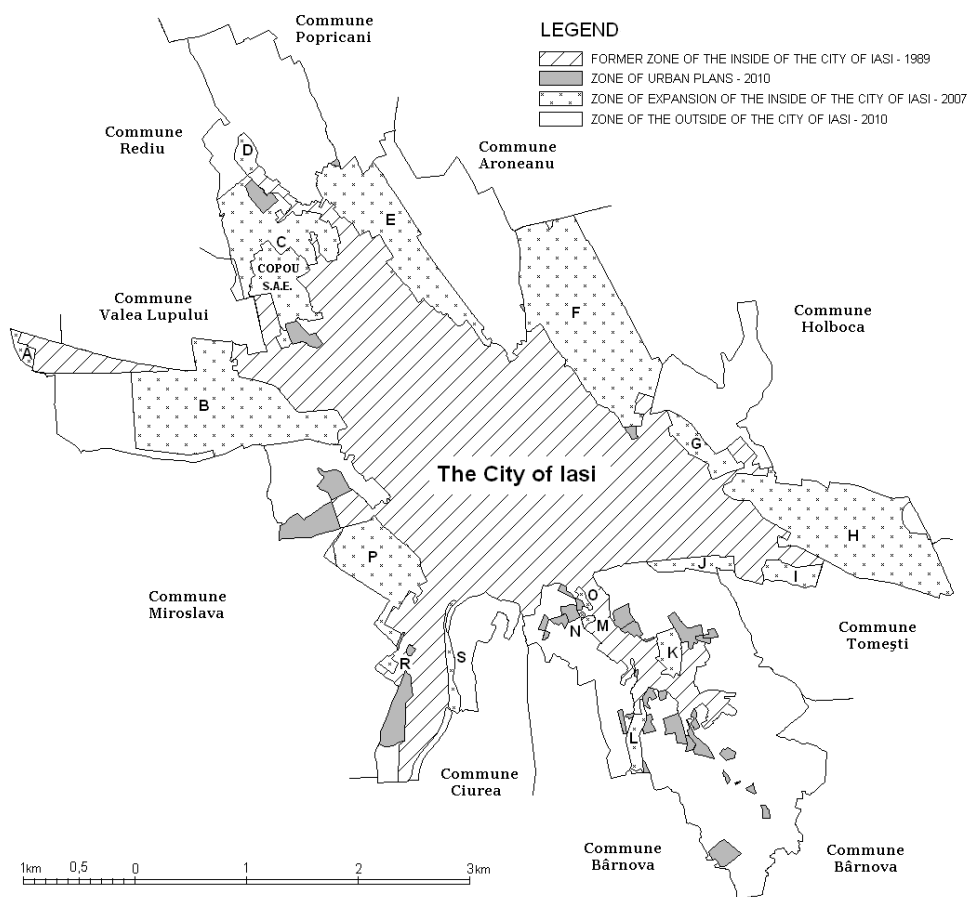
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been taken over the lease contracts of the owners to which it was recognized the right of ownership, according to the Law No. 18/1991.

## MATERIAL AND METHOD

According to the cadastral records of the City Hall of Iasi, in 1989, the built-up area of the City of Iasi was 3679 hectares, so that afterwards the territory of Iasi Municipality was modified, in the following steps (figure 1):

- in 2005, the total area of the City of Iasi was 9366 hectares, following some changes of the outside and inside of the City of Iasi limits, related to the year 1989;
- in 2007, the inside of the City of Iasi expanded with 2382 hectares, by creating 18 expansion areas, denoted by letters from A to S;
- until 2010, the buildable area of the inside of the City of Iasi has increased with another 248 hectares, by approving of 37 urban plans;
- in 2010, the area of the expanded inside of the City of Iasi has reached 6309 hectares, and the area of the outside of the City of Iasi has reached 3057 hectares, dispersed in 14 areas.



**Fig. 1 - The map of the areas of the inside and the outside of the City of Iasi**

By including the expansion areas and urban plans in the former inside of the city, the occupation degree has reached to 67.36% in 2010, related to 39.28% in 1989.

Based on the topographic measurements from 2004 (Huțanu Cr., Nistor Gh., 2010) and on the identification of the numbers and categories of use of the parcels from the 1989's cadastral plan were obtained, for the studied vineyard unit, the topographic and cadastral data presented in figure no. 2 (Huțanu Cr., Moca V., 2010).

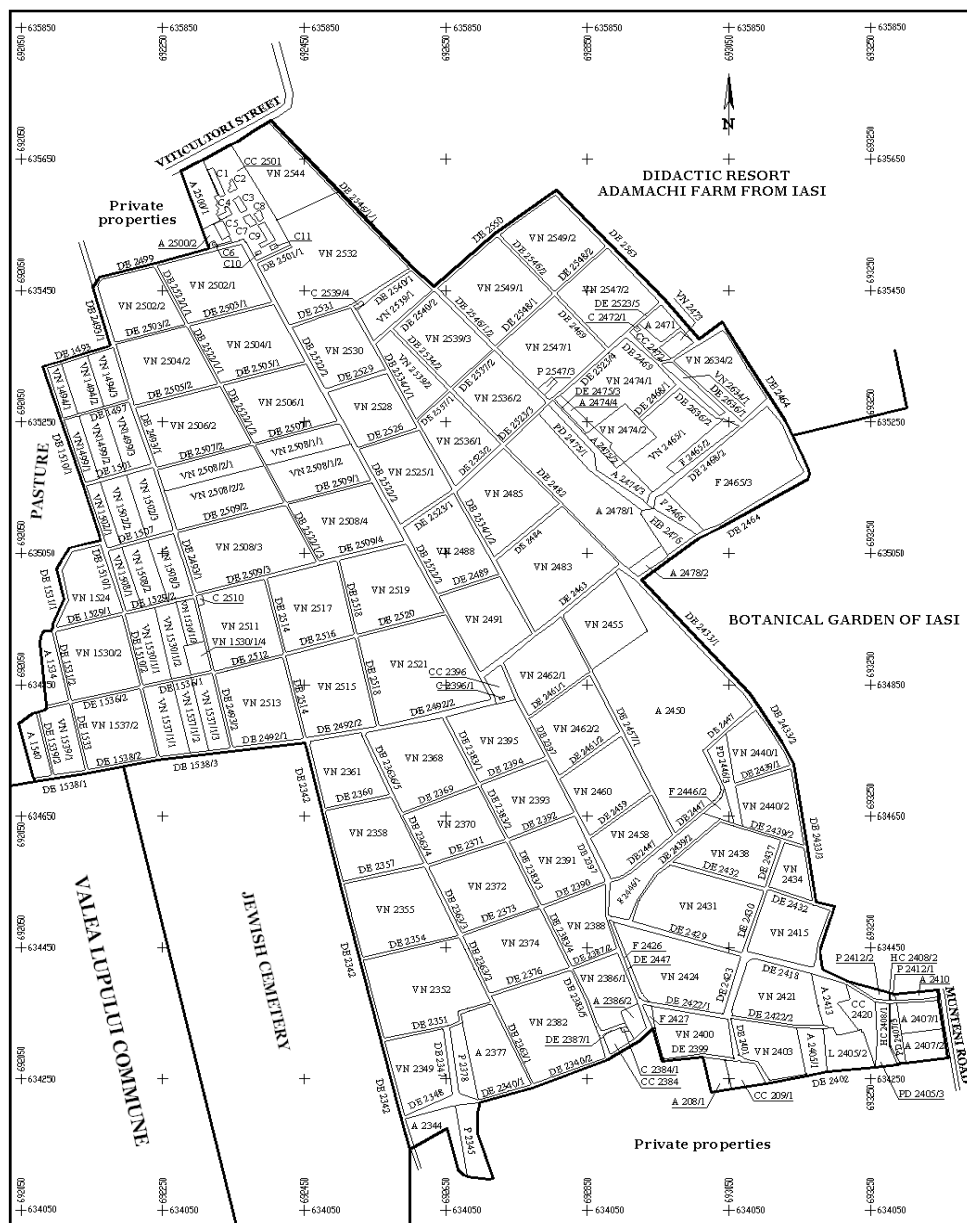


Fig. 2 - Drawing the location and cadastral delimitation plan for the vineyard unit

## RESULTS AND DISCUSSIONS

Updating the location and cadastral delimitation plan and the cadastral situation for the vineyard unit (1989 – 2010):

### ➤ The initial cadastral situation (1989)

According to the cadastral plan from 1989, for the 111 hectares under management and operation of the former Copou State Agricultural Enterprise was obtained the cadastral situation of the parcels presented in the table 1.

Table 1

**1989's Cadastral Situation of the Parcels from the Vineyard Unit by the Category of Use of the Land**

No.	Use category of the land	Plots number	Plots area	
			ha	%
1	Arable (A)	20	6,0107	5,41
2	Pasture (P)	5	0,6828	0,61
3	Hay (F)	7	2,9216	2,63
4	Noble vine (VN)	67	88,7598	79,92
5	Orchard(L)	1	0,3641	0,33
6	Forest(PD)	4	0,8941	0,81
7	Lakes and natural puddles (HB)	1	0,2511	0,23
8	Channels (HC)	2	0,0250	0,02
9	Service roads (DE)	77	9,2241	8,31
10	Yards and constructions (CC)	8	1,9251	1,73
<b>TOTAL ON VINEYARD UNIT</b>		<b>192</b>	<b>111,0584</b>	<b>100,00</b>

### ➤ First stage of updating the cadastral data (1989 – 2004)

On the basis of topographic measurements from 2004, made for the vineyard unit, could be observed how, by fragmentation, the number of parcels increased with 41.67%, by the application of Law No. 18/1991 (table 2).

Table 2

**Cadastral Situation of the Parcels from the Vineyard Unit, by the Category of Use of the Land, for the period 1989-2004**

No.	Use category of the land	Plots number	Plots area	
			ha	%
1	Arable (A)	21	10,0698	9,07
2	Pasture (P)	5	0,6828	0,61
3	Hay (F)	7	2,9216	2,63
4	Noble vine (VN)	97	83,9482	75,59
5	Orchard (L)	1	0,3641	0,33
6	Forest (PD)	4	0,8941	0,81
7	Lakes and natural puddles (HB)	1	0,2511	0,23
8	Channels (HC)	2	0,0250	0,02
9	Service roads (DE)	126	9,9766	8,98
10	Yards and constructions (CC)	8	1,9251	1,73
<b>TOTAL ON VINEYARD UNIT</b>		<b>272</b>	<b>111,0584</b>	<b>100,00</b>

The area of the service roads increased with 0.7525 hectares (7.54%), because by decreasing the surface of those 10 vine parcels had been established 10 new roads, necessary for permitting the access for people on the parcels for which it was recognized the right of ownership, according to the Law No.18/1991.

➤ **Second stage of updating the cadastral data (2004 – 2008)**

Due to the 2008's update of the cadastral data of the parcels (table 3), on the basis of the dismemberments recorded on Cadastre and Land Registration Office, were made the following observations:

- between 1989 and 2007, while the vineyard unit was part of the outside of the City of Iasi, by fragmentation, the number of parcels increased with 45%;
- since the beginning of putting into practice of the Law No. 18/1991 until 2004, by fragmentation, the number of parcels increased with 43.33%;
- between 2004 and 2007, by fragmentation, the number of parcels increased with only 1.66%, because of the different steps of expansion process of the inside of the City of Iasi, the landowners increased prices and the potential buyers waited for the completion of that process;
- since the first year when the vineyard unit was included in the buildable area of the City of Iasi, by fragmentation, the number of parcels increased with 59.27%.

Table 3

**Cadastral Situation of the Parcels from the Vineyard Unit, by the Category of Use of the Land, for the period 2004 – 2008**

No.	Use category of the land	Plots number	Plots area	
			ha	%
1	Arable (A)	21	10,0698	9,07
2	Pasture (P)	5	0,6828	0,60
3	Hay (F)	7	2,9216	2,63
4	Noble vine (VN)	209	83,6351	75,31
5	Orchard (L)	1	0,3641	0,33
6	Forest (PD)	4	0,8941	0,81
7	Lakes and natural puddles (HB)	1	0,2511	0,23
8	Channels (HC)	2	0,0250	0,02
9	Service roads (DE)	131	10,2897	9,27
10	Yards and constructions (CC)	8	1,9251	1,73
<b>TOTAL ON VINEYARD UNIT</b>		<b>389</b>	<b>111,0584</b>	<b>100,00</b>

Then, for the first time, the fragmentation of the parcels was due to the desire of landowners to form, by dismemberment, lots for future houses (Huțanu Cr., Moca V., 2010).

➤ **Third stage of updating the cadastral data (2008 – 2010)**

According to the records of the **General Technical Cadastre**, in table 4, appear three new categories of use: shrubs and briers, green spaces and unproductive land.

Table 4

**Cadastral Situation of the Parcels from the Vineyard Unit, by the  
Category of Use of the Land, for the period 2008 – 2010**

No.	Use category of the land	Plots number	Plots area	
			ha	%
1	<b>Arable (A)</b>	43	4,5629	4,11
2	<b>Pasture (P)</b>	5	0,7037	0,63
3	<b>Hay (F)</b>	14	2,1013	1,89
4	<b>Noble vine (VN)</b>	323	87,0417	78,44
5	<b>Orchard (L)</b>	4	0,7001	0,63
6	<b>Forest (PD)</b>	3	0,3175	0,29
7	<b>Shrubs and briers (PDT)</b>	1	0,0062	0,01
8	<b>Lakes and natural puddles (HB)</b>	1	0,2555	0,23
9	<b>Channels (HC)</b>	2	0,0274	0,03
10	<b>Roads-streets (DS)</b>	219	10,8191	9,75
11	<b>Yards and constructions (CC)</b>	33	3,4716	3,13
12	<b>Green spaces (CP)</b>	8	0,2561	0,23
13	<b>Unproductive lands(N)</b>	4	0,6990	0,63
<b>TOTAL ON VINEYARD UNIT</b>		<b>660</b>	<b>110,9621</b>	<b>100,00</b>

This modifications, materialized in the last two years by the removal from the agricultural circuit of a number of 26 parcels and the tabulation of 27 new constructions, may lead to the conclusion that the process of urbanization of the area has begun.

The 1% changes which occurred for the entire surface of the vineyard unit (0.0963 hectares) is due to the fact that the limit of the zone that makes the object of this study it is not materialized in the field.

## CONCLUSIONS

1. By fragmentation, the number of parcels increased with 45%, while the vineyard unit was included in the outside of the City of Iasi (1989 – 2007), and in the next four years, with 129%, when the vineyard unit was integrated in the inside of the City of Iasi, due to the process of urbanization of the zone.

2. In the next years there can be the possibility that, while the process of fragmentation of the parcels stagnates, to amplify the process of changing the categories of use, especially for the plots designated to the future houses.

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# THE ADOPTION OF SOME LOCAL STEREOGRAPHIC PROJECTIONS IN THE GENERAL CADASTRE WORK FROM GEOGRAPHICALLY EXTREME LOCALITIES OF ROMANIA

## ADOPTAREA UNOR PROIECȚII STEREOGRAFICE LOCALE ÎN LUCRĂRILE DE CADASTRU GENERAL DIN LOCALITĂȚILE GEOGRAFICE EXTREME ALE TERITORIULUI ROMÂNIEI

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**Abstract.** *The geographical position of Romania is framed by the following extremes represented by these localities: in the North, Horodiștea village in Botoșani County; in the South, the city of Zimnicea in Teleorman County, in the East, the city of Sulina in Tulcea County and the village Beba Veche, in Timiș County, in the West. The relative linear deformations for large scale representations of the stereographic projections -1970 have indicated high and very high values in the case of these four localities, as following: 24 cm/km at Horodiștea, 19 cm/km at Zimnicea, 63 cm/km at Sulina and 58 cm/km at Beba Veche. For each locality was adopted a local secant stereographic plan, different from the unique secant plan – 1970 so as to reduce the distance deformations.*

**Key words:** stereographic projections -1970, local stereographic projections.

**Rezumat.** *Poziția geografică a României este încadrată de către următoarele patru puncte ale zonelor extreme, care sunt reprezentate de următoarele localități: satul Horodiștea, județul Botoșani, la Nord; orașul Zimnicea, județul Teleorman la Sud; orașul Sulina, județul Tulcea la Est și comuna Beba Veche, județul Timiș, la Vest. Deformațiile liniare relative determinate pentru reprezentările la scări mari ale proiecției Stereografice-1970, au evidențiat valori mari și foarte mari, în cazul celor patru localități, după cum urmează: 24 cm/km la Horodiștea, 19 cm/km la Zimnicea, 63 cm/km la Sulina și 58 cm/km la Beba Veche. Pentru fiecare localitate a fost adoptat, câte un plan stereografic secant local, diferit de planul secant unic - 1970, în vederea reducerii deformațiilor distanțelor.*

**Cuvinte cheie:** proiecția stereografică-1970, proiecție stereografică locală.

## INTRODUCTION

The Stereographic projection on unique sectional plane - 1970, complies with the basic cadastral plan drawn up for all administrative units in Romania, where the **relative linear deformations** do not exceed  $\pm 5$  cm/km in the city and  $\pm 15$  cm/km outside the city (Moca V. and Oniga Valeria-Ersilia, 2010; Săvulescu C. and Moldoveanu C., 1997). In the case of territorial units, where the relative linear deformations exceed these values the use of **local stereographical projections** is

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required, leading to reduction and/or cancellation of lengths and surface deformation (Moca, V. and Oniga Ersilia Valeria, 2011).

## MATERIAL AND METHOD

The introduction and maintenance of general survey on the administrative-territorial units in the Stereographic projection - 1970 is made based on digital and analog cadastral plans. *The European Terrestrial Reference System-1989* (Dragomir P. I., Rus T. and Dumitru D., 2005; European Terrestrial Reference System, 2009) was adopted since 2009, using satellite positioning technology to the *National Geodetic Network* points. By using the conform representation the maintenance of undistorted representation of angles is ensured, but the lengths and areas are distorted, according to position of points considered to pole projection of Stereographical projection-1970.

Romania's geographical position is delimited in areas of extreme stateborders, by the following locations (Statistical Yearbook of Romania, 2009): **Horodistea** village, Botosani County in North, **Zimnicea** city, Teleorman county at South, **Sulina** city, Tulcea County in East and **Beba Veche** village, Timis county in west (figure1).

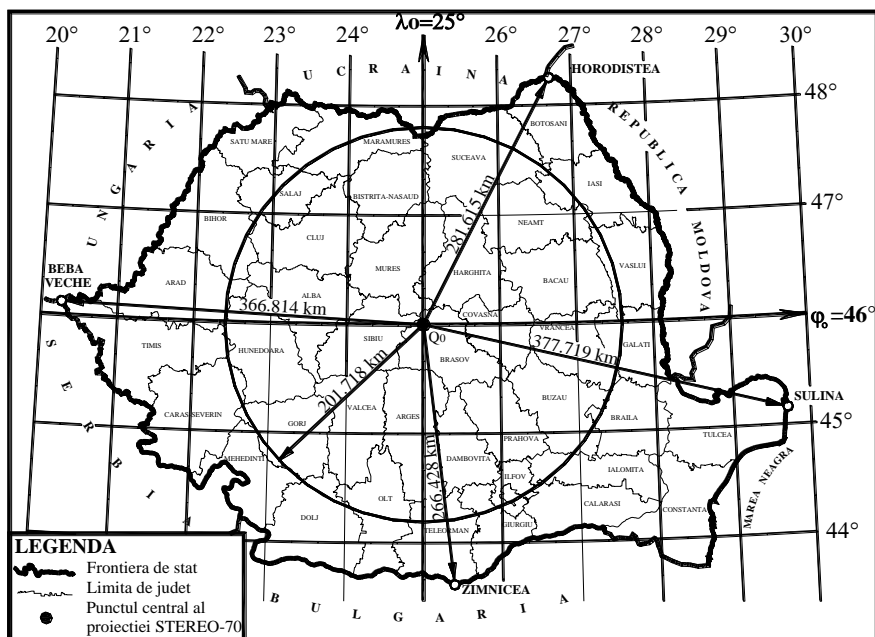


Fig. 1 – Points position of extreme areas of the Romanian territory, relative to the Stereographical projection pole – 1970

Length and surface deformation analysis of extreme points and the bounding trapezoids geodetic mapping, scale 1:5000 was performed according to the spatial variation of the following parameters: linear deformation module ( $\mu$ ), the relative linear deformation ( $D$ ) areolar strain module ( $p = \mu^2$ ), total areolar strain ( $\Delta S = S - T$ ) where:  $S$  – area of the trapezoid from secant plane -1970;  $T$  – trapezoid area on the official reference ellipsoid Krasovski – 1940.



For each of the four points/trapezes, a **local stereographical projection system** was adopted, derived from the Stereographical projection – 1970. Next, the following elements were calculated: local secant plane depth, null local deformation radius and coordinates transformation coefficient.

## RESULTS AND DISCUSSIONS

For length and surface deformations calculation of the four points (localities) of Romanian territory were used plan stereographical coordinates of the geodetic trapezoids corners, scale 1:5000, with 1'15" latitude and 1'52",5 longitude dimensions. Framing mapping of the four extreme geographical areas included four trapezes, scale 1:5000, with the nomenclature M-35-138-Ab-4-III (Horodistea) K-35-15-BB-3-I (Zimnicea) L-34-65-Yes-3-I (Beba Veche) and L-35-108-Cb-2-I (Sulina).

### 1. Plan stereographical coordinates - 1970 of the trapezoid corners

Geographic coordinates conversion of the trapezoids corners from Krasovski reference ellipsoid – 1940, to stereographical coordinates – 1970, was made by using formulas with constant coefficients method.

**In the first stage** were determined stereographical coordinates of "*tangent plane*", parallel to "*the secant plane*", according to difference in **latitude (l)** and **longitude (l)** of the pole projection  $Q_0 (\varphi_0, \lambda_0)$  and the considered point  $P_i(\varphi_i, \lambda_i)$ , using constant coefficients of general form (**aij, bij**):

$$\begin{aligned} X_{tg} < 70 > = & (a_{00} + a_{10}f + a_{20}f^2 + a_{30}f^3 + a_{40}f^4 + a_{50}f^5 + a_{60}f^6) 1,000 + \\ & + (a_{02} + a_{12}f + a_{22}f^2 + a_{32}f^3 + a_{42}f^4) l^2 + \\ & + (a_{04} + a_{14}f + a_{24}f^2) l^4 + \\ & + (a_{06} + \dots) l^6 \end{aligned} \quad [m]$$

$$\begin{aligned} Y_{tg} < 70 > = & (b_{01} + b_{11}f + b_{21}f^2 + b_{31}f^3 + b_{41}f^4 + b_{51}f^5) l + \\ & + (b_{03} + b_{13}f + b_{23}f^2 + b_{33}f^3) l^3 + \\ & + (b_{05} + b_{15}f + \dots) l^5 \end{aligned} \quad [m]$$

**In the second stage** stereographical rectangular coordinates transformation was performed, from the "*tangent plane*" to "*secant plane*" according to the scale reduction factor (**C = 0.999750**), with the following relations:

$$X_{sec} < 70 > = X_{tg} < 70 > \times 0,999750$$

$$Y_{sec} < 70 > = Y_{tg} < 70 > \times 0,999750$$

Stereographical rectangular coordinates of the "*secant plane*" were expressed in the official system, with translated origin by adding the values of **500 000 m** to both coordinates:

$$X < 70 > = X_{sec} < 70 > + 500\,000,000\,m;$$

$$Y < 70 > = Y_{sec} < 70 > + 500\,000,000\,m.$$

Geographical ellipsoidal and Stereographical – 1970 coordinates of the four trapeze's corners, scale 1:5000, respectively, of the extreme points (localities) of the Romanian territory are presented in table 1.

Table 1

**Geographical and Stereographical-1970 coordinates of the trapezoids corners and extreme points of Romanian territory**

No. and point name	Geographic		Stereographic Coordinates (m)	
	$\varphi (^{\circ} \prime \prime)$	$\lambda (^{\circ} \prime \prime)$	X < 70 >	Y < 70 >
<b>Trapezoid: M-35-138-A-b-4-III</b>				
1 - North West	48 16 15	26 41 15	753 783. 230	625 284. 038
2 - North East	48 16 15	26 43 07.5	751 466. 607	625 334. 063
3 - South West	48 15 00	26 41 15	753 833. 790	627 603. 902
4 - South East	48 15 00	26 43 07.5	751 517. 182	627 654. 853
<b>Horodiștea</b>	<b>48 15 06</b>	<b>26 42 05</b>	<b>751 674. 291</b>	<b>626 361. 492</b>
<b>Trapezoid: K-35-15-B-b-3-I</b>				
1 - North West	43 37 30	25 22 30	236 164. 358	530 271. 954
2 - North East	43 37 30	25 24 22.5	236 176. 482	532 794. 607
3 - South West	48 36 15	25 22 30	233 849. 228	530 282. 634
4 - South East	48 36 15	25 24 22.5	233 861. 354	532 806. 177
<b>Zimnicea</b>	<b>43 37 07</b>	<b>25 23 32</b>	<b>235 460. 937</b>	<b>531 665. 642</b>
<b>Trapezoid: L-34-65-D-a-3-I</b>				
1 - North West	46 07 30	20 15 00	524 849. 404	133 080. 612
2 - North East	46 07 30	20 16 52.5	524 705. 650	135 493. 034
3 - South West	46 06 15	20 15 00	522 536. 449	132 942. 341
4 - South East	46 06 15	20 16 52.5	522 392. 666	135 355. 674
<b>Beba Veche</b>	<b>46 07 27</b>	<b>20 15 44</b>	<b>524 700. 549</b>	<b>134 018. 612</b>
<b>Trapezoid: L-35-108-C-b-2-I</b>				
1 - North West	45 10 00	29 41 15	418 169. 295	868 346. 097
2 - North East	45 10 00	29 43 07.5	418 313. 395	870 800. 270
3 - South West	45 08 45	29 41 15	415 856. 452	868 481. 434
4 - South East	45 08 45	29 43 07.5	416 000. 579	870 936. 511
<b>Sulina</b>	<b>45 09 36</b>	<b>29 41 24</b>	<b>417 440. 673</b>	<b>868 585. 768</b>

## 2. Regional length and surface deformations

Secant plane deformation analysis of the Stereographical projection – 1970, was made for extreme points (localities) that enclose Romania, along the cardinal points. Calculation of deformation modules of length ( $\mu$ ) and relative linear deformations (D) was determined using the following relationships:

$$\mu = D_0 + \frac{L^2}{4R_0^2} \quad [km / km] \quad si \quad D = (\mu - 1) \cdot 10^5 \quad [cm / km]$$

where:  $D_0 = -0.000250$  km / km is the deformation length of projection pole;

$L^2 = (X^2 + Y^2)$  is the distance between the projection pole ( $Q_0$ ) and the given point ( $P_i$ );

$R_0 = 6378.956681$  km is the average radius curvature of the reference ellipsoid Krasovski - 1940, for latitude  $\varphi_0 = 46^{\circ} 00'00''$  North.

Relative linear deformations (D) have ranged between **+18.6 cm/km minimum** in the southern extremity (Zimnicea town) and a **maximum** of **+62.7**

**cm/km** in the eastern extremity (Sulina town), based on size of the distance between analyzed points and the projection pole (table 2).

Table 2

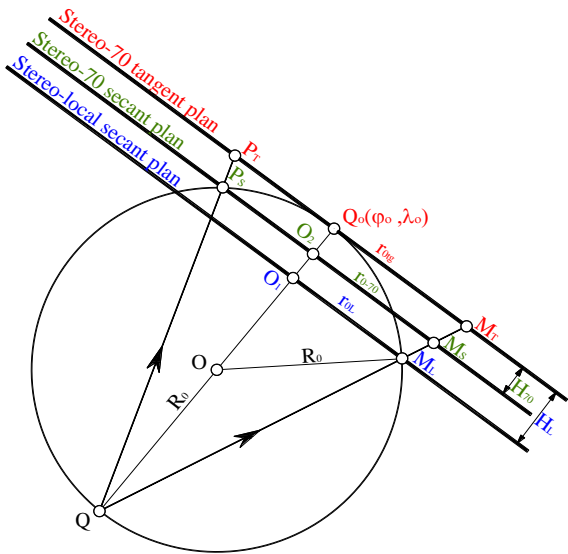
**Length and surface deformations of extreme points (localities) of Romanian territory, in Stereographic projection – 1970**

Trapezoid and location name	Lenght deformations		Area deformations	
	$\mu$	D	$p = \mu^2$	$\Delta S = (S-T)$
	-	cm/km	-	ha
Horodișteea M-35-138-A-b-4-III	1.000237251	23.7	1.000474558	0.2584
Zimnicea K-35-15-B-b-3-I	1.000186113	18.6	1.000372261	0.2191
Beba Veche L-34-65-D-a-3-I	1.000576671	57.7	1.001153675	0.6441
Sulina L-35-108-C-b-2-I	1.000626553	62.7	1.001253499	0.7195

Total areola deformations ( $\Delta S$ ) of trapezoids areas from secant plane of Stereographical projection–1970, showed values between **2191 m<sup>2</sup>**, in Zimnicea’s trapeze and **7195 m<sup>2</sup>** in Sulina’s trapeze, depending on the distance between the central point of the given trapeze and the projection pole (table 2).

### 3. Characteristic elements of local Stereographical projections

For the extreme border localities of the Romanian territory: Horodistea, Zimnicea, Beba Veche and Sulina local stereographical projections derived from the Stereographical projection – 1970 were adopted (figure 2).



**Fig. 2 –** The geometric elements ( $H_L$ ,  $r_{0L}$ ) and the stereographic local secant plan position, compared to the tangent and unique secant projection plans ( $H_{70}$ ,  $r_{0-70}$ )

To calculate the characteristic elements of the four local stereographical projection systems were used the Stereographical-1970 coordinates of the  $M_L$  points from the middle of four trapezes, scale 1:5000, which enclose extreme geographical areas of the Romanian territory. Thought  $M_L$  points “the secant plane” of each, local stereographical projection in depth system ( $H_L$ ) was plotted, parallel to the unique secant plane – 1970 (figure 2).

**In the first stage** transcalculation parameters of the plan coordinates of stereographical – 1970 system, in the local stereographical system and vice versa were determined based on browsing the following specific operations:

- **Stereographical-1970 coordinates calculation of the points ( $M_L$ )** from the middle of trapezoids, scale 1:5000, based on the location of the four corners (1, 2, 3, 4), with expressions:

$$X_{ML}\langle 70 \rangle = \frac{X_1\langle 70 \rangle + X_2\langle 70 \rangle + X_3\langle 70 \rangle + X_4\langle 70 \rangle}{4}$$

$$Y_{ML}\langle 70 \rangle = \frac{Y_1\langle 70 \rangle + Y_2\langle 70 \rangle + Y_3\langle 70 \rangle + Y_4\langle 70 \rangle}{4}$$

- **Stereographical – 1970 coordinates calculation on unique secant plane of the points ( $M_L$ )**, by cancellation of official translation of the coordinate axes.

$$X < 70 >_{\text{sec}} = X < 70 > - 500\,000,000 \text{ m}$$

$$Y < 70 >_{\text{sec}} = Y < 70 > - 500\,000,000 \text{ m}$$

- **Stereographical coordinates calculation on tangent plane of the points ( $M_L$ )**, with return to scale coefficient ( $C' = 1.000250063$ ).

$$X < 70 >_{\text{tg}} = 1,000250063 \times (X < 70 >_{\text{sec}})$$

$$Y < 70 >_{\text{tg}} = 1,000250063 \times (Y < 70 >_{\text{sec}})$$

- **Distance calculation between pole projection  $Q_0$  ( $X_0$ ,  $Y_0$ ) and the considered point  $M_L$  ( $X < 70 >_{\text{tg}}$ ,  $Y < 70 >_{\text{tg}}$ )**, from the plane tangent -1970.

$$r_{0tg} \equiv r_{0L} = \sqrt{\left(X_{ML}\langle 70 \rangle_{tg} - X_0\right)^2 + \left(Y_{ML}\langle 70 \rangle_{tg} - Y_0\right)^2}$$

- **Regional strain calculation** along the length of 1 km, in the tangent plane.

$$\Delta r_{tg} = \frac{r_{0tg}^2}{4R_0^2} = \frac{\left(X_{ML}\langle 70 \rangle_{tg} - X_0\right)^2 + \left(Y_{ML}\langle 70 \rangle_{tg} - Y_0\right)^2}{4R_0^2}$$

- **Reduction coefficient scale calculation ( $U_{ML}$ )** from the tangent plane in the local secant plane, according to regional deformation.

$$U_{ML} = 1,000\,000 \text{ km} - \Delta r_{tg}$$

- **Calculation of transformation coefficient ( $K_{ML}$ )**, coordinates from unique secant-stereographical plan - 1970, in the local stereographical plan and vice versa:

$$K_{ML} = U_{ML} / 0,999\,750$$

Official and local Stereographical coordinates transcalculation parameters from a system to another system (**U and K**) are presented in table 3.

Table 3

**Transcalculation parameters of coordinates from stereographic-1970 system to local stereographic system and vice versa**

Place name and nomenclature trapezoid	Transcalculation parameters	Geometrical elements of local stereographical projections		Area deformations	
		$H_L$ [m]	$r_{0L}$ [km]	Stereo-70 secant plan	Stereo local secant plan
	U/K			$\Delta S = (S-T)$ ha	$\Delta S = (S-T)$ ha
Horodiștea M-35-138-A-b-4-III	0.999509/ 0.999759	6260.155	282.537	+ 0.2584	- 0.0004
Zimnicea K-35-15-B-b-3-I	0.999562/ 0.999812	5584.652	266.866	+ 0.2191	- 0.0002
Beba Veche L-34-65-D-a-3-I	0.999174/ 0.999424	10536.338	366.484	+ 0.6441	- 0.0009
Sulina L-35-108-C-b-2-I	0.999118/ 0.999368	11254.287	378.754	+ 0.7195	- 0.0007

**In the second stage** were determined geometrical elements of the four stereographical projection systems throughout the local secant plane as follows:

- **Local secant plane depth ( $H_L$ )**, corresponding to the central point of the trapezoid ( $M_L$ ) of the considered administrative-territorial unit.

$$H_L = 2R_o(1 - K_{ML} \cdot C) \text{ m}$$

- **Circle radius of null strain of local secant plane ( $r_{0L}$ )**, expressed in terms of depth to local secant plane ( $H_L$ ), with the following ratio:

$$r_{0L} = \sqrt{R_o^2 - (R_o - H_L)^2} \text{ km}$$

**Geometrical elements ( $H_L$   $r_{0L}$ )** which were determined in case of using the local Stereographic projection systems are shown in table 3.

**In the third stage** was made rectangular plan coordinates transformation from secant - 1970 plane to local secant plane and vice versa, as follows:

- **Direct transformation of the coordinates** from secant plane of Stereographic projection-1970 to secant plane of local stereographical projection, taking into account the translation system of axes and the coefficient (**K**):

$$\begin{cases} X_M \langle L \rangle = X_M \langle 70 \rangle \cdot K + 500\,000,000 \text{ m} \cdot (1 - K) \\ Y_M \langle L \rangle = Y_M \langle 70 \rangle \cdot K + 500\,000,000 \text{ m} \cdot (1 - K) \end{cases}$$

- **Inverse transformation of local Stereographic coordinates** into Stereographic-1970 coordinates of the same point was verified with the relations:

$$\begin{cases} X_M \langle 70 \rangle = X_M \langle L \rangle / K + 500\,000,000 \text{ m} \cdot (K - 1) / K \\ Y_M \langle 70 \rangle = Y_M \langle L \rangle / K + 500\,000,000 \text{ m} \cdot (K - 1) / K \end{cases}$$

Adopting stereographic projections on local secant plane has determined linear and areolar deformations reduction to negligible values (table 3).

Technical documentations which are prepared for embracing the local stereographic projections derived from Stereographic projection – 1970 are considered unique to each locality or territorial - administrative unit. Their defining elements are: **the Stereographic-1970 coordinates of the considered area's central point, transcalculation coefficient of coordinates, the formulas used for direct and inverse coordinate transformation.**

## CONCLUSIONS

1. Analysis of regional length deformations has been highlighted depending on the position of the border points in Romania, in relation to the Stereographic - 1970 projection pole, using the following values of relative linear deformations: **+19 cm/km** (Zimnicea), **+24 cm/km** (Horodistea), **+58 cm/km** (Beba Veche) and **+63 cm/km** (Sulina);

2. Total areolar surface deformations of trapezoid mapping areas of border localities, showed the same spatial variation in length, as evidenced by the values: **+2191 m<sup>2</sup>** (Zimnicea) **+2584 m<sup>2</sup>** (Horodistea) **+6441 m<sup>2</sup>** (Beba Veche) and **+7195 m<sup>2</sup>** (Sulina);

3. Projection systems adopted on a local Stereographic secant plane, parallel to the secant plane of Stereographical projection - 1970, has significantly reduced lengths and surface deformation to negligible values, which ensures high precision calculation of surfaces in the work input and maintenance of the general cadastre.

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# SOIL WATER DYNAMIC AND DISTRIBUTION WHEN USING BLEEDING IRRIGATION ON MODERATE SLOPES IN THE HILLY PLAIN OF JIJIA

## DINAMICA SI DISTRIBUȚIA APEI IN SOL LA APLICAREA UDĂRII PRIN PICURARE PE TERENURILE MODERAT INCLINATE DIN CÂMPIA COLINARĂ A JIJIEI

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**Abstract.** *The bleeding irrigation method has extended and improved in Romania due to its numerous advantages: water and energy savings, full water deficit compensation for plants, lower water losses through direct evaporation at soil surface, tight control of the irrigation standards and of the irrigation standards application. Bleeding irrigation is the most efficient solution for watering vegetables in greenhouses, solariums or in the field, for watering flowers, vine and fruit-bearing trees. It may be used on almost all types of soil, on uneven land and even on slopes. This paper describes water dynamic and distribution when using bleeding irrigation to water vine stock planted on ridges covered by black membrane located on a moderate 15 % slope, with cambium chernozem soil formed on loess deposits.*

**Key words:** drip irrigation, soil moisture, land slope

**Rezumat.** *În România, metoda de irigare prin picurare s-a extins și perfecționat datorită numeroaselor avantaje pe care le prezintă: economie de apă și energie, compensarea în totalitate a deficitului de apă pentru plante, micșorarea pierderilor de apă prin evaporare directă la suprafața solului, asigurarea unui control riguros al normelor de udare și al aplicării acestora. Irigarea prin picurare este soluția cea mai eficientă pentru irigarea culturilor de legume în sere, solarii și în câmp, flori, viță de vie și pomi fructiferi, pretându-se aproape pe orice tip de sol, pe terenurile denivelate și în pantă. În această lucrare se prezintă dinamica și distribuția apei la irigarea prin picurare a butașilor de viță de vie, cultivați pe biloane acoperite cu peliculă neagră amplasate pe un teren cu panta medie de 15 % și pe un sol de tip cernoziom cambic format pe depozite loessoide.*

**Cuvinte cheie:** irigarea prin picurare, umiditatea solului, panta terenului

## INTRODUCTION

As a natural renewable, vulnerable and limited resource, water represents an indispensable element for society, being a determined factor in maintaining the ecologic equilibrium, for life existence and for achieving all the human activities (Filipov F. et al., 2004).

Drip irrigation allows the exact measuring of the water quantity necessary in different stages of plant development. Using these drip hose equipments,

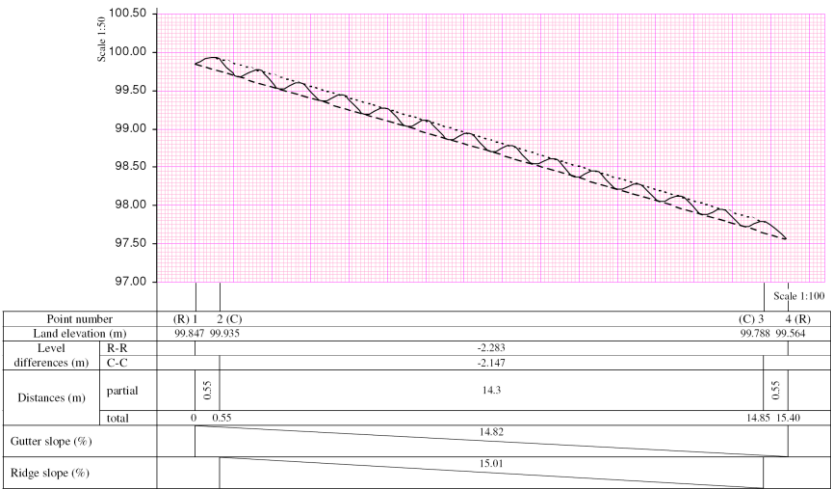
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installations and irrigation systems ensures water and energy economy by distributing water in an uniform manner, drop by drop, using a frequency and proportion appropriate for the plant needs, having the possibility of strictly compensating evapotranspiration and an elaborate control of irrigation norms (Radu O., Filipov F., 2010).

### MATERIAL AND METHOD

Field observations for the purpose of distributing water to drip irrigation have been initiated on the vineyard school located on a sloping land (average slope of 15%) cultivated in ridges covered with black film (Păduraru E. et al., 2007), the ridges being orientated across the contour lines and at a distance of 1.10 m (figure 1).



**Fig. 1** - Transversal profile through ridges

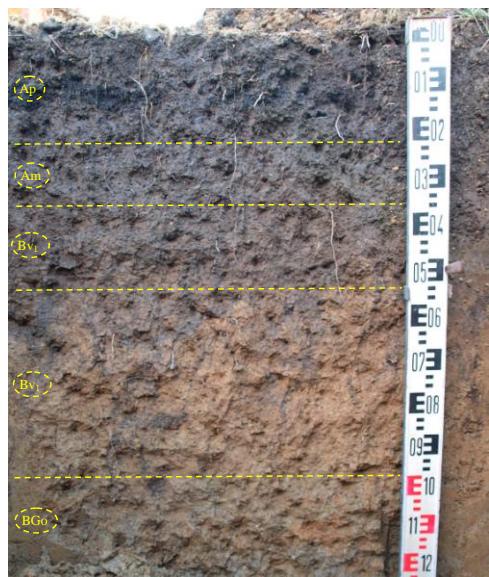
After the morphologic description, the soil was diagnosed as cambicide building-limestone chernozem slightly regraded, the appearance depth of the calcium carbonate being of 105 cm (figure 2).

The formation processes of the cambicide chernozem consisted of calcium carbonate bioaccumulation, argillization and levigation and a slight gleization, starting with the depth of 102 cm. Bioaccumulation has been favored by abundant rainfall and the saturation of the absorptive complex with Ca2+ ions gives stability to the humic fractions. Argillization consisted of altering the primary materials after removing the CaCO3 and the formation of iron hydroxides and oxides, which gives to the horizon a more red color, compared to the adjacent horizons. Weak gleization is due to water lateral circulation.

The cambicide chernozem is a soil with a great and useful edaphic volume and with a good aerohidric regime. The relatively uniform colors of the soil matrix at a depth of 0-100 cm show that the soil is not affected by excesses of stagnant humidity. From an agronomic point of view, the soil does not present major restrictions for the arable land. Some restrictive physical features (resistance to ploughing, workability, trafficability) owed to the high content of argil, are partially compensated by the glomelural structure and of the humus content, which increases the hydric stability of

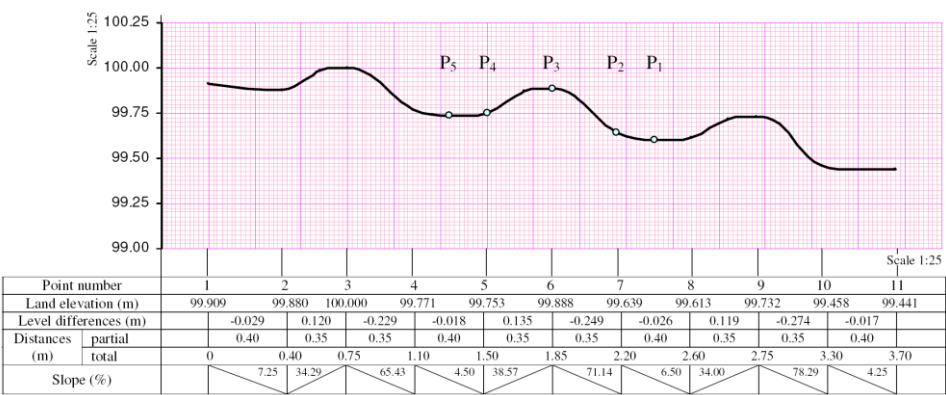


the structural aggregates, detain the dispersion of soil particles and implicitly, crust formation.



**Fig. 2** - Cambicide building-limestone chernozem with argillaceous clay texture

In order to determine the water content of the soil, soil samples have been prevailed with tubular probe on stages of 10 cm, up to a depth of 50 cm, before the irrigation, immediately after the irrigation, at 6 hours, 24 hours and 72 hours from the irrigation. The irrigation norm is of 5 l/linear meter and it has been implemented at a period of 7 days by means of the irrigation band with drip holes distanced at 20 cm. The control points have been located in the middle of the ditch (P<sub>1</sub> and P<sub>5</sub>), on the basis of the downstream billon (P<sub>2</sub>), on the basis of the upstream billon (P<sub>4</sub>) and on the billon crown, point P<sub>3</sub> (figure 3).



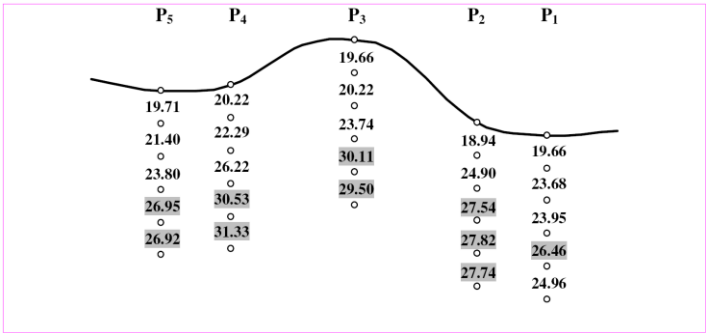
**Fig. 3** – Locating the points of taking soil samples

In order to determine the quota of the land surface from the studied area, topographic measurements of precision geometric leveling have been performed by

radiation method; based on these measurements transversal profiles have been drafted. Level observations have been performed with an average level of accuracy of type Zeiss Ni-030 and of the centimetric topographic rangers, the level differences being determined by means of two horizons of the level instrument.

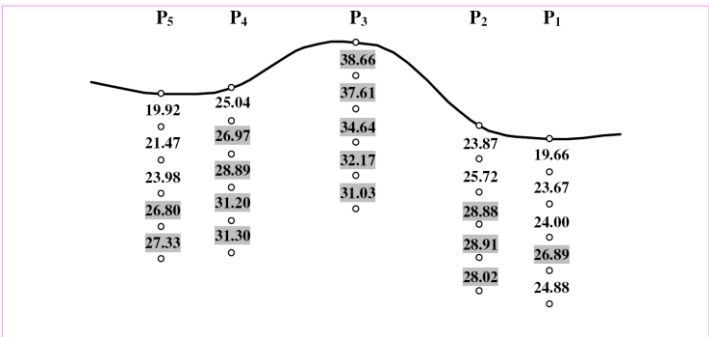
## RESULTS AND DISCUSSIONS

Analyzing the values of the soil water content determined before the irrigation, we can see that these ones increase proportionally with the depth (figure 4). In the depth interval 0-30 cm, the values of the soil water content are smaller than the value of the capacity for water in the field. In point P<sub>3</sub>, located on billon’s crown, the values of the current water content are smaller than the one registered at billon’s basis, in points P<sub>2</sub> and P<sub>4</sub>, because of the superior quota of the control point and of the water consumption by plants. The most increased values of the water content of the soil on the depth interval of 30-50 cm are registered in the control points located on the billon’s crown and at its basis.



**Fig. 4 –** Soil water content on depths, before the irrigation

Immediately after the irrigation (figure 5), we can see that in the control point located on the billon’s crown the values of the water content of the soil decrease proportionally with the depth.



**Fig. 5 –** Water content of the soil on depths, immediately after the irrigation

In the first 30 cm, there are values of the water content greater with 15-20 percentage units compared to the values registered before the irrigation.

Moreover, the values of the soil water content in the control points from the billon's basis start increasing

After 6 hours from the irrigation, we can notice water redistribution in the billon; water content values within the billon are higher than the value of the capacity for water in the field (figure 6). The highest values, with about 8 percentage units over the capacity for water in the field, is registered in point P<sub>3</sub>, located on the billon's crown, and in point P<sub>4</sub>, located on the basis of the upstream billon, because of the smaller distance between the irrigation band, this one being located on the billon's crown, in the upper part of the control point P<sub>3</sub>.

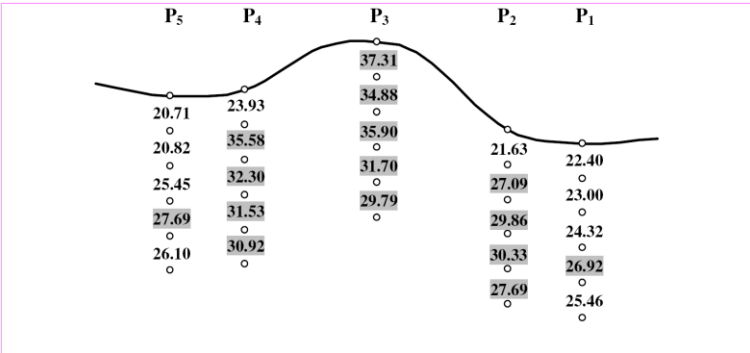


Fig. 6 – Soil water content on depths, at 6 hours from the irrigation

In figure 7 we can notice that after 24 hours from the irrigation with 5 l of water / metric linear unit, in the control points P<sub>2</sub>, P<sub>3</sub> and P<sub>4</sub>, water content values are close to the capacity for water in the field. This is due to the increase and lateral advance of the humidification line, but also of the water consumption by plants, in the depth interval 0-30 cm.

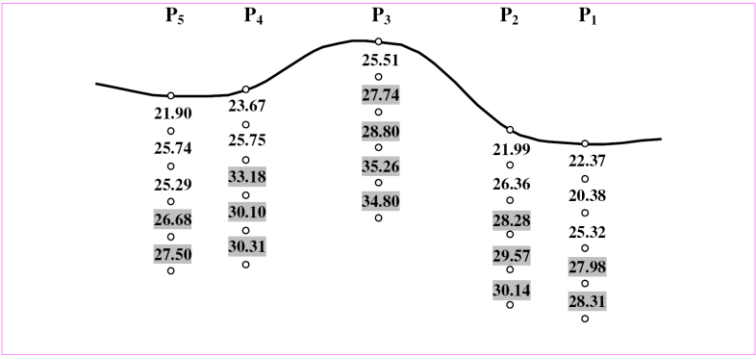


Fig. 7 – Soil water content on depths, at 24 hours from the irrigation

Water content values of the soil registered after 72 hours after the irrigation (figure 8) highlight a relative unification of the water content on the control points, because of the lateral advance of the humidification line. Higher values than the capacity for water in the field are registered in the depth interval 20-50

cm, except the point located on the billon's crown, where in the first 30 cm the registered values are lower than CC, due to the level difference between points and the water consumption by plants.

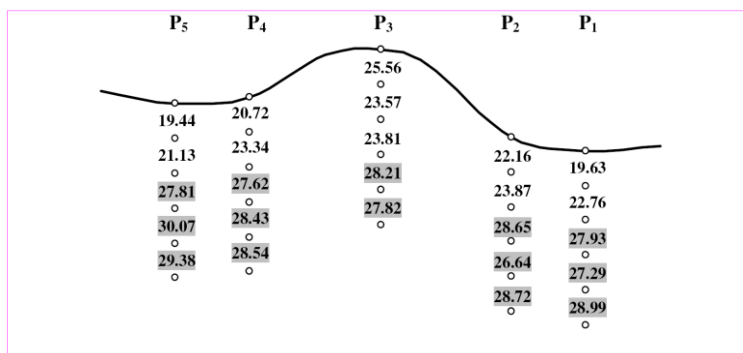


Fig. 8 – Soil water content on depths, at 72 hours from the irrigation

## CONCLUSIONS

1. Soil water content values in the point located on the billon's crown raise proportionally with the depth before the irrigation, at 24 hours and 72 hours from the irrigation and they decrease immediately after the irrigation and at 6 hours from finishing the irrigation.

2. Soil water content value on the billon's crown, immediately after the irrigation, on an interval of depth of 0-30 cm, is higher with about 15-20 percentage units compared to the capacity value for water in the field and it reaches similar values at 24 hours from the irrigation.

3. Soil water content at 72 hours from the irrigation is relatively uniform on the entire control section, due to the water consumption of the plants and to the lateral advance of the humidification line.

4. Drip irrigation determines the significant increase of soil water content only within the billon, in the area of the main mass of the plant's roots, which reflects controlled and reasonable use of water.

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# RESEARCH CONCERNING THE DESIGN AND TESTING OF A LABORATORY RIG FOR THE STUDY OF THE WHEEL-SOIL INTERACTION

## CERCETĂRI PRIVIND PROIECTAREA ȘI EXPERIMENTAREA UNUI STAND DE LABORATOR PENTRU STUDIUL INTERACȚIUNII ROATĂ-SOL

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**Abstract.** *It is known that physical degradation of soil due to the interaction with the wheels of the agricultural units consists mainly in its compaction, but also in the deterioration of its structure. Experimental studies should be developed in order to establish the values of the wheels' working parameters leading to soil degradation and to establish the relationships between the wheels' working parameters and the indices related to soil compaction and structure. In order to solve the above-mentioned problems the Agricultural Machinery Department of the University of Agricultural Sciences and Veterinary Medicine has designed, built and tested a laboratory rig. The rig is composed of a soil channel, the wheel carriage and the carriage traction implement. Tests were carried out in order to validate the design of the rig and the conclusion was that all the imposed requirements were achieved.*

**Key words:** tractor wheels, contact surface, soil pressure.

**Rezumat.** *Se cunoaște faptul că degradarea fizică a solului determinată de interacțiunea roților agregatelor agricole cu acesta, constă în special în compactarea lui dar și în deteriorarea structurii. Trebuie să se efectueze studii pentru a vedea la ce parametri de funcționare ai roților începe degradarea solului. De asemenea, este necesar să se stabilească legătura ce există între parametrii de funcționare ai roților utilajelor și indicii privind compactarea solului și structura acestuia. În vederea rezolvării problemelor menționate, la Universitatea de Științe Agricole și Medicină Veterinară din Iași, în cadrul disciplinelor de mecanizare a agriculturii, s-a proiectat, realizat și experimentat un stand de laborator pentru efectuarea studiilor necesare. Standul este format din canalul de sol, căruciorul pentru susținerea și antrenarea roții motoare și dispozitivul pentru tractarea căruciorului. S-a efectuat experimentarea acestui stand, prin care s-a constatat că au fost realizați parametrii constructiv-funcționali stabiliți prin proiectare.*

**Cuvinte cheie:** roți de tractor, suprafață de contact, presiune pe sol

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## INTRODUCTION

It is known that soil physical degradation is due to its interaction with the wheels of the agricultural units and consists in compaction and structural damage (Căproiu et al., 1982; Jităreanu et al., 2007; Țenu et al., 2010). Researches are needed in order to evaluate these effects and to establish the values of the wheel's working indices leading to soil degradation. The connection between the wheel's working indices and the indices related to soil compaction and structure must be established (Căproiu et al., 1973; Drăgan, 1969 Neculăiaș, 1971; Șandru et al., 1983).

In order to solve these problems a laboratory test rig was designed, constructed and tested, aiming to investigate the interaction between the wheels of agricultural equipment and soil.

## MATERIAL AND METHOD

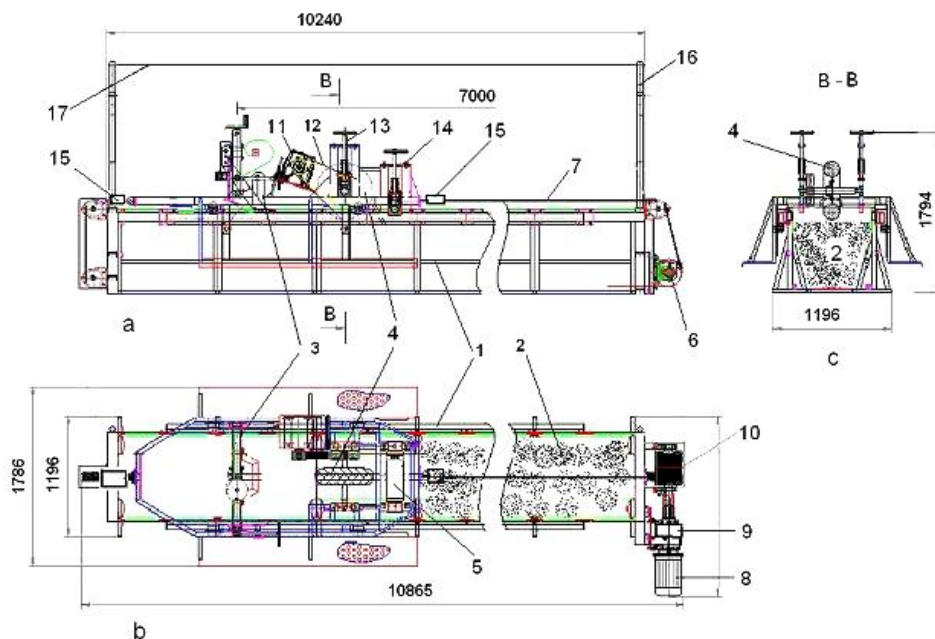
The test rig (figure 1) consists of the frame of the soil channel (1), the soil channel (2) and the carriage (3), on which the tyre wheel (4) and the compacting roller (5) are mounted. The electric cable drum (6) tows the carriage (3) by the means of a cable (7). The electric cable drum (6) consists of an electric motor (8), a cylindrical gear drive (9), a mechanical coupling and a drum (10). An electrical control panel and electric cables are used in order to feed the test rig with electricity. The carriage (figure 2) is composed of a frame (1), on which the tyre wheel (2), the compacting roller (3) and the wheel driving mechanism are mounted. The compacting roller (3) is used in order to achieve a certain level of soil compaction before the rolling the tyre wheel. A screw mechanism (4) is used in order to adjust the vertical position of the compacting roller. The tyre wheel unit (2) is provided with the screw mechanisms (5), allowing the adjustment of the wheel vertical position and load. When the carriage is towed by the means of the cable, the wheel (2) rotates due to its interaction with the soil and thus the conditions for a driven tractor wheel are simulated. When the carriage is not towed, the wheel (2) becomes a driving one, being driven by the electrical motor (6) by the means of a cylindrical gear drive and of a trapezoidal belt drive (7). Thus, the driving wheel of the tractor is simulated. Four upper trundles (8) – two in the front and two in the back – and four lower trundles (9) - also two in the front and two in the back - are mounted on the carriage frame; the trundles are rolling on rails, mounted on each side of the soil channel frame.

The towing cable is connected to the carriage by the means of two strain gauge load cells, allowing the measurement of the traction force needed to displace the carriage.

The electrical control panel is used in order to feed the test rig. The electrical motors are controlled by the means of a frequency converter, allowing the adjustment of the rotation speed when the frequency is modified between 3 and 50 Hz. The dynamic braking principle is used in order to stop the carriage at the end of travel. Switches on the control panel allow the selection of the feeded electric motor (the carriage towing motor or the tyre wheel driving motor), as well as its forward or reverse motion.

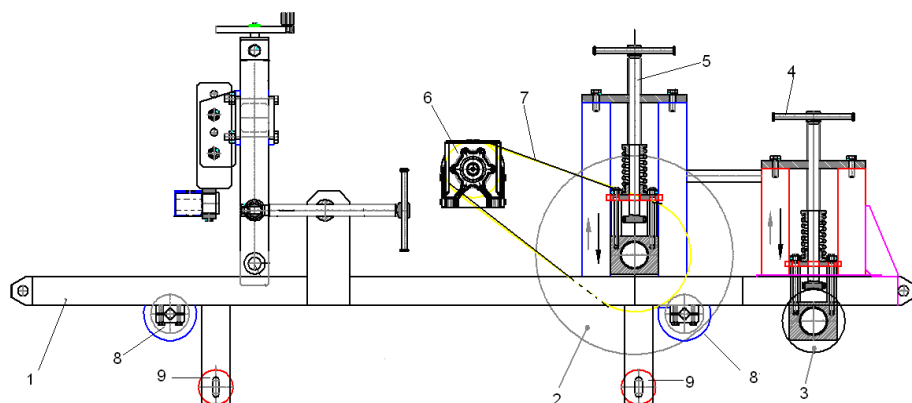
Two strain gauges load cells (1000 daN maximum force) are used in order to measure the carriage towing force; the load cells are connected to an electronic controller, which displays the averaged value of the traction force.

The laboratory test rig has the following features:



**Fig. 1** - Laboratory test rig for the study of wheel-soil interaction:

**a** – side view; **b** – upper view; **c** – front view; 1 – soil channel frame; 2 – soil channel; 3 – carriage; 4 – tyre wheel; 5 – compacting roller; 6 – cable drum; 7 – towing cable; 8 – electric motor; 9 – cylindrical gear drive; 10 – drum; 11 – gear drive; 12 – belt drive; 13 – mechanism for the adjustment of the vertical load over the wheel; 14 – mechanism for the adjustment of the vertical load over the compacting roller; 15 – load cells; 16 – supporting poles; 17 – electric cable.



**Fig. 2** - Carriage of the laboratory test rig:

1 – carriage frame; 2 – tyre wheel; 3 – compacting roller; 4 – screw mechanism for the adjustment of the vertical position of the compacting roller; 5 – screw mechanisms for the adjustment of the vertical wheel load; 6 – electric motor + cylindrical gear drive; 7 – belt drive; 8 – upper trundles; 9 – lower trundles.

- the tyre wheel on the carriage: 5,00 – 12,4 PR tyre (width = 127 mm, outer diameter = 569 mm), with V shaped lugs;
- the carriage towing electric motor: 5.5 kW and 1000 rev/min;
- the tyre wheel driving motor: 3 kW and 1000 rev/min;
- the carriage travel: 7 m;
- the carriage towing cable: D8 6x19 Seale IWR ISO 2408 (8 mm diameter, with 6 strands, each having 19 threads);
- overall dimensions of the soil channel: 0.8x0.8x10 m (width x height x length);
- overall dimensions of the test rig: 2035 x 10865 x 1764 mm;
- gear ration of the towing mechanism: 24.31;
- gear ration of the wheel gear drive: 28.76;
- overall ratio of the wheel driving mechanism: 57.

## RESULTS AND DISCUSSIONS

The wheel-soil interaction laboratory test rig was tested in order to check the achievement of the imposed parameters. As a result, the following parameters were obtained:

- carriage speed (when towed by the cable): 0.5 – 1.55 m/s (1.8 – 5.58 km/h);
- tyre wheel maximum vertical load: 500 daN;
- carriage maximum towing force (at 0.55 m/s): 800 daN;
- cable breakdown point: 40.83 kN.

It was concluded that there were no significant differences between the design parameters and the achieved ones.

Experimental tests were performed in order to evaluate the working parameters achieved for the driving wheel condition of service; the effect of the wheel speed, soil compaction and wheel vertical load over the carriage speed, wheel slip and traction force were evaluated. The experimental results are presented in table 1.

An electronic penetrometer (Penetrologger, Eijelkamp Holland) was used in order to evaluate the soil penetration resistance. A soil penetration resistance of 0.2 MPa was recorded for the loosened soil and of 0.4 MPa for the compacted soil.

Based on the experimental results it was concluded that the increase of the wheel's rotational speed led to the increase of the carriage speed and to the decrease of the wheel slip, while the traction force diminished.

The results showed that an increased soil penetration resistance resulted in an increased carriage speed, due to the increased wheel-soil adhesion and a decreased wheel slip (Popescu, 1993; Roş, 1984; Roş, 1978). In the meantime, the increased wheel-soil adhesion due to the higher penetration resistance led to an increased traction force of the driving wheel (Scripnic, Babiciu, 1979).

As long as the vertical load over the wheel was concerned, it was established that its increase had the effect of increasing the wheel-soil



adhesion, leading to the above mentioned results (diminishing of wheel slip, increasing of carriage speed, increasing of the traction force).

Table 1

**Main working parameters of the test rig, for the driving wheel condition of service**

Wheel rotational speed (rev/min)	Soil penetration resistance (MPa)	Wheel vertical load (N)	Carriage speed (m/s)	Driving wheel slip (%)	Driving wheel traction force (N)
20	0,2	500	0,50	17	230
		750	0,51	15	360
		1000	0,53	14	580
	0,4	500	0,51	15	290
		750	0,52	15	442
		1000	0,54	13	610
30	0,2	500	0,75	16	220
		750	0,76	15	350
		1000	0,79	12	570
	0,4	500	0,76	15	285
		750	0,77	14	438
		1000	0,79	12	600
40	0,2	500	0,99	15	220
		750	1,01	14	340
		1000	1,02	11	560
	0,4	500	1,01	14	280
		750	1,01	13	410
		1000	1,04	10	580

## CONCLUSIONS

The experimental tests confirmed that the working parameters imposed by the design theme were achieved.

It was concluded that the increase of the wheel's rotational speed led to the increase of the carriage speed, the decrease of the wheel slip and the increase of the traction force.

An increased soil penetration resistance resulted in increased wheel speed and traction force, while wheel slip decreased.

An increased vertical load over the wheel resulted in increased wheel speed and traction force and a decreased wheel slip.

The laboratory test rig with soil channel was constructed as a result of the PNCDI II-52107 research grant.

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# RESEARCHES CONCERNING THE SUITABILITY OF VINE PRODUCTION ON SOME LANDS FROM SIDE OF THE COVURLUI HILLS

## CERCETĂRI PRIVIND PRETABILITATEA PENTRU CULTURA VIȚEI DE VIE A UNOR TERENURI DIN ZONA COLINELOR COVURLUI

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**Abstract.** *This paper intends to determine soil availability for vine culture in some areas in the eastern part of the Covurlui Hills by showing the soil quality in the cadastral area of Cavadinesti. Due to various natural conditions, the soils in this area are quite varied in as far as their fertility and production capacity are concerned. As a result, soil and land quality determination and evaluation have a great importance. Through its geographical position, the land under analysis belongs to the great geographical unit of the Covurlui hilly region which is characterized by a great variability of the environmental factors that contribute to the plant growth. In this context, the ecopedological evaluation is compulsory, being required by the sustainable development of viticulture. On the land of the village, N soil units have been defined and grouped under the following categories: protisols, antrisol and chernisols.*

**Key words:** quality, fertility, soil suitability, vine.

**Rezumat.** *Lucrarea de față are ca obiectiv determinarea pretabilității pentru cultura viței de vie unor terenuri din extremitatea estică a Colinelor Covurlui resursele, pe teritoriul cadastral al comunei Cavadinesti. Formate în condiții naturale variate, solurile din zona respectivă diferă foarte mult ca însușiri de fertilitate, respectiv capacitate productivă. Prin poziția sa geografică, teritoriul luat în studiu aparține marii unități geografice Colinele Covurluiului, caracterizată printr-o mare variabilitate a factorilor de mediu care concură la realizarea condițiilor de mediu în care cresc și rodesc plantele. În acest context cunoașterea ecopedologică apare ca o necesitate obiectivă, cerută de realizarea unei viticulturi durabile. Pe teritoriul comunei s-au delimitat unități de sol grupate în următoarele clase și anume: protisoluri, antrisoluri și cernisoluri.*

**Cuvinte cheie:** calitate, favorabilitate, fertilitate, pretabilitate, vița de vie

### INTRODUCTION

The use and the rational and efficient management of the land resources in our country as well as their improvement, protection and conservation, in the context of a sustainable agriculture, may be achieved only by knowing the soil resources perfectly. This information can be obtained only by means of various pedological studies and researches that add to the total pedological info (Teaci D., 1980).

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Plant cultivation can't be conceived without the presence of soil, which is the main agricultural resource and a real material support for the plants. Both the quality and quantity of the crops depends upon the type of soil, its content in nutrients, by its capacity to retain water (Chiriță C.D, 1984).

This research has as its major aims the delimitation, the inventory and the evaluation of soil resources , the delimitation and inventory of the limitative and restrictive factors in using the plots for agricultural purposes and their availability for agricultural activities.

## MATERIAL AND METHOD

The topographical pattern we used during this research is represented by several 1:10000 scale topographical plans, As a result, 192 profiles, 20 main profiles and 172 secondary .

This paper has been done in accordance with the Romanian System of Soil Taxonomy , 2003 and the Methodology for Elaborating Pedological Studies, edited by ICPA in 1987 (Florea N., Bălăceanu V., Răuță C., Canarache A. and all,1987).

Ecopedological indicators are taken into the study presented in table 1.

*Table 1*

**Ecopedological indicators legend  
(vol.III - MESP-ICPA, 1987)**

The Indicator	
3C Average annual temperature	44 Total porosity
4C Average annual precipitation	61 CaCO <sub>3</sub> Content
23A Texture in Ap	63 Soil reaction (Ap or 0-20 cm)
23B Textura in depth	69 Degree ob base saturation
33 Slope of land	133 Edaphic useful volume
34 Exposition	144 Storage humus
38 Landslide	181 Waterlogging
39 Depth of ground water	

We have established the limitative factors of production and measures have been suggested to eliminate them and also prevent soil degradation through anthropic land processing.

## RESULTS AND DISCUSSIONS

### 1. Geographical Position

**Relief.** This study was performed on the cadastral area of the Cavadinesti Village which is placed on the Cavadinesti Plateau, fragmented by flat peaks and platelands, separated by parallel valleys. The geomorphological elements of the main form of relief are interfluves, slopes and valleys.

**Surface Deposits Litology.** The foundation of this region is North-Dobrudgea hercinic-kimmeric christalline schists and paleozoic, triasic and liasic sediments waved during the old hercinic and kimmeric orogenesis (V. Sfinclea, 1980). To the west of the Horincea Valley, the soils are solification rocks like loessoid Quaternary deposits. On the very steep slopes where erosion has eaten up

the layer of Quaternary deposits, neogen deposits replace them, as sandy materials. To the east of the Horincea Valley, the solification rocks are represented by clayey, marly and loessoid deposits. Along the narrow valleys, the solification rocks are represented by alluvio- colluvial deposits of recent age. In the Elan and Prut meadows the solification rocks made up of fluvial deposits of fine texture are predominant here.

**Hydrography and Hydrology.** The hydrographic network belongs to the Prut River Basin. The Prut waters have an average mineralization, characteristic to the carbonated-bicarbonated waters. The Elan, The Horincea and The Liscovat have a torrential behavior, their discharges varying according to the amount of falling rain. Floods are frequent on the Elan valley. Phreatic waters are present as aquiferous layers at 20-30 meters in depth on interfluvies and at 1-3 meters deep on the alluvial regions of meadow lands which influence soil evolution processes through gleization. On the slopes many side springs rise, creating areas of swamps and water bogging. The water in excess here produces pseudogleization processes.

**The Climate.** The climatic characterization of this region was done after the data registered by the Barlad Meteo Station during 1950-2007, according to ANM Bucharest. The annual average temperature is 9.7<sup>0</sup> C, while the sum of the temperatures higher than 10<sup>0</sup>C during vegetation time is 1436.5<sup>0</sup> C. Multiannual potential evapotranspiration is 677 mm, while the annual average rainfalls represent 516.2 mm. Air relative wetness (UR%) has an average annual value of 78.1%, while sun brightness duration (insolation) presents an average annual value of 1828 hours. Wind average speed is 3.3m/sec.

**The Vegetation.** The Cavadinesti region is mainly ante-steppe, characterized by xerophile woods with meadows and grassy vegetation clusters. The wood vegetation is represented by groups of *Robinia pseudocacia*, very rarely *Quercus robur* mixed up with *Ulmus campestris* and *Carpenus betulus*. Small trees are present, too: *Prunus spinosa*, *Crataegus monogina*, *Rosa canina*, while the grassy vegetation is represented by *Festuca vallesiaca*, *Bromus erectus*, *Stipa capilata*, *Carex* sp. etc. The ruderal vegetation is present as *Cirsium arvensis*, *Convolvulus* sp., *Amaranthus retroflexus*, *Brasica nigra*.

In the Elan and Prut meadows, a type of vegetation, characteristic to swamps and pools is also to be found here: *Typha latifolia*, *Potamogeton pusillus* L., *Ranunculus cassubicus* L.

The main cultures in the area are wheat, barley, corn, sunflower, soya, sugar beet, beans and vine.

## 2. Soil Characterization

The soils have been characterized after their morphological description and physico-chemical traces (Florea N., Munteanu I., 2003). On the Cavadinesti cadastral area, 49 soil units have been isolated, grouped into the following classes: Protisols (Regosols, Alluviosols), Antrisol (Erodosols) and Chernisols (Chernozems, Faeoziums).

An area of 690.32 ha is occupied by Protisols. As a result of researches, a *Calcaric regosol* (**RS ka**) has been identified, being present on pasture lands, of middle texture, well-developed grainy structure, an intense biological activity, with an At-Ck type profile, having the following soil formula:

$$\text{RS ka} \quad \frac{\text{X42/k1 - Tem - l/l - Ps}}{\text{D - ULPNBmr12r22f32Q7}} \quad (1),$$

The lands under analysis belong to the 4th class of usability for vines according to Annex 7-1 of the instructions elaborated by ICPA, Vol II, 1987.

*Alluviosols* occupy an area of 391.7 ha and they are present in the Prut Meadows and the holms of The Elan, The Horincea, The Oarba and The Liscovat brooks. They have a Am-C profile and they are also supplied with water in abundance and are base-saturated, but the nutrient supply is low to medium.

They follow this pattern:

$$\text{ASkamo} \quad \frac{\text{k1 - Tfm - t/t - A}}{\text{D - SJ P01 - 0NB Q5}} \quad (2)$$

The lands of this category enter the 4th class of usability for vines, according to ICPA, Vol.II, 1987.

An area of 93.6 ha is occupied by *aluviosol* (**AS**) *calcaric* (**ka**) *gleic* (**gl**) *coluvic* (**co**), with medium texture, low in humus and nutrient supply. It has an Amp-Am-C profile and it shows the following soil formula:

$$\text{ASka gc co} \quad \frac{\text{G3k1 - Spm - t/l - Ar}}{\text{D - IS P03 - 0 NBm Q5}} \quad (3)$$

The lands within this area enter the 4th class of usability for arable lands, according to Annex 7-1 from ICPA statements.

An area of 4585.03 ha is occupied by *typical calcaric*(Czti, ka), *cambic chernozems*(CZcb) with a, Am-AC-C or Am-AB-Bv-Ck type of morphology. The texture is medium, they are spongy with a very good permeability for both water and air. They can be used for a large variety of cultures that require moderate irrigation. They present the following formula:

$$\text{CZ ti} \quad \frac{\text{k3 - Tem - s/l - Ar}}{\text{D - UL P12 - 4NB m Q7}} \quad (4)$$

$$\text{CZka Xad} \quad \frac{\text{k1 - Tem - l/l - Vn}}{\text{D - UL P12 - 4 NBm Q7}} \quad (5)$$

$$\text{CZ cb} \quad \frac{\text{Xad k3 - Teg - s/u - Vn}}{\text{D - UL P12 - 2 NBgQ7}} \quad (6)$$

For the area occupied by the calcaric and cambic chernozem, a 3rd class of usability can be used for vine. Symbols used are found in “*Methodology of Elaborating Pedological Studies*” (1987).

The inclusion in classes of quality, according to the bonitation notes, calculated after ICPA, Vol II, 1987 methodology, the plots analyzed enter the following classes of quality, as we see in table 2.

Table 2

**Land Classification in Classes of Quality**

<b>TEO*</b>	<b>Area-ha</b>	<b>Bonitation note</b>	<b>Class</b>
50	28,79	40	IV
53	37,18	27	IV
54	46,95	40	IV
55	37,27	27	IV
56	40,14	22	IV
57	29,28	20	V
58	13,70	12	V
95	13,36	62	II
96	23,97	59	III
97	36,18	38	IV
100	76,63	32	IV
101	16,68	43	III
103	22,81	18	V
106	32,94	46	III
107	13,44	38	IV
161	92,77	45	III

\*TEO- homogeneous ecological area

### **3. Esteblishing of classes of usabilityfor the limitative and restrictive factors**

The values of the ecological factors have been analyzed in accordance with their favorability for vine growing. According to ICPA (1987), 6 classes of favorability for this culture have been established, as shown in table 3.

Table 3

**Classes of favorability for vine growing**

<b>TEO</b>	<b>Bonitation note</b>	<b>Class</b>	<b>The limitative and restrictive factors</b>
50	40	VII	Climate and soil
53	27	VIII	Climate and soil
54	40	VII	Climate and soil
55	27	VIII	Climate and soil
56	22	VIII	Climate and soil
57	20	IX	Climate and soil
58	12	IX	Climate and soil
95	62	IV	Climate and soil
96	59	V	Climate and soil
97	38	VII	Climate and soil
100	32	VII	Climate and soil
101	43	VI	Climate and soil
103	18	IX	Climate and soil
106	46	VI	Climate and soil
107	38	VII	Climate and soil
161	45	VI	Climate and soil

From the data above we may conclude that no homogeneous ecological territory unit (TEO) ever have conditions of high or extra high favorability. Average conditions of favorability are present in TEO 95, 96, 101, 161, the main limitative factors being the annual average temperature, the average annual rainfalls, the soil hydrophysical indices and the humus content as well.

## CONCLUSIONS

To cultivate vines successfully in this area it is necessary to make a qualitative and quantitative analysis of soil resources and take measures for the improvement of their productive capacities.

If we think that the restrictive factors for vine growing are the climate and the soil, the application of 1st year waterings and the fertilization on the spot while planting the cuttings.

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# RESEARCH REGARDING THE IMPACT OF AGRICULTURAL MACHINES TRAFFIC ON SOME PHYSICAL PROPERTIES OF THE SOIL AT CORN CROP

## CERCETĂRI PRIVIND IMPACTUL TRAFICULUI UTILAJELOR AGRICOLE ASUPRA UNOR PROPRIETĂȚI FIZICE ALE SOLULUI LA CULTURA DE PORUMB PENTRU BOABE

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**Abstract.** *The traffic of agricultural machines, involved in carrying out mechanized agriculture, has a great impact on physical and mechanical characteristics of the soil and ,consequently, on agricultural production. In this paper there were been made experimental research to quantify the effect of soil compaction on systems made by running the tractors and agricultural machines for corn crop. To this end there were been carried out several experimental plots, with different degrees of compaction, and the evolution of the following parameters where determined: bulk density, penetration resistance, the water stable aggregates of the structural elements and the mean weight diameter of these elements.*

**Key words:** corn crop, soil structure, penetration resistance, compaction

**Rezumat.** *Traficul utilajelor, implicate în realizarea mecanizată a lucrărilor agricole, are un impact deosebit asupra caracteristicilor fizico-mecanice ale solului și, implicit, asupra producțiilor agricole. În această lucrare s-au efectuat cercetări experimentale pentru cuantificarea efectului de tasare asupra solului realizat de sistemele de rulare ale tractoarelor și mașinilor agricole la cultura de porumb pentru boabe. În acest scop s-au efectuat mai multe plote experimentale, cu grade diferite de tasare și s-a determinat evoluția următorilor parametri: densitatea aparentă, rezistența la penetrare, hidrostabilitatea elementelor de structură și diametrul mediu ponderat al acestor elemente.*

**Cuvinte cheie:** porumb, structura solului, rezistența la penetrare, tasare

### INTRODUCTION

The effects of soil compaction on corn crops and soil physical and mechanical properties are complex and since the state of compactness is an important soil structural attribute, there is a need to find a parameter for its characterization, such as relative bulk density, that gives directly comparable values for all soils (Hakansson I., Lipiec J., 2000) For this reason the soil bulk density is the most frequently used parameter to characterise the state of soil compactness (Panayiotopoulos K.P. et al., 1994). Soil resistance to penetration is also used as a measure of soil compaction because it reflects soil resistance to root penetration (Hamza M.A., Anderson W.K., 2003). Highly compacted soil, particularly in the surface layers, generates inadequate soil

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physical and mechanical conditions for seedling emergence. Therefore, the challenge is to attain a suitable seedbed while minimizing traffic-induced soil compaction, so that the soil physical properties do not diminish normal root growth (Botta G. et al., 2006).

Wheel load, tyre type and inflation pressure increase soil bulk density and play an important role in soil compaction (Horn R. et. al., 2001). Most of the soil compaction in agriculture is caused by agricultural machines. This causes considerable damage to the structure of the tilled soil and the subsoil, and consequently to crop production, soil workability and the environment (Defosse P., Richard G., 2002). Experimental findings have shown that all soil parameters become less favorable after the passage of a tractor and that a number of passes on the same tramlines of a light tractor, can do as much or even greater damage than a heavier tractor with fewer passes (Chygarev Y., Lodyata S., 2000). The first pass of a wheel is known to cause a major portion of the total soil compaction (Bakker D.M., Davis R.J., 1995). Subsoil compaction may be induced by repeated traffic with low axle load and the effects can persist for a very long time. Wheeled traffic from machinery with axle load in excess can cause increases in bulk density and penetrometer resistance in subsoil at a depth >30 cm below the surface. These changes in physical properties can lead to long-term yield drastic decrease (Bakker D.M., Davis R.J., 1995).

## MATERIAL AND METHOD

The experiment was conducted at the Didactic Station of the „Ion Ionescu de la Brad” University of Agricultural Sciences and Veterinary Medicine of Iasi, Ezareni Farm, during farming years 2009-2010. The experimental site is located in the North-East part of Romania (47°07' N latitude, 27°30' E longitude) on a cambic chernozem (SRTS-2003, or haplic chernozems after WRB-SR, 1998), with a clay-loamy texture, 6.8 pH units, 3.7 % humus content and a medium level of fertilization. The soil has high clay content (38-43%) and is difficult to till when soil moisture is close to 12%. The experimental site has an annual average temperature of 9.6°C and precipitation of 517.8 mm. The experimental design was with a single factor of influence, in three replications, having as influence factor the degree of soil compaction. There were established three experimental plots, with the same system of agricultural machines, but with different degrees of soil compaction (table 1).

*Table 1*

**Experimental plots layout at corn crop in agricultural year 2009-2010**

Experimental plots	Soil compaction degree	Agricultural machines system used
V <sub>1</sub> -control	Uncompacted	Valtra T190 tractor + Opal 140/5 plow; Valtra T190 tractor + BS 400 A Kompaktor; U-650 tractor + SPC-8 drill
V <sub>2</sub>	Compacted once	
V <sub>3</sub>	Compacted twice	

The soil compaction was realized by many “wheel by wheel” passages, using the tractor with 190 horse power, before plowing, by one or two passages in order to achieve different degrees of compaction. Before seeding in order to achieve the seedbed preparation, the following agricultural aggregate was used: Valtra T190+Kompaktor BS

400 A. Experimental plots covered surface of 150 m<sup>2</sup> each, being cultivated with corn, hybrid Pioneer PR38V91 (FAO 300, or CRM 91 after the Pioneer classification), drilled on May 10, 2010 using a SPC-8 drill. The distance between rows was of 0.7 m and the harvesting density was of 65000 plants/ha.

In this experimental research the influence of soil compaction degree on some soil physical and mechanical properties was studied. In order to determine soil bulk density, mean weight diameter of structural elements of soil and the hydro stability of these elements, soil samples were taken from each plot in ten days after the corn seeding.

Soil penetration resistance was measured in ten days after sowing, by using a digital penetrometer (Eijkelkamp equipment, The Netherlands). The measurements were realised at a soil depth of 40 cm by using the Eijkelkamp penetrometer which had a 30° cone angle and a 1 cm<sup>2</sup> base area and by making ten repetitions for each experimental plot.

After seeding, in order to determine the soil bulk density there were taken soil samples from each experimental plot using a steel cylinder of 100 cm<sup>3</sup> volume (5 cm in diameter, and 5.1 cm in height) (Blake G.R., Hartge K.H. 1986), which were carried out at four depths (0-10 cm, 10-20cm, 20-30 cm and 30-40 cm).

The analysis of hydro aggregate stability of soil structural elements and the analysis of soil structural elements distribution was measured by using the dried and wet sieving, after Tiulin-Erikson procedure. The soil samples were taken on three depths: 0-10 cm, 10-20 cm and 20-30 cm and each sample was air-dried. The soil samples were sieved by using a sieve shaker machine named „Granular composition test set” (Eijkelkamp, Netherlands), provided with a set of overlapping sites (sites with holes: 10, 5, 3, 2, 1, 0.5 and 0.25 mm), in order to achieve the dry sieving. The eighth sieve, mounted below the sieve with 0.25 mm holes, is blind (without holes). After finishing the dry sieving, the soil fractions for each sieve were weighed and the percentage of soil structural elements for each fraction was calculated: soil structural elements larger than 10 , between 10 to 5, 5 to 3, 3 to 2, 2 to 1, 1 to 0.5, 0.5 to 0.25 mm and smaller than 0.25 mm. According to Tiulin-Erikson procedure, in order to determine the hydro stability of soil structural elements, twenty grams of average soil sample of dry soil structural elements were placed on a set of six overlapping sieves, having holes of 0.25, 0.5, 1, 2, 3, 5 mm diameter. The fractions of soil structural elements retained by each sieve were gently back-washed off the sieve. The soil samples were rinsed, the water was removed, and then, the soil structural elements were put in numbered aluminum vials and they were weighed. Forwards, the vials were placed in a forced-air oven at ~105°C and then, after 8 hours, they were weighed. Certain indicators, as mean weight diameter of soil structural elements, were determined by calculation (Canarache A., 1990).

The corn seed yield was determined from 5 m<sup>2</sup> of each experimental plot by taking ten repetitions for each experimental plot.

Statistical processing of data was done by means of the analysis of variance.

## RESULTS AND DISCUSSIONS

The influence of soil compaction degree on some soil physical and mechanical properties and corn seed yields are presented herein.

The soil penetration resistance values are presented in table 2. It is noted that, once with the increasing of the soil compaction degree, the values of soil penetration resistance increase, the highest value of 0.530 MPa is recorded at V<sub>3</sub> which is the experimental plot with the highest degree of compaction. Regarding

the variation in depth of the soil resistance to penetration, we find that in the upper soil layers of 0-20 cm, the soil penetration resistance is having lower values due to the action of active working bodies of Opal 140/5 plow and due to the BS 400 A Kompaktor. In the soil layers, in the range of 20-40 cm, due to compaction produced by the agricultural machinery wheels, we can observe a systematic increase of the amount of soil resistance to penetration, as the depth increases.

Table 2

**Soil resistance to penetration at corn crop in agricultural year 2009-2010**

Experimental plots	Depth (cm)										Statistical significations
	0-5	5-10	10-15	15-20	20-25	25-30	30-35*	35-40*	Average 0-30	Average 0-40	
	Soil resistance to penetration (MPa)										
V <sub>1-control</sub>	0.128	0.212	0.214	0.218	0.226	0.248	0.536	0.711	0.172	0.311	-
V <sub>2</sub>	0.278	0.280	0.312	0.338	0.370	0.388	0.607	0.881	0.327	0.431	xxx
V <sub>3</sub>	0.342	0.350	0.356	0.396	0.412	0.438	0.930	1.020	0.382	0.530	xxx

\*the subsoil layers was not tilled with the plow

LSD 5%=0.059 MPa

LSD 1%=0.082 MPa

LSD 0.1%=0.114 MPa

The soil bulk density, as well as the soil resistance to penetration, is having the same variation, depending on degree of the soil compaction. As seen in table 3, the experimental plot which has the highest value of the soil bulk density is V<sub>3</sub>. This value is of 1.52 g/cm<sup>3</sup>. It is also found that the soil bulk density increases continuously with the depth's increase.

Table 3

**Soil bulk density at corn crop in agricultural year 2009-2010**

Experimental plots	Depth (cm)						Statistical significations
	0-10	10-20	20-30	30-40*	Average 0-30	Average 0-40	
	Soil bulk density (g/cm <sup>3</sup> )						
V <sub>1-control</sub>	1.17	1.33	1.35	1.42	1.28	1.31	-
V <sub>2</sub>	1.31	1.42	1.47	1.60	1.40	1.45	xxx
V <sub>3</sub>	1.37	1.46	1.59	1.67	1.47	1.52	xxx

\*the subsoils layer was not tilled with the plow

LSD 5%=0.053 g/cm<sup>3</sup>

LSD 1%=0.08 g/cm<sup>3</sup>

LSD 0.1%=0.128 g/cm<sup>3</sup>

Table 4

**Mean weight diameter at corn crop in agricultural year 2009-2010**

Experimental plots	Depth (cm)				Statistical significations
	0-10	10-20	20-30	Average 0-30	
	Mean weight diameter (mm)				
V <sub>1-control</sub>	3.75	4.35	4.75	4.28	-
V <sub>2</sub>	3.45	3.91	4.41	3.92	000
V <sub>3</sub>	3.02	3.63	4.12	3.59	000

LSD 5%=0.113 mm

LSD 1%=0.188 mm

LSD 0.1%=0.352 mm

In table 4 we can observe that the mean weight diameter of the structural elements of the soil decreases once the degree of soil compaction increases. The lowest value of the mean weight diameter of the soil structural elements is recorded at  $V_3$ , the experimental plot with the value of 3.596 mm.

Regarding the hydro stability of the soil structural elements we can conclude that, from the values of the  $I_1$  quality parameter of soil structure presented in table 5, the hydro stability of the structural elements of the soil are decreasing once the degree of the soil compaction is increasing.

As it resulted from the data presented in table 5, by making an extrapolation to the value classes of the hydro stability of the soil structural elements ( $I_1=3$  to 5, the soil structure is very good;  $I_1=0.61$  to 3, the soil structure is good;  $I_1=0.3$  to 0.61, the soil structure is medium;  $I_1=0.18$  to 0.3, the soil structure is weak), we can conclude that the experimental plot  $V_1$  is having the best soil structure from the soil hydro stability's point of view by belonging to the value class „soil with a very good structure”, respectively 3.67, while the experimental plot  $V_3$  belongs to the value class „soil with a good structure”, respectively 1.76.

Table 5

**Values of the  $I_1$  quality parameter of soil structure at corn crop in agricultural year 2009-2010**

Experimental plots	Depth (cm)				Statistical significations
	0-10	10-20	20-30	Average 0-30	
	The values of $I_1$ quality parameter of soil structure				
$V_{1-control}$	3.48	3.64	3.89	3.67	-
$V_2$	1.97	2.79	3.08	2.63	00
$V_3$	1.07	1.74	2.48	1.76	00

LSD 5%=0.62

LSD 1%=1.03

LSD 0.1%=1.94

The corn seed yields obtained in the three experimental plots are presented in table 6. It can be noted that the increase of the soil compaction degree leads to drastic yield decrease. Therefore, the corn seed yields on the experimental plot  $V_2$  is decreasing in comparison with the experimental control plot  $V_{1-control}$  with 21.5%. Regarding the experimental plot  $V_3$ , the corn seed yields is decreasing in comparison with the experimental control plot  $V_{1-control}$  with 40.99%.

Table 6

**The yields obtained at corn crop in agricultural year 2009-2010**

Experimental plots	Corn seed yield (kg/ha)	Statistical significations
$V_{1-control}$	10407.3	-
$V_2$	8170.66	000
$V_3$	6041.66	000

LSD 5%=410 kg/ha

LSD 1%=681 kg/ha

LSD 0.1%=1272 kg/ha

The statistical analysis of mean values has indicated that the soil compaction lead to negative modifications of the soil physical and mechanical properties (table 2, table 3, table 4, table 5) and the corn seed yields (table 6).

## CONCLUSIONS

1. The increase of the soil compaction degree, induced by the traffic of the agricultural machines, has a negative impact on the soil physical and mechanical properties.

2. The soil resistance to penetration increases once with the increase of the soil compaction degree, having lower values in the upper soil layers of 0-20 cm.

3. The soil bulk density is having the same variation as the soil resistance to penetration, this two parameters being the most used indicators of the soil state of compactness. As the soil bulk density increases, it's of soil compaction degree increases too.

4. The mean weight diameter of the soil structural elements presents major modifications, it's values decreasing once with the increase of soil compaction degree.

5. The hydro stability of the soil structural elements is also decreasing once with the increase of soil compaction degree.

6. All these negative modifications of the physical and mechanical properties have lead to drastic yield decrease.

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# RESEARCH REGARDING DETERMINATION OF WORKING INDEXES FOR TRC 150 CHOPPING MACHINE

## CERCETĂRI PRIVIND DETERMINAREA INDICILOR DE LUCRU AI MAȘINII DE TOCAT TRC 150

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**Abstract.** *The experiments were conducted in 2009-2010 at the University Agricultural Experimental Didactic Station in a vineyard inhabited with a Chasselas Dore variety. The experiments had targeted the determination of the main indices of an aggregate consisting in a Goldoni Aster tractor and in a 45 TRC 150 chopper for vegetable scraps. For this purpose, various tests were conducted, aiming the establishment of an optimum operating speed for the string chopping work on the intervals between the vine rows. Based on the interpretation of the experimental facts, it was establish that the optimum experimental version of the strings' chopping work, is the one which has the higher quality indices, with a low fuel consumption.*

**Key words:** viticulture, strings' chopping work mechanization, fuel consumption.

**Rezumat.** *Experiențele au fost efectuate în perioada 2009-2010, într-o plantație de viță de vie cu soiul Chasselas doré, din cadrul Stațiunii Didactice Experimentale a Universității Agronomice din Iași, și au vizat determinarea principalilor indici pentru agregatul format din tractorul Aster 45 Goldoni și tocătoarea pentru resturi vegetale TRC 150. Pentru aceasta s-au efectuat diferite încercări, care au urmărit stabilirea vitezei optime de lucru pentru efectuarea lucrării de tocat coarde pe intervalele dintre rândurile de viță de vie. În urma interpretării rezultatelor obținute s-a stabilit varianta experimentală optimă a lucrării de tocat la care se obțin valori superioare ale indicilor de calitate, cu un consum redus de combustibil.*

**Cuvinte cheie:** viticultură, mecanizarea lucrării de tocat coarde, consum de combustibil.

### INTRODUCTION

It is estimated that each year about 0.7 to 1.4 of t dry substance per hectare is lost out of our vineyards from all over the country after the dry cuttings (Bernaz and Dejeu, 1999).

An appreciable micro and macro elements contribution of a 6-20 kg / ha N, 0.7 to 3.6 kg / ha P and 6-20 kg / ha K is made possible by due to the vegetable strings scraps which are chopped and incorporated into the vineyards soils, over the year (Bernaz and Dejeu, 1999).

Researches made all over the world state that chopped strings' incorporation into the soil fertilizes and has a positive effect over the physical and

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chemical properties of the soil and it is a useful method because the land is immediately released, being ready for the following working stages.

Several researches had been carried out, in order to determine the efficiency of both strings' chopping and the resulting material incorporation's into the soil technologies.

Therefore, in 2009-2010, the TRC 150 chords chopper for vegetable scraps has been tested. The chords were left on the top of the soil between vine rows during the spring dry cuttings.

Based on the experimental results analysis, it is intended to introduce the TRC-150 machine into the vineyards maintenance technology with the main goal in reducing the fuel consumption, technological traffic, the workload used to remove cut strings, erosion and soil compaction.

## MATERIAL AND METHOD

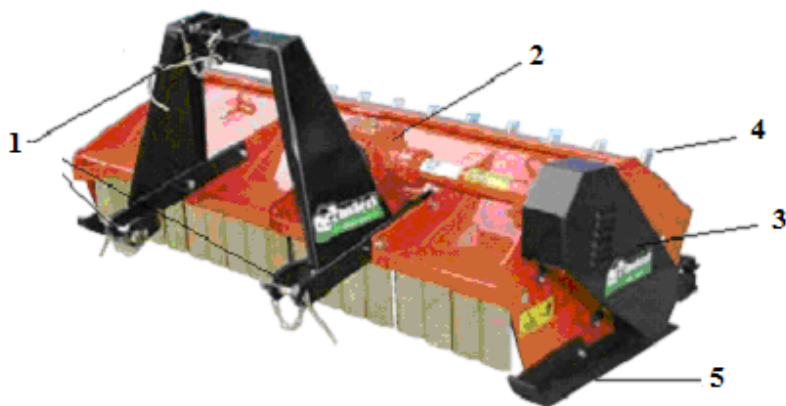
Measurements were taken in a vineyard founded in 1985, inhabited with the Chasselas Doré variety, with planting distances of 2.2 x 1.2 m and a density of 3787 vines / ha. The vineyard is located on a land with a slope of approximately 8%, exhibition west - south west and the vines rows are oriented towards the north – south direction along the contour. The predominant soil in this plantation is the cambic chernozem, with a clay-loam texture.

In spring, the chord chopping work has been done right after the dry using the TRC 150 machine manufactured by the italian company Rinieri.

The TRC 150 universal chopper (fig. 1) is composed of a frame fitted with a tractor coupling, a protective case, the rotor blades, the lifting cords teeth, the transmission mechanism and two skids for support and adjustment.

The protective case fixed on the top of the frame is made out of steel sheet. This part covers the machines' rotor blades.

The tractor coupling ensures the three points attachment to the towing machine. The machine can be fastened to the tractor side rods in two positions.



**Fig. 1** - The TRC 150 universal chopper:

1 - triangular grip, 2 - the multiplier cone group, 3 - belt drive, 4 - toothed lifting, 5 - support skid.



The rotor with knives receives motion from the tractor PTO shaft. It consists of a steel shaft supported on two casings with oscillatory bearings, positioned perpendicular to the machine movement direction. The knives are fixed on a propeller shaft with two beginnings. The rotor shaft supports' number, respectively the number of blades pairs is 36.

Lifting tusks are made out of steel, have a rectangular section; their role is to pick up the strings sitting on the soil surface and to bring them in range of the knives. Therefore, the tusks are leaned forward and penetrate the soil while working at a depth of 1-2 cm (Neagu Tr. et al. 1980; Suditu P. et al 2002)

The two support strips are made of metal and can be adjusted vertically in order to obtain different rotor working heights from the surface of the soil.

The motion is transmitted from the tractor PTO shaft by the means of a telescopic shaft, a conical gear, toothed wheels and drive belts. At 540 rpm speed of the tractor PTO, the rotor speed is 1600 rpm. Due to the rotor motion and the submission of the machine, the knives (the active organs) pick up the strings from the surface of the soil and chop them by cutting and tearing. The rear tusks take the undriven strings and bring them into the rotor's action range, ultimately resulting in a continuous strip of chopped chords.

This machine was mounted on an Aster 45 hp tractor, manufactured by Goldoni Italian company, using the first, the second and the third gear, respectively three different speeds: very slow, slow and fast.

The devices used to determine the working indices are: simple metric frame, electronic balance, stopwatch, paper bags for taking samples and a device for measuring the fuel consumption.

In order to calculate these indices, the following formulas (Toma Dr. and Sin Gh., 1987) were used:

- **global chopping degree ( $G_{TG}$ )**

$$G_{TG} = \frac{\sum_{i=1}^{i=n} \frac{G_i - G_f}{G_i}}{n} \cdot 100 \text{ (\%)}$$

where:  $G_i$  is the amount of existing vines strings per unit area between of the rows before the machine passing,  $G_f$  - the amount of strings with a length of 20 cm on the same surface, after the machine passing.

- **the actual aggregate driving speed ( $V_l$ )**

$$V_l = 3,6 \frac{S}{T} \text{ (km/h)}$$

where:  $S$  is the distance (in meters) that was needed to perform the timing, respectively 50 m,  $T$  – is the time (in seconds) that aggregate runs the distance.

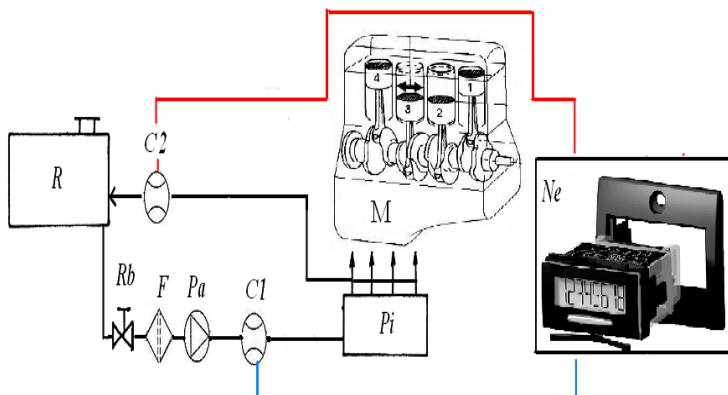
**hourly fuel consumption of the engine ( $Ch$ )** is measured during the working process, with a special device mounted on the tractor.

In order to determine the fuel consumption, the volumetric method was used. The device (fig. 2) consists of two volumetric counters from CONTOIL family, type VZO 4, manufactured by AQUAMETRO AG in Switzerland, and a counter with six

simultaneously channels, model 9201, manufactured by TRUMETER company in England.

Fuel consumption is calculated as the difference between the recorded value of the C1 counter mounted on the engine's feed line and C2 counter mounted on the return line.

The value recorded by the electronic counter is displayed on the LCD screen's type, and by using the front panel button, any of the six counts can be selected for display on the screen.



**Fig. 2** - Mounting diagram of the fuel consumption measuring device

R - tank; Rb - tap F-filter, C1, C2 - volumetric meters, Pa. – fuel pump;  
Pi - injection pump; Ne - electronic counter, M - Motor

The electronic counter has a RS 232 interface that allows connection to the PC in order to configure the counters..

The hourly fuel consumption was calculated with the formula:

$$C_h = 3,6 \frac{V_c}{t} \cdot \gamma \text{ (kg/h)}$$

where:  $V_c$  - volume of fuel consumed ( $\text{cm}^3$ ),  $t$  - the time recorded over the 50 m running distance, while the  $V_c$  volume of fuel is consumed (s);  $\gamma$  - the fuel density ( $0.845 \text{ g/cm}^3$  at a temperature of  $15^\circ \text{C}$ ).

## RESULTS AND DISCUSSIONS

Based on the measurements made in the vineyard, during the vine strings' chopping work with the TRC 150 machine, at working speeds between 0.65 and 7.51 km/h, the experimental results were presented in table 1.

The agrotechnical requirements for this work impose that the percentage of chopped strings into fragments smaller than 10 cm should be at least 60%.

By summing the percentage values obtained for the 0-5 cm and 5-10 cm string fragments, it is clear that the agrotechnical requirements were obtained for working speeds contained between 0.65 and 5.92 km/h. It is also clear that for speeds over 6 km/h, the chopping degree obtained is inadequate.

The TRC 150 vegetable scraps chopping machine has fragmented strings with a diameter between 0.45 cm and 1.7 cm, into segments shorter than 20 cm.

Table 1

**The effect of the working speed over the fuel consumption and over the chopping degree**

Agricultural year	Working speed			C <sub>h</sub> kg/h	The chopping degree (%)			
	Gear range	Gear	Effective speed km/h		0-5	5-10	10-15	15-20
					cm	cm	cm	cm
2009	Very slow	I	0,66	3,5	52	16	12	20
		II	1,20	3,8	56	12	15	17
		III	1,91	4,3	59	10	6	15
	Slow	I	2,07	4,7	48	21	18	13
		II	3,73	5,2	53	17	11	19
		III	5,92	5,5	62	15	12	11
	Fast	I	7,50	6,1	24	27	26	23
2010	Very slow	I	0,65	3,3	64	5	7	24
		II	1,18	3,6	67	6	5	22
		III	1,89	4,1	68	7	5	19
	Slow	I	2,05	4,5	52	20	13	15
		II	3,66	5,0	55	18	15	12
		III	5,87	5,3	59	12	18	11
	Fast	I	7,51	6,2	19	21	27	33

The fuel consumption was comprised between 3.3 and 6.2 kg h, increasing when speed increased. It was established that the aggregate's optimum working speed for the vine strings chopping should be comprised between 5.92 to 6.0 km/h. For speeds above 6 km / h, the hourly fuel consumption and the chopping degree were much lower than the agrotechnical requirements.

## CONCLUSIONS

1. Reducing the fuel consumption is an important goal for achieving an economic efficiency of a farm, because 10-15% of the price of agricultural products is due to fuel consumption and also because of its effect over the environment protection.

2. Data obtained during the testing of the TRC 150 machine for the strings chopping in vineyards, show that this machine fulfils the requirements imposed by the agrotechnical specifications, except for speeds over 6 km / h, for which the vine chords' chopping degree is inadequate.

3. Using the TRC 150 vegetable scraps chopping machine to chop the vine chords, facilitates the access of agricultural units during the rainy spring periods and reduces the costs related to the removal of the cut chords.

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# ASPECTS REGARDING THE IMPACT OF TECHNOLOGIC WORKS ON A SOIL FROM A VINEYARD IN VITERBO REGION, ITALY

## ASPECTE PRIVIND IMPACTUL LUCRĂRILOR TEHNOLOGICE ASUPRA SOLULUI ÎNTR-O PLANTAȚIE VITICOLĂ DIN REGIUNEA VITERBO ITALIA

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**Abstract.** *The experiences were carried out in 2010, in a vineyard, inhabited with Trebbiano grape variety, at the „Nello Lupori” experimental farm, in the town of Viterbo, Italy and aimed to determine the main physical properties of the soil for different maintenance variants. The tests made at the University of Tuscia’s soil physics laboratory aimed to determine soil texture, bulk density, density and porosity for four different technological maintenance variants. After the interpretation of tests results, the best technological variants were established for soil maintenance, with the purpose to preserve its physical characteristics.*

**Key words:** viticulture, soil tillage, soil physical properties

**Rezumat.** *Experiențele au fost desfășurate în anul 2010, într-o plantație de viță de vie soiul Trebbiano, în cadrul fermei experimentale Nello Lupori din localitatea Viterbo Italia, și au vizat determinarea principalelor proprietăți fizice ale solului, pentru diferite variante de întreținere a acestora. Analizele efectuate în cadrul laboratorului de Fizica solului al Universității Tuscia au vizat determinarea texturii solului, densității aparente, densității și a porozității pentru patru variante tehnologice de întreținere. După interpretarea rezultatelor obținute s-au stabilit variantele optime de tehnologii pentru întreținerea solului, folosite, în principal, pentru conservarea însușirilor fizice ale acestuia.*

**Cuvinte cheie:** viticultură, lucrările solului, însușiri fizice ale solului.

### INTRODUCTION

Trebbiano Sortogrup counts for about one third in the assortment of white wine in Italy. It is used for blending, in more than 80 DOC wines in Italy, although it has only six varieties of its own (local clones): Trebbiano d'Abruzzo, Trebbiano di Aprilia, Trebbiano di Arborea, Trebbiani Capriano del Colle di, di Trebbiani Romagna and Trebbiano dei Colli Piacentini Val Trebbia.

Trebbiano grapes are often the foundation (basis) for white table wines from Italy, which can be significantly improved if they are mixed with Malvasia Bianca grapes.

Probably the most successful Trebbiano wine based on a mixture is Umbria Orvieto Bianco, using a local clone called Procanico.

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Besides the use of this variety for the wine production, it is also used to obtain beverages like armagnac and cognac or it is used in balsamic vinegar preparation, a product very popular in Italian cuisine.

## MATERIAL AND METHOD

The experimental plot containing the Trebbiano grape variety is placed at the didactic and experimental "Nello-Lupori" farm, which was established in 1981, covers an area of 30 ha and is located in Riello, 500 meters away from Faculty of Agriculture, University of Tuscia, Italy.

The measurements were performed for four different technological variants of soil maintenance between the rows of plants, with three repetitions per each variant; the soil samples were analyzed in the laboratory of soil physics of the same faculty .

The soil samples taken at a 0-15 cm depth and 15-30 cm respectively, were used to determine soil texture, soil bulk density, soil density and soil porosity (Canarache A., 1990; Societa italiana della scienza del suolo, 1985)

The soil maintenance system for each experimental variant was as follows:

a) **tillaged**, which required four interventions on the soil between the rows (two with the disc harrow and two with the vertical rotors milling unit);

b) **natural**, which consisted of the land natural grassing and 4 grass chopping tillage;

c) **grass 1**, with *Trifolium subterraneum* and three works of grass mowing using the Turbo 2 machine manufactured by Gianni Ferrari;

d) **grass 2**, *Poa pratensis* and 5 interventions for cutting and for the vegetal waste recovery using Turbo 2 machine.

The following devices and materials were used in the field-laboratory: plastic bags, shovel, spatula, electronic scales, pycnometer, drying stove, cone with sand, leachate, measuring cylinders, etc..

In order to determine the physical properties of the soil, the following formulae were used:

**Density (SD)** is given by:

$$d_s = \frac{d(P_s - P_v)}{P_s - P_v - (P_l - P_w) \cdot f} \quad (\text{g/cm}^3)$$

where: d – the density of water, at room temperature, Ps – the pycnometer mass containing the sample of air dried soil, Pv – the empty pycnometer mass, P1 – the pycnometer mass containing the soil sample when filled with water; PW – the pycnometer mass, filled with water; f - correction factor for humidity

**Soil bulk density (D<sub>a</sub>)** was determined using the sand cone and was calculated using the formula:

$$D_a = \frac{P_t - D_s}{P_s} \quad (\text{g/cm}^3)$$

where: Pt = the mass of the soil dried in the stove, SD = the sand density, Ps = the mass of the sand that filled the hole.

### Soil porosity

Soil porosity is expressed as a percentage porosity (P) and it is given by:

$$P = 100 \cdot \frac{D_a}{d_s} \cdot 100$$

where:  $D_a$  is the soil bulk density and  $d_s$  is the soil density.

## RESULTS AND DISCUSSIONS

The results obtained in the experimental research are presented in table 1.

Table 1

**The effect of technological works over the physical characteristics of the soil**

Soil maintenance method	Depth cm	Soil texture			$d_s$ g/cm <sup>3</sup>	$D_a$ g/cm <sup>3</sup>	Porosity %
		Clay %	Dust %	Sand %			
tillaged	0 / 15	28,52	15,066	56,41	2,55	0,89	65,1901215
	15 / 30	31,89	17,383	50,73	2,40	1,11	53,9550375
tillaged	0 / 15	21,01	19,820	59,17	2,44	0,83	66,0253786
	15 / 30	22,6	18,957	58,44	2,40	1,01	57,7870564
Naturally	0 / 15	23,09	18,272	58,64	2,66	0,92	65,2992096
	15 / 30	25,64	18,844	55,52	2,40	1,09	54,6250000
Naturally	0 / 15	30,99	14,797	54,21	2,65	1,04	61,0022607
	15 / 30	34,97	19,320	45,71	2,52	1,00	60,3407290
Grass 1	0 / 15	26,04	24,340	49,62	2,54	1,06	58,2248521
	15 / 30	30,92	17,074	52,01	2,47	1,20	51,6781237
Grass 1	0 / 15	14,83	11,087	74,08	2,50	0,90	64,1313050
	15 / 30	17,33	14,651	68,02	2,45	0,93	62,2040816
Grass 2	0 / 15	15,44	17,840	66,72	2,37	0,95	59,9323753
	15 / 30	23,16	17,766	59,07	2,43	1,15	52,5773196
Grass 2	0 / 15	24,65	16,784	58,57	2,70	0,94	65,1851852
	15 / 30	29,22	16,919	53,86	2,68	1,12	58,2089552

Based on the granulometric analysis of the soil samples and using textural classification approved by Italian researchers, it was noticed that the predominant texture is sandy clay, followed by the clayed-sandy soil. The exception is represented by the grass 1 variant, in which case the soil is belonging to the group with graded coarse, respectively sand textural class.

Regarding the other physical characteristics of the soil, it was observed that the bulk density values ( $D_a$ ) for the 15-30 cm soil stratum indicates a slight compaction of this layer in all variants. The minimum value (0.83 g/cm<sup>3</sup>) for the 0-15 cm depth, was achieved in the tillaged variant.

For all the four technological variants, soil porosity fits within the normal limits. The maximum porosity, 66.0253786% respectively, was recorded in the tillaged variant, for the 0-15 cm depth, as expected, due to the large number of

loosening works (interventions) that were performed during the growing season. At the same depth, diametrically opposed, stands the grass 1 variant, which recorded a minimum value of 58.2248521%.

## CONCLUSIONS

1. The maintenance system of the intervals between the rows of vines which is mainly used in most vineyards in Italy is the one with the grassing of these intervals.

2. Based on the analysis performed it was concluded that the experimental soil is of volcanic origin and has a predominantly middle texture.

3. Mechanical interventions over the soil in the tilled variant at the 0-15 cm depth led to the maximum values of porosity (65.1901215%), due to the soil loosening as the effect of the action of the machines' active parts.

4. All the three variants using the technology of grassing the intervals between the rows of vines are more efficient from the economical and technological point of view, because soil tillage is thus avoided and the access of the equipments during the rainy periods is facilitated.

## ACKNOWLEDGEMENTS

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# BIOLOGICAL CONTROL OF GRAPE CROWN GALL

## METODĂ BIOLOGICĂ DE COMBATERE A CANCERULUI BACTERIAN LA VIȚA DE VIE

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**Abstract.** Genetic date transfer T-DNA from a pathogen to a plant cell occure the process of tumefaction on vineyard. Treatment of woundings by biologic prepare Paurine (suspension of bacteria cells of *Pseudomonas fluorescens*) deteriorate the interaction of bacteria-pathogen with the cell of host plant. Application of this preparat decrease the quantity of plants with tumors.

**Key words:** crown gall, biological control, grape

**Rezumat.** Cercetările se referă la transmiterea informației genetice de la patogen către celula vegetală exprimă procesul de formare a tumorilor la vița de vie. Prelucrarea leziunilor vegetale cu biopreparatul Paurin (suspensia de celule a bacteriei *Pseudomonas fluorescens*) preîntîmpină penetrarea acestei bacterii în celula vegetală a plantei. Aplicarea preparatului reduce numărul de vițe altoite și tufe contaminate cu tumori.

**Cuvinte cheie:** cancer bacterian, control biologic, vița de vie

### INTRODUCTION

Among the chronic diseases of perennial plants crown gall is a very dangerous ones, which caused considerable waste of productions in the industrial vineyards of the Republic of Moldova. First of all the danger is determined by the situation that pathogenic agent could survived a lot of time in vascular plant system in latent form, without provocation of any tumors on the aerial grape plant surfaces. Crown gall pathogen agent is represented by pathogenic species *Agrobacterium*- bacteria bacilare gramm negativ - *A. tumefaciens* which penetrate in whole vascular system of plants throw freeze induced wounds, periderm deteriorations on new developed roots, mechanical lesions of stem ramification as well as on the trunk. It is preserved there for long time in latent form, without tumors provocation. Grape initiation of tumorigenesis coincide with the period of „bleeding” , during the spring running, when it is favourable penetration of enormous quantities of pathogenic bacteria throw new wounds. As a result of complex biological processes with participation of bacteria land plant cell enzymes a portion of bacterial gene- plasmid T i is incorporated in chromosome of vegetal cell, which starts cell division according the ways of tumorous proliferation. Once being contaminated, grapes vine plants began chronic manifestation of diseases. Tumors represent a consequence of contamination, and as a rule are formatted after 1-3 years after theirs establishments on plants at permanent place (Chemin L.S., 1997; \*\*\*, 1990).

There is no exist resistant to crown gall grapes vine varieties. This disease is

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spread all over the zones of grape cultivation in the Republic of Moldova. Maximal cancerogenesis intensity there are presented on the sites and microareas characterized by cold winter, freeze injures, as well as in the cases of provocation of additional freezes, induced wounds, graft unions, mechanically produced wounds.

According to our long-term observations on the development of infected plants in the vineyards every years 6% of plants became infected, in the same time varieties Cabernet et Merlot -9,2%. In the nursery 10-20% of plants are already infected, and developments of shoots is reduced at the level of 36%. Therefore 30 plants for one thousand could not be standardized. Depending on type of soil during 10 years plantation 8-19% of plants are lost (Lemanova N.B., 1991). Members of the *Agrobacterium* genus naturally have the ability to transfer a segment of DNA from a plasmid hosted by the bacterium into the genome of a cell of a living plant. The DNA transferred into the plant (the T-DNA) causes the plant cells to initiate two activities. One activity is to manufacture a class of chemicals, called opines, which can be metabolized by the bacteria as a food source. The other activity is to initiate the growth of a tumorous mass referred to as a crown gall. It is not necessary to create a competition relationships between bacterial disease and antagonists in the first step of pathogenesis. In this case *Agrobacterium* could not be attached to walls of plant cells. For this scope it is indispensable to obtain lesions of another bacteria, which is responsible for introduction of pathogen agent. In this situation it is impossible to transfer parasite T-ADN transference into mother cell.

Rizoferial bacteria from genus *Pseudomonas* are the most important for production of biologically active compounds – bacteriocine, antibiotics, enzymes. That is an explanation referring theirs utilization like antagonists for ecological production of microorganisms with biological origin.

## MATERIAL AND METHOD

The researches were carried out in different representative sites of moldavian vineyards within the Experimental Station of Research Institute for Horticulture and Alimentary Technologies, Chisinau. Experiences were consecrated to application of preparation Paurin for biological control of grape crown gall. „Paurin” (\*\*\*, 1990) represent semitransparent liquid, color of milk, mat, with specific smell, non-significant sediment, which disappear on the process of agitation. Ingredients of preparation: suspension of live cells of *Pseudomonas fluorescens*, cultural media within metabolic compounds of bioagent. Content of 1mL of preparation - 10mld bacterian cells. It is necessary to agitate 3-5 minutes diluted preparation before treatment. In case of the production of grafted material plants (scion and rootstock) are treated before paraffination and stratification during 10 sec. using the work solution of 300 ml of Paurin prepare and 100ml water. Before plantation in field duration of treatment of grafted plants is 30 min. Irrigation of planted material should contain 2L of Paurin in 1 t of water.

Obtained mature plants for industrial plantations should be treated with Paurin during 2 hours (proportion: 3l of Paurin and 1t. of water). Treatment in established new plantations annually in the period of intensive circulation of liquids in shoots: 3 L/1ha and 1liter of Paurin to 100 l water for treatment of individual plants. In the vineyards were are affected trunks and principal shoots of plants it is used Paurin in the proportion 5L to 1 ton of water two times during the vegetation.

## RESULTS AND DISCUSSIONS

The importance of the method for controlling crown gall disease in grapes vine (*Vitis vinifera*) plants using an effective quantity of Paurin occurs from table 1.

Table 1

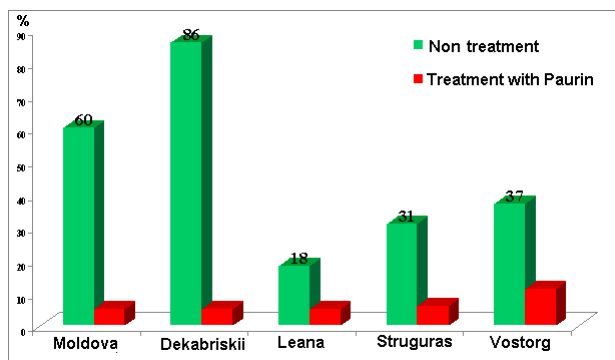
**Effects/Influence of grapes plant treatment with Paurin variety Pinot Franc  
(after sever winter of 2009-2010)**

Spring tilling	Number of planting places	Autumn 2010					
		Killed trunks		Trunks with tumors		Healthy trunks	
		nr	%	nr	%	nr	%
2008-2009 years	88	9	10	2	2,3	79	90,9
2009	88	25	26,4	4	6,4	63	71,6
Without treatment	88	35	39,7	24	45,3	53	60,2

Our investigations and experimentations demonstrate that utilization of Paurin in the production of grafted and non grafted vegetative material in the Republic of Moldova, Krasnodar region of Russia, Herson region of Ukraine reduced percentage of affected plants of varieties Leana, Moldova, Dekabriskii, Strashemskiii, Vostorg from 1 to 5% comparatively with control (non treatment) – 31-86% (fig. 1). Treatment of infected variety Cabernet, grafted on rootstocks S x B-41 B and Kober 5BB before stratification contributed to increase production of good vegetative material in the first field around 56%, comparatively with 42% in control. Biopreparation Paurin have been utilization for replantation of six grapes varieties in the period of vegetation within 900 thousand grafted plants in nursery and in greenhouse. Experimentally are established effectiveness of Paurin in the process of irrigation of plant on containers before plantation and for rooted plants in greenhouse and in open field. Plantation established in 1990-1994 using pretreatment with Paurin actually are economically efficient, without compromise from diseases.

On the basis of bacterial metabolic products in Australia (A. Kerr), USA (Xi-o Pu, Gudman C.) and China (Sule S., 2005; Chen F. et al., 2007; Burr T., 2004) there are created analogical biofungicides for prevention of bacterial tumors development. In Western Europe (Bazzi C., Bini F., 2005; Chen F. et al., 2007) because of mild climate manifestation of tumors are reduced, respectively there are no used treatment in the first stage of plant production. In the same time a special attention there are provided to selection of healthy material for vegetative reproduction (scion and rootstock).

Likewise Paurin is efficient for stopped tumorous proliferation in vineyards. Our investigation demonstrated, that early spring Paurin treatment of experimental vineyards of our Institute before the bleeding vines consecutively 2 years (2008-2009) conducted to reduction of intension of tumor formation (tab.1) in the conditions of cold, air temperature -26°C. For this consideration variety are very important. The incidence of crown gal land its importance in local moldavian vineyards appears to be on the increase. Especially because the enlargement of varietal convective, climate change etc.



**Fig. 1** –Susceptibility of grapes varieties to crown gall and efficiency of Paurin utilization



**Fig. 2** – Tumors and necrosis caused by *Agrobacterium vitis*: **a** – non treatment; **b** – treatment with "Paurin"

## CONCLUSIONS

1. Early spring infected grapes plants treatment using biologic prepare "Paurin" provoke effects of inhibition of tumorous development, have an anti-stress effect for whole plants, stopped grows of tumorous within the injuries.
2. In the scope of reducing the occurrence of crown gall it is necessary to plant winter hardy grape vine varieties.
3. Cultural control strategies include mounding soil around grape vine plants with multiple trunks.

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# MONITORING OF METALS ACCUMULATION (CU, CD, FE AND ZN) IN LEAFY VEGETABLES SAMPLED FROM PRIVATE PRODUCERS IN THE WESTERN PART OF ROMANIA

## MONITORIZAREA ACUMULARII METALELOR (CU, CD, FE ȘI ZN) ÎN LEGUMELE VERDEȚURI PRELEVATE DE LA PRODUCATORII PARTICULARI DIN PARTEA DE VEST A ROMÂNIEI

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**Abstract.** *This paper presents the study of different metals accumulation in leaf vegetables, lettuce and spinach under the conditions of western Romania. In the period 2005-2007 were sampled from food markets in Timisoara, lettuce and spinach, in order to determine their metal content. These vegetables come from private producers of Timis county localities: Gelu Jimbolia Duestii Noi, Sanandrei, Cenad Utvin, Sacalaz, Dinias. Analyses were performed in the Laboratory of Chemistry of USAMVB Timisoara, using a spectrophotometer SpectrAA 220. Cadmium, copper and zinc did not exceed the maximum allowed value in any of spinach and lettuce samples analyzed but shows a lack of zinc and copper. Lead is found in excess, exceeding the maximum permissible limit of 0.5 ppm, but not exceeded the critical concentration of 20 ppm, for lettuce samples from the localities Jimbolia and Utvin. This excess is recorded throughout the period analyzed, 2005-2007. Spinach samples analyzed shows the same trend of higher levels of lead in samples from areas where there are roads with heavy traffic: Topolovat, Jimbolia and Utvin .*

**Key words:** spinach, lettuce, lead, zinc, copper, cadmium

**Rezumat.** *În această lucrare este prezentat studiul acumulării diferitelor metale în legumele verdețuri, salata verde și spanac, în condițiile din vestul României. În perioada 2005-2007 au fost prelevate de pe piețele agroalimentare din Timișoara, salată și spanac, în scopul de a determina încărcarea cu metale a acestora. Aceste legume provin de la producătorii particulari din localitățile: Gelu, Jimbolia, Duestii Noi, Sanandrei, Cenad, Utvin, Sacalaz, Dinias. Analizele au fost efectuate în Laboratorul de chimie de la USAMVB Timișoara, cu ajutorul Spectrofotometrului SpectrAA 220. Cadmiul, cuprul și zincul nu depășesc limita maximă admisă în nici una dintre probele de spanac sau salata verde analizate însă prezintă un deficit de zinc și cupru. Plumbul se găsește în exces, depășind limita maximă admisă de 0.5 ppm, însă nu este depășită concentrația critică de 20 ppm pentru probele de salată din localitățile, Utvin și Jimbolia. Acest exces se înregistrează pe întreaga perioadă de timp analizată, 2005-2007. Probele de spanac analizate prezintă aceeași tendință de creștere a nivelului de plumb în cazul probelor provenite din zona în care există drumuri cu trafic intens: Topolovat, Utvin și Jimbolia..*

**Cuvinte cheie:** spanac, salată, plumb, zinc, cupru, cadmiu

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## INTRODUCTION

Heavy metals, such as cadmium, copper, lead, chromium and mercury, are important environmental pollutants, particularly in areas with high anthropogenic pressure. Their presence in the atmosphere, soil and water, even in traces can cause serious problems to all organisms, and heavy metal bioaccumulation in the food chain especially can be highly dangerous to human health. (Cozma A., 2007). Heavy metals enter the human body mainly through two routes namely: inhalation and ingestion, ingestion being the main route of exposure to these elements in human population (Catana L., 2002). Heavy metals were determined in different concentrations in soil, water, and air, vegetable or animal food, depending on various factors that determine their pollution. Accumulation of heavy metals is associated with a wide range of sources of metals as smaller industries (including the production of batteries, metal objects, the production of cables), emissions from vehicles and particles generated from the highway diesel engines. All this contributes to the accumulation of metals in green vegetables (Beceanu D., 2002). Other sources of metal contamination of vegetable crops, from urban areas and cities province, may be considered the following: irrigation with wastewater, domestic and industrial effluents leading to contamination of soil and plants, pesticides, fungicides and domestic sludge fertilizers applied in excess or in unsafe way (Krishna M., 2001). Metal toxicity is influenced by the solubility of metal and metal compounds. On the other hand revealed a potency synergism between Co and Zn, Co and As, Co and Sn, Zn and As, but an antagonism between these elements and lead. (Woese, K. et al., 2001 **Cadmium** is used in steel alloys in dentistry, colouring the enamelling vessels, etc. Use of fertilizers (with residues of Cd) leads to its accumulation in soil, where plants take it rapidly and migrates in their organs. Rice, wheat accumulates large amounts of cadmium (Rivis A., 2004). **Zinc** has a significant biological role, but in high quantities causes toxic effects. Is use as compound (oxide, sulfide, sulfate, chloride) in industries. Use of insecticides and fungicides based on organic compounds of zinc lead to contamination to food and feed products (Alexa Ersilia, 2008). **Copper** accumulates in roots and cell walls, being transported in the plant and can be eliminated mainly through the leaves (Cumpătă S.D., Beceanu D., 2005).

## MATERIAL AND METHOD

During 2005-2007, were sampled spinach and lettuce, from Timisoara agro-food markets, in order to determine their metal content (copper, zinc, lead and cadmium).

These leafy vegetables come from different localities of Timis county, such as: Gelu, Jimbolia, Dudestii Noi, Sanandrei, Cenad, Utvin, Sacalaz, Dinias. The metal determination was done with the help of *Varian atomic absorption Spectrophotometer SpectrAA 220* in Laboratory of Agro-chemistry of Banat's University of Agricultural Sciences and Veterinary Medicine Timisoara.

Critical and toxic concentration values of studied metals in vegetables are presented in table 1.

Table 1

**Critical and toxic concentration of studied metals in vegetables  
(Kastori R., 1997)**

<b>Metal</b>	<b>Critical concentration (<math>\mu\text{g/g}</math>)</b>	<b>Toxic concentration (<math>\mu\text{g/g}</math>)</b>
Cd	5	10
Cu	15	20
Pb	10	20
Zn	150	200

According to Order No. 640 from 19/09/2001, regarding security and quality conditions for vegetables and fresh fruits for human consumption published in Official Monitor no. 173 from 13/03/2002, maximum admitted limits for metals in vegetables and fresh fruits for sale and human consumption, expressed in mg / kg of fresh product are presented in table 2.

Table 2

**Maximum limits of arsenic and heavy metals in vegetables and fresh fruits  
according with Order No. 640 from 19/09/2001**

<b>Vegetables</b>	<b>As</b>	<b>Cd</b>	<b>Pb</b>	<b>Zn</b>	<b>Co</b>
Leafy vegetables (lettuce, spinach, cabbage)	-	0,2	0,5	-	5,0

## RESULTS AND DISCUSSIONS

The analysis regarding microelements content in lettuce and spinach were done according with SR EN 14082. The obtained results are shown in figures 1-4.

Regarding Cd, Co and Zn content in lettuce samples taken from agro food markets are within the admitted limits of Order No. 640 from 19/09/2001, regarding security and quality conditions for vegetables and fresh fruits for human consumption. Lead was found in excess amounts, which exceed the maximum limit of 0.5 ppm, but not exceeding the critical concentration of 20 ppm for lettuce samples from Utvin and Jimbolia (figure 1). This excess was recorded throughout the time, ie 2005-2007.

Unlike other heavy metals, **lead** is an exclusive toxic element, he having no role in the body. Lead causes the disease called saturnism, is also a cumulative toxic element, lead poisoning causing blackening gums, abdominal pain, nervous system disturbances and digestive tract lesions. Auto emissions are the major source of lead pollution in plants near the road-traffic are register high values. Dust and gases are carried by air currents and eventually deposited on plants, on the ground or surface waters (Ejazul,I., and all.,(2007).

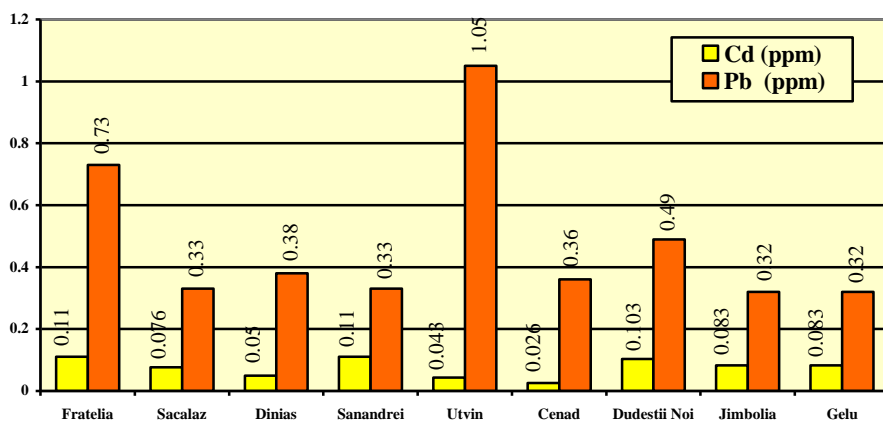


Fig. 1 - Cd and Pb (ppm) content in analysed lettuce samples.

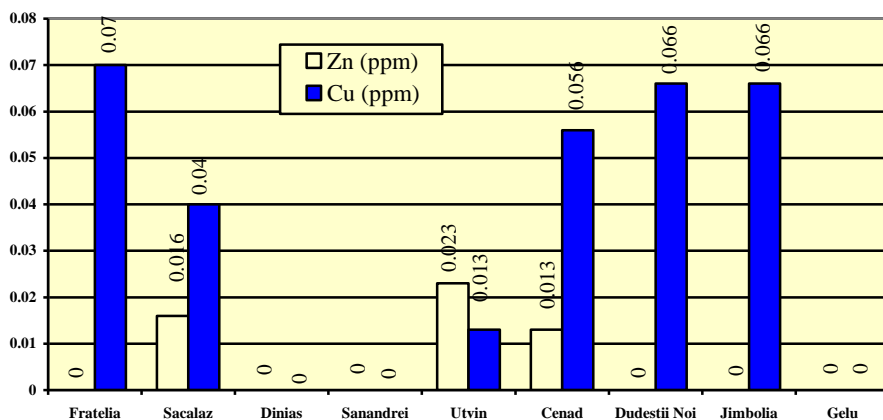


Fig. 2 - Cu and Zn (ppm) content in analysed lettuce samples.

Maximum admitted limit for lead of 0.5 ppm in analyzed lettuce samples was exceeding (figure 1) in samples coming from locations near European and national roads (city Jimbolia and Fratelia) and the area immediately around Timisoara (Utvin is to 5 km from Timisoara) where traffic is very intense and the risk of lead dust deposition on plants, from the exhaust gas is increased.

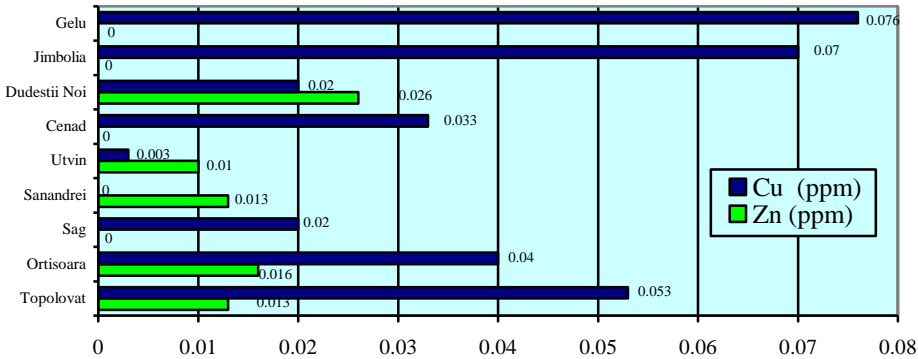
Double values recorded over the maximum allowable limit in Utvin (**1.12, 1.04, 0.99 ppm**) (Figure 1) and which was kept at this level during the 3 analyzed years is a warning signal about the danger caused by lead contamination of lettuce sampled in Timisoara and adjacent area (Negrea M., (2009). Sag locality situated on European road linking Timisoara to Serbia, with intense road traffic, the values obtained for lead in lettuce samples is approaching maximum allowed limit of 0.50 ppm, but not exceed it, registering (0.37-0.40 ppm). Dudestii Noi lettuce samples also recorded values near to the admissibility limit values (0.45 – 0.52 ppm).



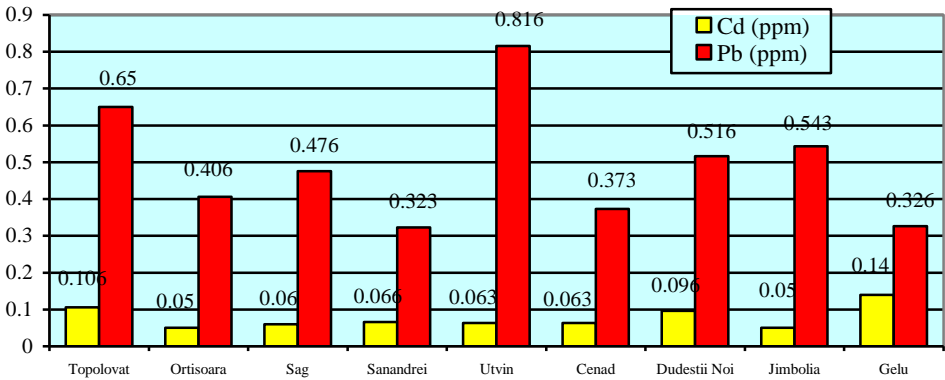
Vegetable plants grown in places less exposed to road traffic, *Ortisoara*, *Sanandrei*, *Gelu*, are less likely to be contaminated with lead from the exhaust gases.

Regarding **copper content** of analyzed lettuce samples, there is a deficiency compared to the normal level in all analyzed samples (figure 2). *Copper content* does not exceed 0.10 ppm in no one of the studied samples, the normal level of copper in vegetables is up to **5 mg/kg** (Ordinul nr. 640 din 19/09/2001). Plants require small amounts of copper, an average content for normal growth is situated between **5-20 mg/kg**. Over this value, copper is considered toxic.

According to previous international studies fresh fruits can contain maximum 0.5 mg/kg As, 0.05 mg/kg Cd, 0.5 mg/kg Pb, 5 mg/kg Zn, 5 mg/kg Cu, and leafy vegetables can contain up to 0.2 mg/kg Cd, 0.5 mg/kg Pb (Gherghi, A. et al., 2001).



**Fig. 3 - Cu and Zn (ppm) content in analyzed spinach samples.**



**Fig. 4 - Cd and Pb (ppm) content in analyzed spinach samples.**

To spinach samples (figure 3) were registered the same trend of increasing levels of lead in samples taken from the area in high traffic roads. Localities where were registered high values of lead, above maximum allowable limit, were: Topolovat, Utvin and Jimbolia, thus demonstrating once again, the negative impact of lead pollution in villages near roads (town Jimbolia and Topolovat) and

the area immediately around Timisoara (city Utvin) where traffic is very intense and the risk of lead dust accumulation from vehicles exhaust gases are high.

The average of lead values of spinach samples coming from the Utvin was 0.816 ppm, exceeding the allowable limit of 0.5 ppm. Moreover, values that exceeded the permissible limit of lead in spinach occurred in samples coming from localities Topolovat 0.65 ppm and Jimbolia 0.543 ppm (figure 4).

## CONCLUSIONS

1. Cadmium, copper and zinc did not exceed the maximum admitted limit in none of the spinach and lettuce samples, studied during the 3 years of research. Low content of copper and zinc show a deficiency of these elements in analyzed leafy vegetables.

2. Lead was exceeding the admitted limit in lettuce and spinach in samples coming from localities near national roads with intense traffic (Topolovat, Utvin and Fratelia).

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# THE CONTENT OF HEAVY METALS AND PESTICIDE RESIDUES IN SOILS OF MONITORING POLYGONS

## CONȚINUTUL DE METALE GRELE ȘI REZIDUURI DE PESTICIDE ÎN SOLURILE POLIGOANELOR DE MONITORING

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**Abstract.** *Research content of heavy metals in arable soils, carried out within 20 Monitoring polygons placed in all zones of Moldova, showed that concentrations not exceeding the Maximum admissible concentration (MAC) and can not be hazardous to the environment. The content of pesticide residues in soils showed a low concentration of DDT and HCH, which does not exceed the MAC. Remediation measures should target not only harmful to the removal of sources, but to include all measures to recover and restore affected agrochemical indices acquire their basic soil - fertility, as they are "cumulative deposits" and pollutant sources. Only a fertile soil has qualitative properties and "resistance" to the harmful effects of pollution degrading.*

**Key words:** monitoring, heavy metals, pesticide, pollution

**Rezumat.** *Cercetările conținutului de metale grele în solurile arabile, efectuate în cadrul a 20 poligoane de Monitoring amplasate în toate zonele Republicii Moldova, au demonstrat că acestea nu depășesc Concentrația maximal admisibilă (CMA) și nu pot fi periculoase pentru mediul înconjurător. Conținutul reziduurilor de pesticide în soluri a evidențiat o concentrație redusă de DDT și HCH care nu depășește CMA. Măsurile de depoluare trebuie să vizeze nu numai înlăturarea surselor cu efect nociv, dar să cuprindă toate măsurile menite să refacă indicii agrochimici afectați și să redea solurilor însușirea lor de bază – fertilitatea, întrucât acestea sunt „depozite cumulative” ale unor surse și agenți poluanți. Numai un sol fertil deține însușiri de calitate și de „rezistență” la efecte nocive, degradante ale poluării.*

**Cuvinte cheie:** monitoring, metale grele, pesticide, poluare

### INTRODUCTION

Uncontrolled application of fertilizers and pesticides or only the cultivation of agricultural plants on land previously contaminated causes of nutritional disorders, impaired quality of irreversible phenomena, hampers crop production; accumulate the elements and substances above the permissible limits for users. In most cases, plant pollution with heavy metals occurs amid intense negative effects caused by some high emissions of sulfur and nitrogen oxides. Plants accumulate heavy metals in conditions where the soil has polluted with these elements, in dependence on the type and specificity of the plant uptake and translocation of these elements, their tolerance level increased concentrations of chemical elements. Leaves, shoots and plant organs with photosynthetic activity

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accumulate high amounts of heavy metals than seeds. The phytotoxic effect of lead occurs at lower levels for beans, but sunflower is more tolerant and resistant to high concentrations of this element. Bioaccumulation of cadmium is higher in plants grown in acid soils and low in cereals and legumes (seeds) compared with that obtained in roots and leaves of vegetable plants. With regard to soil pollution effects on grown plants with copper, it has found that the intensity of phytotoxic phenomena is different and depending on the species, the most tolerant to increasing concentration of copper in soil were barley and beans and most sensitive were peas and oats (Rusu et al., 2005).

Pesticides content in soils shows a negative action on living organisms, accumulate in animal tissues, have carcinogenic properties, mutagenic, embryo toxic, neurotoxin effects, disrupt the immune system, contributing to anemia and liver disease (Regional Report., 2003).

## **MATERIAL AND METHOD**

Analysis of content of heavy metals and pesticide residues in soils has conducted by the Center for Monitoring of Soil Quality (CMCS) of the Department of Environmental Quality Monitoring of the State Hydrometeorological Service. Were analyzed the 20 soil samples collected from different agricultural zone of R. Moldova. In the soil samples were determined mobile forms of copper, zinc, lead; and organic-chlorinated pesticide residues (alpha-HCH, beta-HCH, gamma-HCH, 4,4-DDE, 4,4 - DDD, 4,4-DDT). Method of determination: atomic absorption spectrometry, device «SOLAAR».

## **RESULTS AND DISCUSSIONS**

The maximum admissible concentration (MAC) values of mobile forms of heavy metals in soil is: Cu – 3,0 mg/kg, Zn – 23,0 mg/kg, Pb – 6,0 mg/kg. According to the obtained results, the content of mobile forms of heavy metals in soils does not exceed the MAC and the concentration cannot be dangerous for the environment (table 1).

Pesticides used in agricultural technologies in the past, some substances with insecticide character, other with herbicide effect, are persistent, and their residues are present in soils and crop production. In previous years they were totally abandoned and were replaced by organic-chlorine insecticides (based on HCH-hexachlorocyclohexane and DDT-pp'-dichlorodiphenyltrichloroethane), as the organic-phosphorus (methyl-, etilparatione, malathione, mevinphose) due to their high persistence and recovery in soils and crop production. Determination of pesticide residues in soils in the Republic of Moldova has suspended in 1970. However, the high degree of pesticide resistance and high capacity to migrate generated content need to monitoring the DDT and its metabolites in soil and environmental components. Herbicides applied for weed control has cumulative actions in time and sized their amount of residue in the soil, which ultimately determine the lingering effects including phytotoxicity to plants.

Applied in soil, the herbicides enter into interaction with this polydispersity system, participating in a variety of processes resulting effective action against not only weeds, but also effects the amount of residue remaining on the plants.

Table 1

**The content of mobile forms of Zn, Cu, Pb (mg/kg) in soils (Ah 0-20 cm)**

Nr.	Commune	Soil	Zn	Cu	Pb
1	Bănești	Chernozem ordinary, swarding	0,74	0,43	0,49
2	Căzănești	Chernozem ordinary, arable	0,73	0,59	0,94
3	Chiștelnița	Chernozem stagnic, arable	1,03	0,64	0,68
4	Olănești	Chernozem ordinary, irrigate	1,38	0,64	0,81
5	Baccialia	Chernozem ordinary, arable	0,79	0,82	1,42
6	Calfa	Chernozem ordinary, swarding	0,78	0,26	0,27
7	Cimișeni	Cernoziom typical, irrigate	0,86	0,20	0,18
8	Cupcui	Chernozem ordinary, arable	0,53	0,47	0,90
9	Burlacu	Chernozem ordinary, arable	0,54	0,09	0,89
10	Burlacu	Chernozem ordinary, swarding	1,13	0,33	0,32
11	Congaz	Chernozem ordinary, arable	0,56	0,16	0,88
12	Napadova	Chernozem typical, arable	0,55	0,44	0,40
13	Alexandrovca	Grey soil, arable	0,71	0,28	0,90
14	Alexandrovca	Grey soil, virgin	0,48	0,51	0,26
15	Lebedenco	Chernozem ordinary, eroded	1,02	0,12	0,59
16	Grinăuți	Chernozem typical, swarding	1,07	0,56	2,05
17	Bălți, "Selectia"	Chernozem typical, arable	0,62	0,37	0,30
18	Ivancea	Chernozem cambic, unfertilized	0,59	0,54	0,28
19	Ivancea	Chernozem cambic, (NPK) <sub>60</sub>	0,68	0,24	0,29
20	Ivancea	Chernozem cambic, N <sub>300</sub> (PK) <sub>60</sub>	0,60	0,35	0,41

These soil-herbicide interaction processes have several actions: fixation by clay minerals and humus absorption from the soil, volatilization of adsorbing substances, leaching of the remaining quantities in the soil solution and obviously, their decomposition by biodegradation, inactivation and activation (Leah, 2010).

MAC for  $\Sigma$ HCH and  $\Sigma$ DDT in soil is 0,01 mg/kg. The determine limits of method are:  $\alpha$ -HCH,  $\beta$ -HCH, 4,4-DDE, 4,4-DDD – 0,0004 mg/kg;  $\gamma$ -HCH – 0,0001 mg/kg, 4,4-DDT – 0,0008 mg/kg. Determination results revealed that the pesticide content of  $\Sigma$ HCH and  $\Sigma$ DDT in studied soil samples of monitoring polygons is insignificant and does not exceed the MAC (table 2).

Content amount of DDT ranging from 0,00013 mg/kg to 0,00604 mg/kg (MAC=0,001-0,060 mg/kg). The most of the total  $\Sigma$ DDT in soils returns to metabolite DDE. Maximal level of  $\Sigma$ HCH is 0,00012 mg/kg (MAC=0,001 mg/kg). In the total content of  $\beta$ -HCH in soils, are predominated isomers as  $\alpha$ -HCH and  $\gamma$ -HCH. The content of  $\beta$ -HCH isomer is less than the detection limit of the device (<0,0004 mg/kg), except for sample nr.7 (typical chernozem post irrigation with wastewater from livestock complex), the isomer - 0,0008 mg/kg.

From the above, to determine a lower polluting effect as, the preferred use the pesticides with containing the active substance as effectively, but to run out of

environment control and treatment (including land) as quickly as possible. This goal is becoming increasingly useful to solve the successive treatments, especially widespread in viticulture and orchards. The pesticides used to be able to decompose in the soil from one treatment to another, without the accumulation of pollutant, residues (*Starea mediului în Republica Moldova, 2007*).

Table 2

The content of pesticide residues in soils (Ah 0-20 cm), C, mg/kg

Nr	$\alpha$ - HCH	$\beta$ - HCH	$\gamma$ - HCH	4,4-DDE	4,4-DDD	4,4-DDT
1	0,0002	<0,0004	0,0002	0,0013	<0,0004	<0,0008
2	0,0001	<0,0004	0,0001	0,0054	0,0010	0,0016
3	0,0002	<0,0004	0,0001	0,0031	0,0012	0,0018
4	0,0001	<0,0004	0,0001	0,0084	0,0009	0,0015
5	0,0001	<0,0004	0,0001	0,0086	0,0010	0,0015
6	0,0001	<0,0004	0,0001	0,0032	<0,0004	<0,0008
7	0,0001	0,0008	0,0002	0,0198	0,0133	0,0273
8	<0,0001	<0,0004	<0,0001	0,0028	0,0004	<0,0008
9	0,0001	<0,0004	0,0001	0,0046	0,0008	0,0014
10	<0,0001	<0,0004	<0,0001	0,0019	0,0004	<0,0008
11	0,0001	<0,0004	0,0001	0,0116	0,0008	0,0016
12	0,0001	<0,0004	<0,0001	0,0022	0,0007	0,0013
13	0,0001	<0,0004	<0,0001	0,0029	0,0015	0,0030
14	<0,0001	<0,0004	<0,0001	0,0084	0,0011	0,0023
15	0,0001	<0,0004	0,0001	0,0051	0,0006	<0,0008
16	0,0001	<0,0004	<0,0001	0,0008	<0,0004	<0,0008
17	0,0002	<0,0004	0,0001	0,0162	0,0038	0,0057
18	0,0001	<0,0004	0,0001	0,0132	0,0014	0,0028
19	0,0001	<0,0004	0,0001	0,0302	0,0041	0,0069
20	0,0001	<0,0004	<0,0001	0,0272	0,0044	0,0071

## CONCLUSIONS

1. Research on heavy metal content in the main arable soils, carried out in 20 key polygons of monitoring placed in all zones of the Republic of Moldova, have found that their concentrations do not exceed the MAC and cannot be hazardous to the environment.

2. Determination on the same key polygons of pesticides residues in soils showed that their content has reduced and does not exceed the MAC.

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# SEASONAL DYNAMIC OF EARTHWORMS OF *EISENIA FOETIDA* (SAVIGNY-1826) (*OLIGHOCHAETA-LUMBRICIDAE*), IN A MANURE HEAP, IN THE FIELD

## DINAMICA SEZONIERĂ A POPULAȚIILOR DE RÂME DIN SPECIA *EISENIA FOETIDA* (SAVIGNY-1826) (*OLIGHOCHAETA-LUMBRICIDAE*) ÎNTR-O PLATFORMĂ DE GUNOI DE GRAJD

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**Abstract.** *This paper analyzes the population dynamic of Eisenia foetida (Oligochaeta, Lumbricidae) from a manure platform over a year, to find the epigeal earthworm response, to season changes. The earthworms are collected from the same manure platform, in all four season, October 2009 for the autumn, March 2010 for the winter, May 2010 for the spring and August 2010 for the summer. The biological material are collected and sorted manually from each sample of wastes in part, was determined, studied and classified into three biological categories: adults, juveniles and cocoons. It was found that the transition from a season to another, can strongly influence the density of individuals, reproductive activity and biomass. All the biological parameters studied was recorded maximum efficiency in spring, the number of cocoon by the number of mature individuals has remaining constant.*

**Key words:** earthworm, the dynamic of species, manure heap, season

**Rezumat.** *Lucrarea analizează dinamica populației de Eisenia foetida (Oligochaeta, Lumbricidae) dintr-o platformă de gunoi de grajd, pe parcursul unui an, pentru a afla care este reacția lumbricidelor epigee la schimbările de anotimp. Ca urmare, au fost colectate râme din aceeași platformă de gunoi de grajd în cele patru anotimpuri și anume în octombrie 2009 pentru perioada de toamnă, în martie 2010 pentru perioada de iarnă, în mai 2010 pentru anotimpul de primăvară și în august 2010 pentru anotimpul de vară. Materialul biologic colectat a fost sortat manual, din fiecare probă de gunoi în parte, apoi a fost determinat, studiat și clasificat în trei categorii biologice: adulți, juvenili și coconi. S-a constatat astfel că trecerea de la un anotimp la altul poate influența puternic densitatea indivizilor, activitatea reproductivă și biomasa. Randamentul maxim la toți parametrii studiați a fost înregistrat în perioada de primăvară, numărul de coconi raportat la numărul de indivizi maturi a rămas constant pe parcursul întregului an.*

**Cuvinte cheie:** râme, dinamica populației, gunoi de grajd; anotimp.

## INTRODUCTION

Soil fauna is influenced by the environmental factors, by the physical and chemical properties of soil, been affected the abundance, density and species

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diversity. Some of these factors such as seasonal changes can affect animal live cycle and annual dynamics of population (Rozen A., 1988).

Earthworms are major component of soil fauna, and seasonal changes have a great influence on the biomass of their populations (Edwards C.A., P.J. Bohlen, 2004).

Since earthworms species have different ecological requirements, the influence of environmental factors on population dynamics varies from one species to another.

The activity of earthworms is often influenced by temperature and humidity, epigeal species is most affected by the transition from one season to another (Neuhauser E.F., R. Hartenstein, D.L. Kaplan, 1980).

If changes in temperature or humidity, individual of different species carried in the vertical movement in soil, but low temperatures can cause biological functions reducing the minimum size of individuals, but also affects their prolificacy.

*Eisenia foetida* (Savigny, 1826) (*Oligochaeta - Lumbricidae*) is an epigeic species, preferring soil rich in manure and individuals living in high density communities.

## MATERIAL AND METHOD

The specimens of *Eisenia foetida* were collected in a manure platform located in the area of Popricani, Iași. Average annual rainfall in the region is 530-550 mm, and the thermic average is 9,3-9,6 °C, with highest values in summer.

The biological samples were collected and monitored in a manure platform. The individuals were collected and sorted manually, from five samples of wastes (equally). The collection was made in October 2009, from autumn, March 2010 from winter, May 2010 from spring and August 2010 from summer.

The earthworms collected in each samples were separated in three biological categories: adults, juveniles and cocoons. Cocoons were counted per 1 kg. soil (manure) (Elvira C., J. Dominguez, M.J.I. Briones, 1996).

## RESULTS AND DISCUSSIONS

The population density in the manure, over an entire year was 1-8 individuals/ kg soil (manure).

The most of biological parameters analyzed varied throughout year (table 1) the number of individuals increased significantly to spring, when the maximum density was recorded.

In summer the population density had the low value. The density and weight cocoons was highest in the spring, and they are completely absent in autumn and winter.

The age structure of population also changed during the year. The ratio of adults and juveniles averaged 4,5/ 3,25 over the year, and at the season was 4/0 in autumn, 1/0 in winter, 5/3 in spring and  $\frac{3}{4}$  in summer.

The total number of individuals vary widely from one season to another, the smallest number of individuals per kg soil was recorded in winter (1 ind.), and the



largest number of individuals was recorded in spring (8). The total number of cocoons by the number of adults has remained constant.

Table 1

**The effect of transition from one season to another on the density and reproductive activity in the populations of *Eisenia foetida* (*Oligochaeta* - *Lumbricidae*)**

Biological category	Autumn	Winter	Spring	Summer	Total year	Annual average
Total individuals (nr./kg.)	4	1	8	5	18	4,5
Adults	4	1	5	3	13	3,25
Juveniles	-	-	3	2	5	1,25
Cocoons	-	-	5	3	12	4

It was also found that ecological factors changes from one season to another, affects not only individuals but the numerical density (table 2) or the size and weight of cocoons.

Table 2

**The changes of morphological parameters of *Eisenia foetida* each season**

Morphological parameters	length mm	Diameter Ø mm	Clitel position	Total number of segments
Season				
Autumn (4 ind.)	130	2,5	27-32	143
	127	3,0	24-31	87
	132	3,0	24-31	89
	110	2,5	24-30	91
Winter (1 ind.)	85	2,0	24-30	87
Spring (5 ind.)	110	2,5	24-31	122
	110	2,5	24-31	100
	125	3,0	27-32	132
	122	2,5	27-32	117
	132	3,0	24-31	133
Summer (3 ind.)	100	3,0	24-31	110
	85	3,0	24-30	91
	88	3,0	24-30	99

We can see that the size of the largest individuals were collected during the autumn and spring, in these season we are collected individuals with 110-132 mm, and 2,5-3,0 mm diameter, explained by the rich source of food at the collection site.

By comparison, the small individuals were recorded in the winter, were length is 85 mm, located at the lower limit for this species.

In this case, the absence of individuals in the area or small parameters is correlated with lower temperature, determining the withdrawal in depth.

Another factor affected by the seasonal transition is the prolificacy of individuals, reflected in the number of cocoons taken from the samples.

A lack of cocoons can be seen in autumn and winter season, explained by the low temperature in the external environment, that reduce all vital functions.

## CONCLUSIONS

1. The transition to one season to another influencing the growth and reproduction of earthworm from *Eisenia foetida* (*Oligochaeta- Lumbricidae*), and acts equally on the age structure of population (Tsukamoto J., H. Watanabe, 1977).

2. The high density of individuals is typical of *Eisenia foetida* population, especially when it has plenty of organic matter.

3. This species living in environments were food sources and living environment is identical, favouring reproduction and a large number of individual.

4. The small number of adults recorded during the summer is another characteristic of *Eisenia foetida* population, been the consequence of the cumulative action of the high temperature and low humidity, but also results in a reduction of food resources.

5. The changes in density of cocoons can be recorded to the variation in adult density.

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# RESULTS ON THE EFFECTIVENESS OF NEW INSECTICIDES IN MAJOR PESTS OF APPLE

## REZULTATE PRIVIND EFICACITATEA UNOR NOI INSECTICIDE ÎN COMBATAREA PRINCIPALILOR DĂUNĂTORI AI MĂRULUI

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**Abstract.** In 2010, the SCDP Iasi were carried out research on testing the effectiveness of plant protection products. The experiment was conducted in experimental polygon, in an apple orchard, the variety Idared. Pests on which observations were made were: *Cydia pomonella* L., *Adoxophyes reticulana*, *Panonychus ulmi*, *Phyllonorycter* spp, and the products tested were: Affirm SG 095 and Voliam Targo SC 063.

**Key words:** control, effectiveness, insecticides, pests, biology

**Rezumat.** În anul 2010, la SCDP Iași s-au efectuat cercetări cu privire la testarea eficacității unor produse de protecția plantelor. Experimentul s-a desfășurat în poligonul experimental, pe o plantație de măr, la soiul Idared. Dăunătorii asupra cărora s-au efectuat observații au fost: *Cydia pomonella* L., *Adoxophyes reticulana*, *Panonychus ulmi*, *Phyllonorycter* spp., iar produsele testate: Affirm SG 095 și Voliam Targo SC 063.

**Cuvinte cheie:** combatere, eficacitate, insecticide, dăunători, biologie

### INTRODUCTION

In all areas of apple fruit production is affected by many factors, including pests that have a special role. The main pests dominant, causing extensive damage in apple orchard are: apple worm (*Cydia pomonella* L.), peel fruit moth (*Adoxophyes reticulana*), mites (*Panonychus ulmi*) și mined (*Phyllonorycter* spp.).

Reducing losses caused by these pests is achieved by a complex of integrated control measures, among them remains the most important chemical control. (Beșleagă Ramona, 2009; Cîrdei E., 2005)

In 2010, at Research and Development Station for Fruit Growing Iasi, have experienced two new insecticides, to determine effectiveness in combating major pests of apple.

### MATERIAL AND METHOD

The research was conducted in an experimental polygon of apple plantation, the distance between trees being 3X1 m, arranged in the form of palmettes.

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The aim of the experience was to test the effectiveness of plant protection products, to combat the major pests of apple. The used products were: Affirm SC 095 și Voliam Targo SC 063.

Affirm insecticide has been tested to combat skin fruit moth and apple worms, but Voliam Targo to combat mites, mined and apple worms.

Insects biology and treatment efficacy was influenced by the climatic conditions (table 1).

Table 1

The main climatic elements in 2010 at RDSFG Iași

Month	Temperature °C			Rainfall	Number of rainy days	Humidity
	Average	Maximum	Minimum			
I	-6,4	-10,4	-26,0	35,6	11	91
II	-1,1	12,6	-12,6	22,6	12	85
III	4,5	22,6	-7,5	16,2	8	65
IV	12,6	23,3	2,0	28,0	10	61
V	17,3	28,1	6,5	77,2	15	63
VI	19,8	35,0	8,2	153,8	15	63
VII	21,8	33,7	11,4	25,6	15	79
VIII	23,1	37,0	9,4	45,2	6	69
Total	-	-	-	404,2	92	-

Between Aprilie and August average temperatures were 12,6°C-23,1°C (with maximum of 37,0°C), and rainfall in May – June 2010 recorded an amount of 231,0 l/m<sup>2</sup> (77,2 l/m<sup>2</sup> in May and 153,8 l/m<sup>2</sup> June), thus very favorable. Also the number of days with rain per month is 15 in all three months (15 days in May, 15 days in June și 15 days in July).

The Affirm and Voliam Targo products were variants chosen for experience, as follows:

V1 – Affirm SG 095 – 3 kg /ha

V2 - Affirm SG 095 – 4 kg/ha;

V3 – Voliam Targo SC 063 – 0,75 l/ha

V4 - Voliam Targo SC 063 – 1,1 l/ha

V5 – untreated control

Coragen insecticide was used as a standard product comparison (dose of 0,15 l/ha for apple worm and mined), and Vertimec 0,75 l/ha for mites.

Experimentation insecticides was conducte don a variety of Idared, each one being of 15 trees.

## RESULTS AND DISCUSSIONS

During the growing season of 2010 there have been a very favorable conditions for development and pests attack studied.

Results on the density and the four pest attack are presented in tables 2 and 3.

Affirm product was tested for control of two insects: *Adoxophyes reticulana* and *Cydia pomonella* L., Coragen insecticide was used as a standard product, in dose of 0,15 l/ha. There have been two treatments for each generation, and the volume of used solution was 1500l/ha.

As a result of treatment, the product Affirm SG 095 has a satisfactory efficacy for apple worm and very good for skin fruit moth, with a sensitivity advantage for the version with 4 kg/ha, compared with untreated control (table 2).

Table 2

**Affirm SG 095 product effectiveness in combating species  
*Adoxophyes reticulana* and *Cydia pomonella* L. at SCDP Iași**

Variant	Dose	<i>Adoxophyes reticulana</i>		<i>Cydia pomonella</i> L.	
		% dead larvae	% contested fruits	% attacked apple	
				G I	G II
V1 – Affirm SG 095	3,0	91	4,8	6,4	4,5
V2 – Affirm SG 095	4,0	91	4,5	5,2	3,8
V3 – Coragen	0,15	95	1,0	1,0	0,5
V4 – untreated control	-	-	60,5	33,4	54,5

Coragen standard product had a significantly better efficacy for both insects, compared to Affirm.

Voliam Targo SC 063 insecticide was tested for three pest control: mites, mined and worm apples. Results on the density and attack of these pests are presented in table 3.

Table 3

**Voliam Targo SC 063 product efficacy in combating major  
pests of apple at SCDP Iași**

Variant	Dose l/ha	Mites / leaf				Mined		<i>Cydia</i> - % contested fruits	
		Before treatment	3 days	7 days	% mobile larva	% attacked leaves	nr. mines/ leaf	G I	G II
Vm –untreated control		394	412	510	-	20,1	4,5	35,5	57,6
V1- Voliam	0,75	312	230	147	47,1	1,7	1,2	1,1	1,4
V 2- Voliam	1,1	356	269	123	34,5	1,1	0,9	0,5	0,7
V3- Vertimec	0,75	425	210	54	12,7				
V4 -Coragen	0,18					0,5	0,3	0,7	0,8

If mites, Voliam Targo product had acaricide effect, but does not approach the effectiveness of standard Vermitec that after 7 days of treatment were still 54 alive of 425 mites before treatment (12.7%) and Voliam in dose of 0,75 l/ha – 147 alive of 312 initially (47.1%) and 123 alive of 356 initially (34,5%) for Voliam in dose of 1,1 l/ha.

Regarding mined, Voliam Targo insecticide had a good efficacy compared to the untreated control, values from 1,1 – 1,7% of which is satisfactory compared with 0,5% in Coragen.

Also, the insecticide had a very good efficacy in combating worm apples, which applied in dose of 1,1 l/ha, percentage of attacked fruits was 0,5 – 0,7 %, lower than Coragen.

Both products tested had satisfactory to good efficacy in apple pest, compared to Coragen product which showed a higher efficacy to combat worm apples.

## CONCLUSIONS

1. Climatic conditions of 2010 were very favorable for the development and apple pests attack, for which they have been testing new insecticides for the control;

2. Affirm SG 095 insecticide, had a satisfactory efficacy for control of insects, *Adoxophyes reticulana* și *Cydia pomonella* L., compared with Coragen product, which showed a much better efficacy.

3. Voliam Targo insecticide applied at a dose of 1,1 l/ha was very effective in combating species *Cydia pomonella* L., with inconclusive effect against mining larvae compared with the Coragen product;

4. Affirm SG 095 și Voliam Targo SC 063 insecticides had a good efficacy in comparison with untreated control.

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# THE STRUCTURE OF COREOIDS COMMUNITIES (INSECTA, HETEROPTERA, COREOIDEA) WITHIN ANTHROPIZED MEADOWS IN THE LOWER BASIN OF THE SIRET RIVER

## STRUCTURA COMUNITĂȚILOR DE COREOIDE (INSECTA, HETEROPTERA, COREOIDEA) DIN PAJIȘTILE ANTROPIZATE LOCALIZATE ÎN BAZINUL INFERIOR AL RÂULUI SIRET

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**Abstract.** *Our studies of the coreoids fauna within anthropized meadows in the lower basin of the Siret River were carried out between 2004-2005, 2007-2008. From the studied regions we have collected 82 specimens of coreoids pertaining to 14 species (25,45% of the entire amount of Coreoidea in Romania), 12 genera and 4 families. As compared to previously carried out studies, some rare species of coreoids from Romania are first reported in the lower basin of the Siret River and Moldavia: Agraphopus lethierryi Stal 1872 and Chorosoma gracile Josifov 1968 from Rhopalidae family.*

**Key words:** Heteroptera, Coreoidea, biodiversity, anthropized meadows

**Rezumat.** *Studiul faunei de coreoide (Heteroptera, Coreoidea) în pajiștile antropizate localizate în bazinul inferior al râului Siret s-a realizat în perioada 2004-2005, 2007-2008. În zonele studiate au fost colectați 82 de indivizi ce aparțin la 14 specii (25,45% din totalul speciilor de coreoide raportate pe teritoriul României), 12 genuri și 4 familii. Raportat la studiile realizate anterior în zona studiată, dintre speciile de coreoide rare pentru fauna României, semnalăm pentru prima dată în bazinul inferior al râului Siret și în toată zona Moldovei, prezența speciilor Agraphopus lethierryi Stal 1872 și Chorosoma gracile Josifov 1968 din familia Rhopalidae.*

**Cuvinte cheie:** Heteroptera, Coreoidea, biodiversitate, pajiști antropizate

### INTRODUCTION

Lower Siret or the plain below, is located downstream from the mouth Putney. The area is characterized by changes in river dynamics changes as a direct result neotermic and geoclimatic of postglacial and it fits on the overall climate in the floor of low hills (200-500 m altitude) of predominantly basic topoclimate meadow and terraces depending on local conditions.

Lower meadow Siret belongs to a temperate continental dry, hot summers and harsh winters, kept the specific climate and steppe plains. Droughts, the climatic phenomenon, arising from the reduction or even absence of rainfall for a period shorter or longer time, which increases the saturation deficit of air.

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In the southern basin of the Siret River precipitation are extremely low. Summer rains were torrential character, large quantities at very short thus forming floods.

The human impact on the floodplain Siret intensifies after the second world war by massive deforestation activities, irrigation, dams, hydraulic structures, crops. Floodplain forests and water meadows vegetation is replaced by plantations of hybrid poplar, willow, pine and glade. Industrialization and urban development on the tributaries of the Siret and produced a strong river water pollution with adverse impacts on vegetation and ecosystem in general.

Siret River Valley, with its terraces and meadows, is an important corridor that was used for morphological location of transportation routes - the first road and rail nineteenth century - which has made the link between southern and north-east of the country (Monah, 2001).

Research on coreoids in the lower basin of the Siret River have been conducted sporadically by Marcu Aurora in 1982 and Kis 2001.

Studies on the coreoids fauna in the lower basin of the Siret in recent years have led to the identification of 31 species of coreoids (56.36% of the total species of coreoids reported from Romania) (Serban, 2010).

## MATERIAL AND METHOD

Coreoids study of anthropogenic grasslands located in the lower basin of the Siret River was conducted in 2004-2005, 2007-2008. Heteropterologic material was collected by sweeping the vegetation with entomological net in the following areas:

- ✓ grassland in the **Ivesti** municipality, located in the western county of Galati (on the border with Vrancea county), in the meadow Siret Plain and Tecuci.

**Coordinates: 45.656288° lat. N, 27.492599° long. E**

- ✓ **Muchea** (Siliştea village, Braila county) - xerophile and mezoxerophile grassland on the outskirts, bordering the road, close to farmland and vineyards, which occur in species such as *Artemisia austriaca*, *Euphorbia* sp, *Hypericum perforatum*, *Stipetum capillatae*, *Poa angustifolia*

**Coordinates: 45.33821° lat. N, 27.822876° long. E**

- ✓ **Baldovinesti** (Braila county) - the edge of town, near the railway, a meadow is composed mainly of antropophilic weeds: *Amaranthus retroflexus*, *Centaurea cyanus*, *Chenopodium album*, *Matricaria recutita*, *Setaria pumila* forming segetal weed communities. In some places the weeds growing community nitrofile Artemisietea Class: *Arctium lappa*, *Conium maculatum*, *Artemisia absinthium*.

**Coordinates: 45.383291° lat. N, 27.981791° long. E**

- ✓ **Maxineni** (Braila county) - mesophilic grassland on the microrelief of periodically flooded banks, the floristic composition of many species are in - Festuco- Brometa Class found only the cenozes *Juncus gerardi*.

**Coordinates: 45.407806° lat. N, 27.654498° long. E**

## RESULTS AND DISCUSSIONS

The analysis of table 1 in anthropogenic grasslands of the lower basin of the Siret were identified 14 species of coreoids (45.16% of the coreoids fauna found in the lower basin of Siret), of a total of 82 individuals collected, belonging



to four families which what is in our country Coreoidea Superfamily (Kis 2001, Moulet 1995, Wagner 1966). Thus, two species meet the family Coreidae, family Alydidae with one species, 10 species in Rhopalidae family and Stenocephalidae family is represented by one species.

Table 1

**The ecological and fauna characterization of the coreoids communities from anthropized meadows**

Nr. crt	Taxon	Zoogeographical area	Ivești		Mucnea		Baldovinești		Măxineni		Total
			N	X	N	X	N	X	N	X	
Coreidae Family											
1	<i>Coreus marginatus</i>	P	3	0,43			1	0,14			4
2	<i>Ceraleptus gracilicornis</i>	EuM	3	0,43	1	0,05					4
Alydidae Family											
3	<i>Camptopus lateralis</i>	P			6	0,28					6
Rhopalidae Family											
4	<i>Corizus hyoscyami</i>	P	4	0,57	2	0,1					6
5	<i>Liorhyssus hyalinus</i>	C			1	0,05					1
6	<i>Rhopalus parumpunctatus</i>	P			1	0,05					1
7	<i>Brachycarenum tigrinus</i>	P			3	0,14					3
8	<i>Stictopleurus abutilon</i>	Eu			2	0,1			1	0,14	3
9	<i>Stictopleurus pictus</i>	M			1	0,05					1
10	<i>Agraphopus lethierryi</i>	Sp			1	0,05					1
11	<i>Myrmus miriformis</i>	Eu	3	0,43	37	1,76			1	0,14	41
12	<i>Chorosoma schillingi</i>	Eu			2	0,1	1	0,14			3
13	<i>Chorosoma gracile</i>	EuAs							1	0,14	1
Stenocephalidae Family											
14	<i>Dicranocephalus albipes</i>	EuM			7	0,33					7
Total			13		64		2		3		82

P – Palearctică, Eu – European, C – Cosmopolit, EuM – Euromediterranean, Sp- Sud Palearctic, EuAs - Eurasiatic

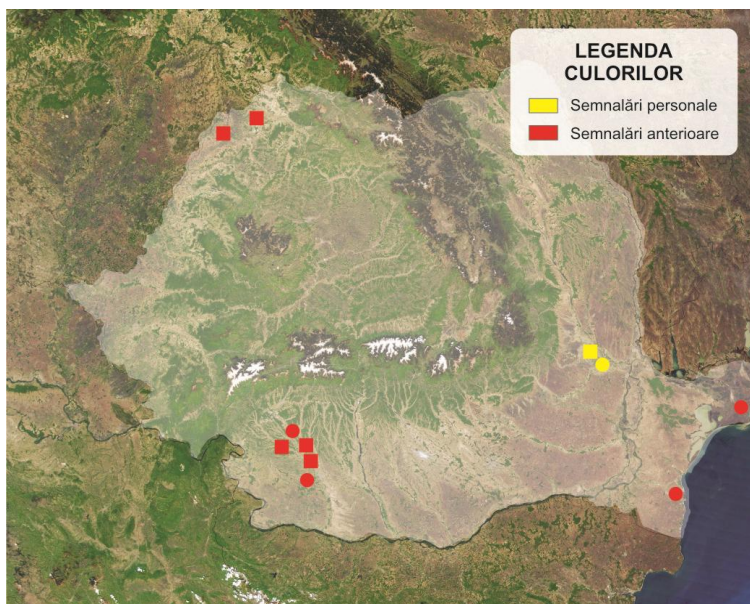
N- total number of collected samples; X – numerical abundance

The distribution of species on the four points of collection and collected number of individuals varies greatly. Station with the largest number of species (12) and with most coreoids individuals collected (64) is the edge, it is clearly detaching Ivești station (four species and 13 individuals), because the stations and Maxineni Baldovinești, number of individuals collected is extremely small (two

or three individuals). This is explained by the presence of a mezoxerophyte lawn Muchea station with parts that meet xerophyte species such as *Artemisia austriaca*, *Euphorbia* sp, *Hypericum perforatum*, *Stipetum capillatae*, *Poa angustifolia*, plant species in the trophic spectrum of many coreoids in our case of species *Myrmus miriformis*, which was collected in a large number (41 individuals).

Most species have been identified at the edge (12 species), followed Ivesti (four species), Maxineni (three species), because at Baldovinesti be identified only two species coreoids. The distribution of four grassland species studied is different. Thus, *Camptopus lateralis*, *Liorhyssus hyalinus*, *Rhopalus parumpunctatus*, *Brachycarenum tigrinus*, *Stictopleurus abutilon*, *Stictopleurus pictus*, and *Dicranocephalus albipes*. *Agraphopus lethierryi* are present only at Muchea and *Chorosoma gracile* is present only in the Maxineni lawn.

Among the fauna of rare species, first identified in the lower basin of the Siret, we identified at Muchea (Braila county) *Agraphopus lethierryi* a male (fig. 1) *Rhopalidae* family, known species in the southern areas of the Palaearctic region and in India , and in November he was identified in Oltenia and Dobrogea to: Desa, Craiova (Dolj county), Constanta (Constanta county), Caraorman, St. George (Tulcea County) (Kis, 2001).



**Fig.1** - Alerts *Chorosoma gracile* species (■) and *Agraphopus lethierryi* (●) in Romania (original)

*Agraphopus lethierryi* is a species characteristic of sandy dunes, the host plant was cited *Cynodon dactylon*. At Maxineni (Braila county), we identified *Chorosoma gracile* species (family *Rhopalidae*) (fig. 1), species found in our country by previous studies Foeni (Satu Mare County), Michael Valley (Bihor

county), Desa, Bechet, Prunet (Dolj county) (Kis, 2001), characteristic of sand dunes with different grasses (*Elymus*, *Festuca*, *Stipa*).

Anthropogenic grassland species present in the lower basin of the Siret River are, in terms of zoogeography, a large variety of items: Palaearctic (five species), European (three species), Euro-Mediterranean (two species), Cosmopolitan (one species), Eurasian (one species), Mediterranean (one species) and South-Palaearctic (one species).

Population size, estimated by numerical abundance, is great for *Myrmus miriformis* ( $X = 1.76$ ) in Muchea station, all other species identified by both the edge and the rest of the stations were below par value of numerical abundance, the catches being made by the often, a single individual, rarely occur two or three individuals (table 1). Therefore, only the edge coreoids community has an unbalanced structure, dominated by species *Myrmus miriformis* ( $A = 57.81\%$ ), *Dicranocephalus albipes* ( $A = 10.93\%$ ) and *Camptopus lateralis* ( $A = 9.37\%$ ) The other species are either subdominant or recedent (table 2). On appears, coreoids communities to Maxineni and Baldovinești are relatively balanced, as shown in the number of individuals captured in samples.

Table 2

**Ecological indices for coreoids communities of anthropogenic grassland habitats formed in the lower basin of the Siret River**

Nr. crt	Species	Ivești		Muchea		Baldovinești		Măxineni	
		A	F	A	F	A	F	A	F
1	<i>Coreus marginatus</i>	23,07	28,57			50	14,3		
2	<i>Ceraleptus gracilicornis</i>	23,07	42,85	1,56	4,76				
3	<i>Camptopus lateralis</i>			9,37	28,57				
4	<i>Corizus hyoscyami</i>	30,77	28,57	3,12	9,52				
5	<i>Liorhyssus hyalinus</i>			1,56	4,76				
6	<i>Rhopalus parumpunctatus</i>			1,56	4,76				
7	<i>Brachycarenum tigrinus</i>			4,68	14,28			33,3	14,3
8	<i>Stictopleurus abutilon</i>			3,12	9,52				
9	<i>Stictopleurus pictus</i>	23,07	28,57	1,56	4,76			33,3	14,3
10	<i>Agraphopus lethierryi</i>			1,56	4,76	50	14,3		
11	<i>Myrmus miriformis</i>			57,81	100			33,3	14,3
12	<i>Chorosoma schillingi</i>			3,12	9,52				
13	<i>Chorosoma gracile</i>								
14	<i>Dicranocephalus albipes</i>			10,93	33,33				

A – dominant, F – frequent

The small number of individuals captured indicated numerically smaller populations.

In terms of frequency of occurrence in samples coreoids species identified in the four stations with anthropogenic grasslands fall into the categories

accessories and accidental, due both to the low number of individuals in the population and uneven dispersion, is the exception *Myrmus miriformis* species (F = 100%), the only constant species in Muchea station.

## CONCLUSIONS

1. The anthropogenic grasslands of the lower basin of the Siret River have been identified 14 species belonging to 12 genera and coreoide 4 families;

2. Studies in this type of habitat, located in the lower basin of the Siret River, led to the identification of two rare species of fauna of Heteroptera: *Agraphopus lethierryi* and *Chorosoma gracile* belonging Rhopalidae family. The two species are new to the fauna of Moldova;

3. In terms of zoogeography, coreoidele identified in this study belong to a wide range of elements: Palaearctic (37.71%), Europe (21.43%), Euro-Mediterranean (14.28%) and Eurasian Mediterranean sudpaleartice (by 7 , 14%);

4. The anthropogenic grasslands of the lower basin of the Siret, *Myrmus miriformis* is the species that records the highest values of number and relative abundance, followed by *Chorosoma schillingi*, both of which are characteristic for this type of habitat.

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# THE ANALYSIS OF CELLULASES AND LIGNIN PEROXIDASE ACTIVITY IN *PHANEROCHAETE CHRYSOSPORIUM* GROWN ON MEDIA WITH FIR AND BEECH SAWDUST UNDER THE INFLUENCE OF SOME TRACE ELEMENTS

## ANALIZA ACTIVITĂȚII CELULAZELOR ȘI A LIGNIN PEROXIDAZEI LA SPECIA *PHANEROCHAETE CHRYSOSPORIUM*, CULTIVATĂ PE MEDII CU RUMEGUȘ DE BRAD ȘI FAG SUB INFLUENȚA UNOR OLIGOELEMENTE

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**Abstract.** *The purpose of this paper is the study on the influence of trace elements on cellulase and lignin peroxidase activity in Phanerochaete chrysosporium grown on media with fir and beech sawdust. In order to achieve research, carbon source was replaced from Sabouraud medium with fir and beech sawdust which were added separately and some trace elements such as: boron, molybdenum, manganese, lead, copper, zinc, iron, and a mixed solution with trace elements and control with no trace elements, resulting in final nine final working variants. Measurements were made at 7 days and 14 days after sowing. After analyzing the data obtained showed that the activity of cellulase and lignin peroxidase was stimulated in the second period in the presence of trace elements to both kinds of sawdust media. Boron was the most nutrient stimulus, while zinc and trace elements solution had an inhibitory effect.*

**Key words:** *Phanerochaete chrysosporium, cellulase, lignin peroxidase, trace elements.*

**Rezumat.** *Scopul acestei lucrări este studiul influenței unor oligoelemente asupra activității celulezelor și a lignin peroxidazei la specia lignocelulozolică Phanerochaete chrysosporium, cultivată pe medii cu rumeguș de brad și fag. În vederea realizării cercetărilor s-a înlocuit sursa de carbon din mediu Sabouraud cu rumegușuri de brad și fag la care s-au adăugat următoarele oligoelemente: bor, molibden, mangan, plumb, cupru, zinc, fier (introduse separat), precum și o soluție amestec de oligoelemente, rezultând în final 9 variante de lucru. Varianta martor nu prezintă oligoelemente. Determinările au fost realizate la 7 zile și respectiv 14 zile de la însămânțare. În urma analizei datelor obținute s-a evidențiat faptul că în prezența oligoelementelor a fost stimulată activitatea celulezelor și a lignin peroxidazei în a doua perioadă de timp la ambele tipuri de mediu de cultur. Borul a avut un efect stimulator, în timp ce zincul și soluția de oligoelemente au avut un efect inhibitor.*

**Cuvinte cheie:** *Phanerochaete chrysosporium, celuleze, lignin peroxidaza, oligoelemente*

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## INTRODUCTION

Cellulolytic microorganisms such as fungi and bacteria that inhabit diverse habitats play a vital role in the recycling of carbon in nature. In order to produce the white wood rot, fungus *Phanerochaete chrysosporium* induces degradation of lignin and cellulose by producing enzymes such as cellulase and ligninase. Cellulose degradation process is problematic due to the semi-crystallin character of cellulose, thus the decomposition process is never an isolated event. The combined action of extracellular enzymes with complementary specificity is essential (Beguin și Aubert, 1994).

Simionescu et al. (1993) have highlighted the important role of trace elements in the processes of cellulase biosynthesis and the effect of their transfer between the medium, the solid substrate and mycelium.

Previous studies on cellulolytic activity of fungi grown on waste from the forestry industry have been conducted in the Department of Microbiology, Institute of Biological Science of which include: the evolution of the cellulase complex in the fungus *Alternaria alternata*, cultivated on medium containing wastes from the forestry industry (coniferous and deciduous sawdust) (Manoliu Al. et al., 2005), the influence of electromagnetic field (EMF) on the cellulase activity in cellulolytic fungi *Trichoderma viridae* and *Chaetomium globosum* grown on medium containing hardwood sawdust (Manoliu & al., 2007).

The lignolitic system of *Phanerochaete chrysosporium* is not induced by lignin but appears constitutively as culture enters the secondary metabolism, when primary growth ceases because of depletion of nutrients (Schmidt, 2006).

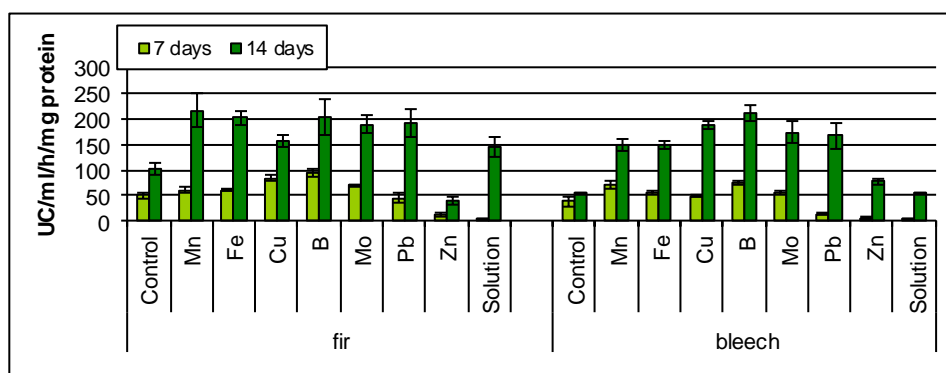
The purpose of this study was to investigate the influence of trace elements on lignin peroxidase and cellulase activity in the fungus *Phanerochaete chrysosporium* grown on medium containing pine and fir sawdust.

## MATERIAL AND METHOD

The study was conducted on the fungus *Phanerochaete chrysosporium* (HEM no. 5772) acquired by the Institute of Biological Science from the Institute Scientifique Santé Publique, Belgium. Carbon source was replaced in Sabouraud medium with sawdust from beech and pine tree to determine the influence of some trace elements on cellulase and lignin peroxidase activity. Trace elements were then added to the medium as follows: B-10 mg, Cu-100 mg, Mn-20 mg, Mo-20 mg, Fe-20 mg, Zn-200 mg, Pb-20 mg. These amounts were calculated by nutrient equivalent of the following compounds: 0.0571  $\text{H}_3\text{BO}_3$  g/l, 0.3928  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  g/l, 0.07204  $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ , 0.05043  $\text{NaMoO}_4 \cdot 2\text{H}_2\text{O}$  g/l, 0.18  $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$  50% ml/l,  $\text{CH}_3\text{COO} \cdot \text{Pb} \cdot 3\text{H}_2\text{O}$  0.0366 g/l. The control showed no source of trace elements. Measurement of enzymatic parameters was made at 7 days and 14 days after seeding in both fungus mycelium and culture fluid. Endoglucanase activity was determined on the basis of Peitersen method, the celobio-hidrolase activity was determined using Petterson and Porath's method, celobiose activity was determined using colorimetric method with dinitrosalicylic reagent and lignin peroxidase activity was determined using Tien and Kirk's method (1996) of veratryl alcohol. The enzymatic activity was reported to the amount of total soluble protein determined by Bradford method.

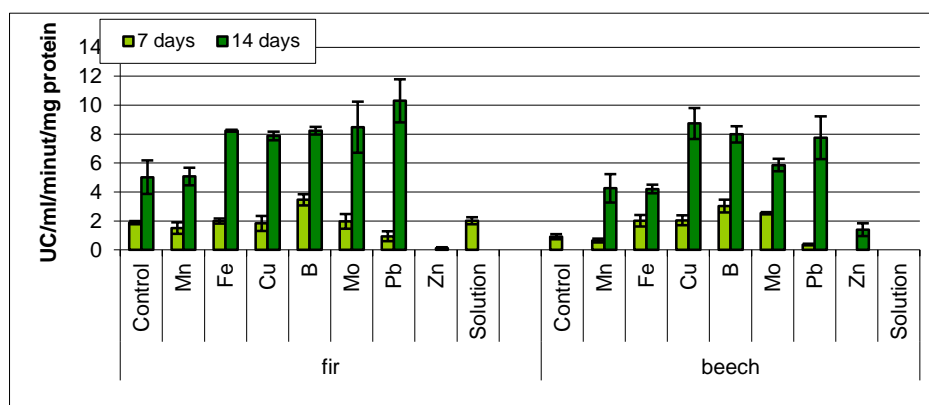
## RESULTS AND DISCUSSIONS

Results of our research on the endoglucanase activity activity in the fungus *Phanerochaete chrysosporium* grown on media with pine and beech sawdust and under the influence of trace elements is showed in figure 1. Seven days after seeding enzymatic activity registered values lower than control in media variants with lead, zinc and trace elements solution, and the highest value was registered in the medium variant with boron. After 14 days all media variants showed values higher than control medium and the highest value was recorded in the media containing boron.



**Fig. 1** - Endoglucanase activity in fungus *Phanerochaete chrysosporium* grown on media with pine and beech sawdust under the influence of trace elements

Celobiohidrolase activity in the fungus *Phanerochaete chrysosporium* grown on media with pine and beech sawdust under the influence of trace elements is presented in figure 2.

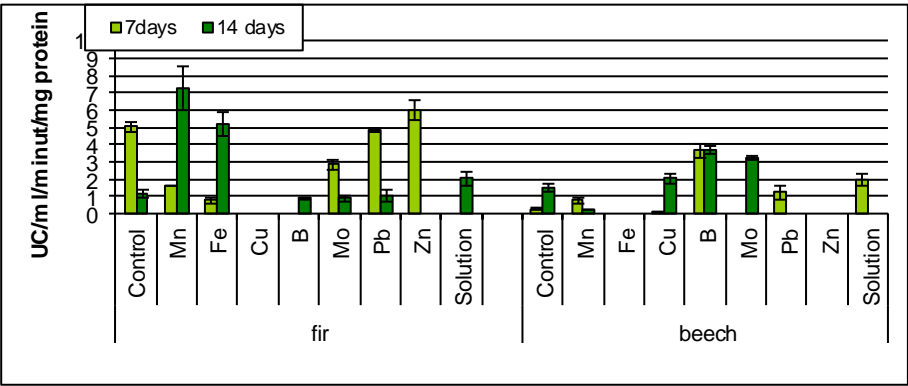


**Fig 2** - Celobiohidrolase activity in fungus *Phanerochaete chrysosporium* grown on media with pine and beech sawdust under the influence of trace elements

Seven days after seeding the enzymatic activity was stimulated by the presence of boron in both media, while zinc and trace elements solution had an inhibitory action. At 14 days from seeding celobiohidrolase activity was stimulated in all the media containing trace elements compared to control media, except for samples with zinc and trace elements that had an inhibitory influence.

Seven days after seeding,  $\beta$ -glucosidase activity (figure 3) was stimulated only in variants of pine sawdust medium under the influence of zinc compared to control medium and in medium containing solution of trace elements and copper the enzymatic activity was completely inhibited. At 14 days after seeding, enzymatic activity was stimulated in media with manganese, iron and trace solution, where they recorded the highest values compared with control variant and in the medium with zinc and copper the enzymatic activity was completely inhibited. On medium with beech sawdust under the influence of trace elements, in which variants with iron and zinc show no enzymatic activity, the highest value was registered in the medium variant with boron at 7 days and in the following period of determination.

We can notice a synergy between endoglucanase and celobiohidrolase activity, and just as stated by Simionescu et al. 1993, *Phanerochaete chrysosporium* is able to synthesise more endoglucanase and celobiohidrolase than celobiose.



**Fig 3 -** Celobiose activity in fungus *Phanerochaete chrysosporium* grown on media with pine sawdust under the influence of trace elements

Lignin peroxidase of *Phanerochaete chrysosporium* is an enzyme that acts during secondary metabolism when food resources are depleted and when the culture liquid is influenced by stress factors.

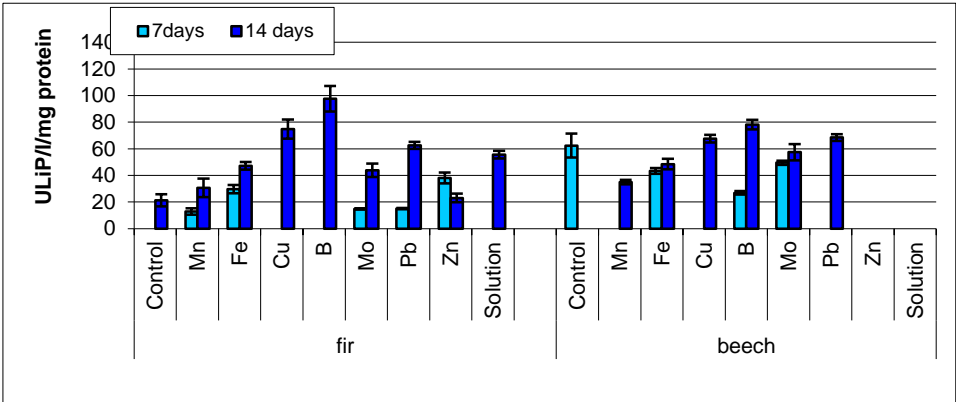
In the medium with pine sawdust under the influence of trace elements (figure 4), lignin peroxidase activity is recorded only in variants with zinc, iron, lead, molybdenum and manganese, the rest of the variants show no enzymatic activity. Lignin peroxidase activity is recorded only in some of the media variants suggesting the presence of toxic factors in the case of variants with manganese,



zinc, lead, molybdenum, and in the variant with iron activity can be stimulated by the fact that iron enters the structure of the enzyme's active site.

Enzymatic activity was stimulated in all variants 14 days after seeding except variant medium with zinc, where the activity is low but in all variants under the influence of trace elements enzymatic activity increased compared to control variant.

On media with beech sawdust under the influence of trace elements seven days after seeding, enzymatic activity was present only in versions of medium containing iron, boron and molybdenum and was weak compared to the control. At 14 days after seeding enzymatic activity increased in all media variants with trace elements except zinc medium, trace elements solution and control version. Lignin peroxidase activity recorded the highest value in the media variant with boron 14 days after seeding.



**Fig. 4** - Lignin peroxidase activity in fungus *Phanerochaete chrysosporium* grown in media with pine sawdust under the influence of trace elements

Based on our research we can assume that the extracellular enzyme profile may vary depending on the state of degradation of the substrate and the various expressions of enzymes with different specificities may be the most effective way for an organism to biodegrade the substrate in order to obtain optimal nutrients necessary for growth and development.

### CONCLUSIONS

1. In the presence of trace elements cellulase activity was stimulated after 14 days from seeding on both media types. Boron was the most stimulating nutrient, while zinc and trace elements solution had an inhibitory effect.

2. Celobiose activity was completely inhibited by the presence of copper in both time intervals on medium with pine sawdust and by the presence of iron and zinc on medium with beech sawdust.

3. In the presence of trace elements, lignin peroxidase activity was stimulated 14 days after seeding in both types of medium. Boron was the most stimulating nutrient.

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# ECOPHYSIOLOGICAL ASPECTS OF *QUERCUS PETRAEA* IN FOREST ECOSYSTEMS FROM TROTUS VALLEY (BACAU COUNTY) UNDER CHEMICAL POLLUTION AND DEFOLIATING INSECTS ACTION

## ASPECTE FIZIOLOGICE ASUPRA SPECIEI *QUERCUS PETRAEA* SUB ACȚIUNEA POLUĂRII CHIMICE ȘI A DEFOLIATORILOR DIN ECOSISTEME FORESTIERE DE PE VALEA TROTUȘULUI

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**Abstract.** The aim of this paper is to evaluate the ecophysiological responses of the *Quercus petraea* after twenty years of pesticides actions and air chemical pollution. Analyzed forests are situated in neighbourhood of Petrochemical Plant of Borzesti, Bacau County that produced oil petroleum products, pesticides (based on chlorine) and rubber. Response to stress induced by chemical pollution was evaluated based on analysis of physiological leaves of *Q. petraea*, related to entomological studies on defoliator populations that affected oaks forests in this part of Romania. Physiological researches the plant responses investigated the content of chlorophylls and carotenoids and the sugars metabolism. Entomological studies have assessed the level of *Apethymus cereus* infestation in oaks stand affected by this pest. Starting from a literature review, we discuss the possible roles of various abiotic (air pollution, climatic extremes, site conditions) and biotic factors (insect defoliation) that have been related to oak decline observed in this part of East Europe.

**Key words:** chemical pollution, photoassimilatory pigments, *Apethymus cereus*

**Rezumat.** Scopul acestui studiu constă în evaluarea răspunsului ecofiziologic al speciei *Quercus petraea* din păduri de cvercinee după douăzeci de ani de poluare chimică a aerului și a solului. Pădurile studiate se află în vecinătatea Combinatului Petrochimic Borzești, jud Bacău, care a constituit mulți ani o sursă de poluare prin producerea de produși petrolieri, pesticide (oraganoclorurate) și cauciuc sintetic. Răspunsul la stresul indus de poluarea chimică s-a evaluat pe baza analizelor fiziologice din frunzele de *Q. petraea*, corelate cu studiile entomologice asupra populațiilor de defoliatori ce au afectat pădurile de cvercinee din această zonă a României. Studiile fiziologice au constatat din analiza pigmentilor asimilatori (clorofile și carotenoizi) și a metabolismului glucidic (mono-, di- și poliglucide) din frunzele speciei de *Q. petraea*. Studiile entomologice au evaluat nivelul infestărilor cu *Apethymus cereus* din pădurile de cvercinee afectate de acest dăunător. Pornind de la o analiză a literaturii, vom discuta despre rolurile posibile ale factorilor abiotici (poluarea aerului, condițiile climatice extreme, biotopul), precum și factorii biotici (insectele defoliatoare) care au fost legate de declinul gorunului observat în această parte a Europei de Est.

**Cuvinte cheie:** poluarea chimică, pigmentii fotoasimilatori, metabolismul glucidic, *Apethymus cereus*

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## INTRODUCTION

The combined effects of climate change and air pollution are especially affected differently by synergistic or antagonistic action of polluting factors. Authors, who studied the pure stands of oak drying problems in this area, accused some determining factors, including a long drought between 1973-1985 (Ciornei et al., 2001; Popa, 2007). These conditions have encouraged the breeding of *Apethymus cereus* (Kluger, 1918), in sessile oak stands at Heltiu station. In 1994, that pest was first recorded in Romania as invasive species it in Heltiu forest (Căiuți Forest District, Bacău County), where he produced a massive defoliation area of 150 ha. Maximum level was reached in years 1999 and 2000. Combating major defoliator insects that produced gradations in this forest during 1980-1992 (tortricide, geometride, *Lymantria dispar*) was performed using pesticides products of organochlorine (DDT, found in soil undecomposed after 10 years of application), and organophosphorus and some pyrethroids, nonselective, which contributed to the accumulation of pollutants and disturbances occurred in populations of natural enemies (Hance, Cambier, 2003). After 2000, no pesticide treatments were made in Heltiu and Păltinata forests.

## MATERIAL AND METHOD

The studies were made in three stations (forests) located at different distances from Petrochemical Plant Borzești, Bacau County. Forests analyzed: Cornatel, Heltiu and Păltinata have 90% of *Quercus petraea* (sessile oak). In the forests studied (organized in landscape units= ua's), the sampling was carried out from several points depending of the distance to the Combined. Păltinoasa Forest is located at a distance of between 5 to 5.5 km Petrochemical and an altitude of 310-450 m. Heltiu Forest is situated at a distance of between 6-12 km from the Petrochemical Plant, at an altitude between 240-410 m. Cornețel Forest - control untreated with pesticides - is at 23 km from Borzești Petrochemical Plant and lies at an average altitude of 270 m. The physiological analyses consisted of determining assimilatory pigments: chlorophylls and carotenoids (Meyer-Bertenrath method modified by Știrban in 1985) and carbohydrate indicators: mono-, di- and polysaccharides (Bertrand-Borell, 1953; Hager et al., 1966). The results were expressed as mg/g of fresh weight (mg/g fr.-assimilatory pigments) and respectively, as g of glucose's per cent (g %) from dry leaf matter (carbohydrate indicators). Based on the results the statistical analyses were performed.

Setting defoliator insect infestation was made on permanent sample trees corresponding to the entomological methods.

## RESULTS AND DISCUSSIONS

### Studied area

The studied area (different oak stands) from the North-Eastern part of Romania belongs to the geographic unit of Moldavia Subcarpathians, along Trotus Valley, between the Onesti and Adjud towns situated in Bacau County. The localization of the Petrochemical Plant of Borzești in this area permitted the influence of the polluted air for many years, because of industrial emissions like

halogenated and nitric elements, phenols, hydrochloric acid, ammonia, aldehydes, solvents, sulphurous acid, and metallic carbide (Ciornei et al., 2003).

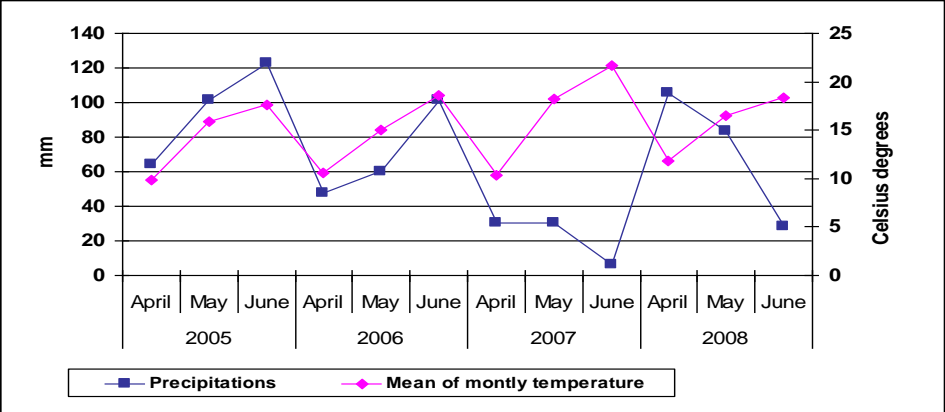
**Ecopedological and climatic factors**

Pedogenetic processes specific for this studied zone determined by the climatic phenomenon and the soil is the illuvial clay. The type is preluvosoil and luvosoil. Ecological conditions represented by the rocky forest soil with the pH from moderate to a strong acid (4.5-4.6), oligobasic trophicity, permeable and dry losing water along the slopes located on sand and gravel deposits nonhorizontal.

The directions of the winds downstream of the valley transported the polluted emissions damaged the pure oak stands, especially from Heltiu forest (Popa, 2007). Beginning with year of 1997 mean of annual precipitations registered a progressive decreasing from 850 mm/year to 400 mm/year in 2000 year. During that period the temperature increased from 8°C (1996 and 1997) until 11°C (2000 year). In 2008, mean of April precipitations registered a value of 100 mm and also, in May and June, a value of 30 mm, which was much lower (fig. 1). In 2007 and 2008, temperatures have maintained the same increasing trend, while precipitation has decreased dramatically in 2007, in June (fig. 1)

**Biotic factor**

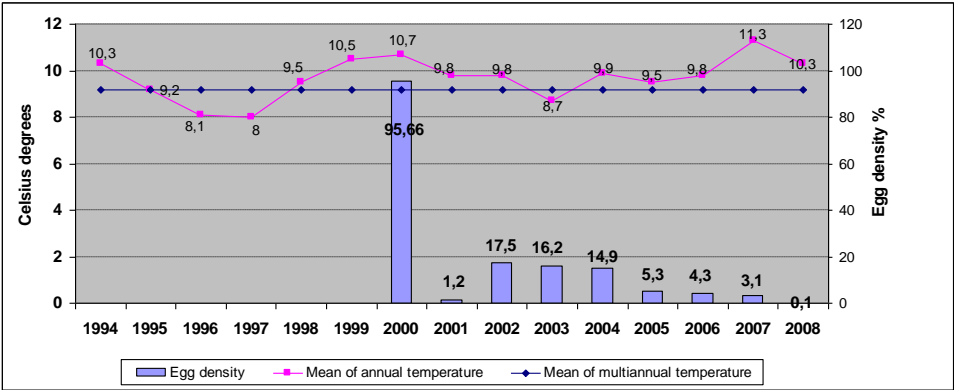
Since 1998 and continuing until 2000, the mean of annual temperature increased from 9.5 °C to 10.5 °C, which is above than mean of multi-annual value of 9.2 °C (fig. 2). In parallel, we found an increase in population densities of *Apethymus cereus*, defoliator of sessile oak forests in this area. Thus, in spring 2000, the average density of eggs of this pest species recorded the value of 95.66%. In 2008, after treatment with chitin synthesis inhibitors (Rimmon and Dimilin) egg density of *Apethymus cereus* reached to 0.1% in Heltiu forest (fig. 2).



**Fig. 1– Means of temperature and monthly precipitations**

Regarding pest larval density *Apethymus cereus*, it was an increase from 0.3% in 2001 to 30.9% in 2002. In 2008, the average was 0 %. In recent years

there have no correlations between larval density and mean of annual temperature (Ciornei et al., 2007).



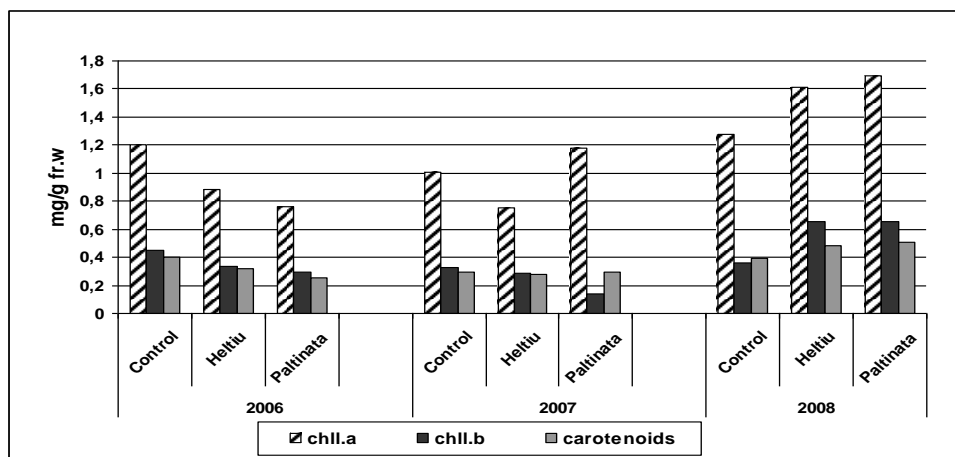
**Fig. 2** - Variation of egg density of *Apethymus cereus* from Heltiu forest in correlation with mean of annual temperature between 2000-2008

### Aspects of *Quercus petraea* physiology

Ecophysiological response of *Q. petraea* to the converged action of factors biotic, abiotic and residual pollution was evaluated by investigating the specific parameters (chlorophylls, carotenoids and carbohydrates). Previous researches in that field were limited concerning the observation of the chlorosis, dryness phenomenon, the decrease of the density foliage, debilitation and decline of the sessile oak from this forest (Murariu et al., 1997; Ivănescu et al., 2003; Popa, 2007).

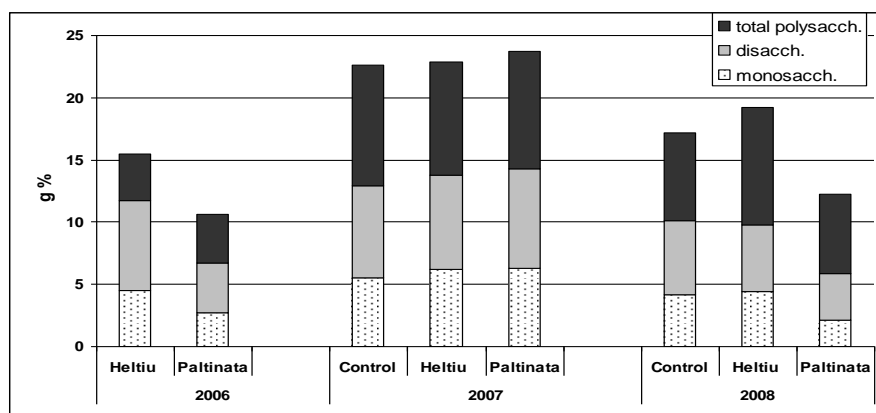
Present study observed that in May (in 2006 and 2007) the values of assimilatory pigments are lower in leaves species of *Q. petraea* from Heltiu and Păltinata forests, comparatively with untreated control (Cornăţel forest). Especially, chlorophyll a registered lower values in tree leaves at Heltiu and respectively Păltinata in comparison with control (fig.3). In May 2007, chlorophyll b recorded the lowest value (0.142 mg/g fr.w) and chlorophyll a the highest value (1.17 mg/g fr.w.) in leaves of forest trees Păltinata.

This variation led to the unbalanced ratio of 8.26 (being 2.6 times higher than control) between the two chlorophylls (a/b), in leaves of *Q. petraea* at Păltinata station. In August 2008, photosynthetic parameters registered higher values compared with the control, which may show a slower metabolism of this species from the stations situated under the chemical action of pollutants. During studied period, carotenoids registered comparable values with those of control (fig.3).



**Fig. 3** - Variation of the photoassimilatory pigments in leaves of *Q. petraea* at studied forest ecosystems

Sugar metabolism was studied through analysis of the monosaccharide, disaccharide and polysaccharides. In 2006 and 2008, analyzed carbohydrates indicators registered the lower values in leaves of *Q. petraea* at Paltinata station (fig.4).



**Fig. 4** - Variation of the sugars parameters in leaves of *Q. petraea* at studied forest ecosystems

In 2007, it could be possible that some stationary factors (low rainfall, high temperatures etc.) led to an acceleration of carbohydrate biosynthesis and thus to the obtaining the quite close values of the analyzed parameters from all studied stations (fig. 4). It was found that the ecophysiological response of species *Q. petraea* is still influenced by residual pollution in the soil and also, by the climatic factors. Chlorophylls pigment analysis showed the lower values in the forests Heltiu and Paltinata (affected by pollution) and a decreased photosynthetic efficiency (changing ratio chlorophylls a/b) in Paltinata forest.

## CONCLUSIONS

1. Investigation of physiological processes in *Q. petraea* showed that the biosynthesis of chlorophylls and carbohydrate metabolism in the leaves of this species showed changes in analyzed forest ecosystems.

2. Once with reducing distance from the pollution source was found the decreasing of the values of physiological parameters analyzed. Thus, the lower carbohydrate values were recorded in forest ecosystem of Păltinată, the closest with Petrochemical Plant Borzești.

3. Sinergic action of some factors such as, climatic (drought), biotic(pest attack) with soil deposits (pollutants) influenced over a long period the ecophysiological parameters in *Q. petraea* at oak forest ecosystems from Trotuș Valley.

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# WOOD ENERGY POTENTIAL AT REGIONAL LEVEL IN ROMANIA, IN EUROPEAN CONTEXT

## UTILIZAREA LEMNULUI IN ROMANIA LA NIVEL REGIONAL CA SURSA DE ENERGIE REGENERABILĂ

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**Abstract.** *The paper presents a case study on wood energy potential in Suceava County, in the frame of the increased interest on renewable energy development in Romania. The green energy sector development is favored by the recent development of legal regulation on European and national level, and is reflected in the on-going projects located in the higher rate forested Romanian counties. The study provides important and useful data on the actual situation in biomass end-use in Suceava County and the possibilities to increase the resources for producing wood energy.*

**Key words:** forest biomass, regional potential, renewable energy

**Rezumat.** *Articolul analizează potențialul de utilizare a lemnului ca sursă de energie în contextul creșterii interesului pentru energiile “verzi” la nivel național și european, evidențiat legislația recentă a Uniunii Europene. Aplicarea acestei legislații în țara noastră a determinat implementarea unor proiecte localizate în județele cu cele mai mari suprafețe împădurite, printre acestea numărându-se și Suceava. Studiul analizează și oferă informații privitor la utilizarea actuală a lemnului ca sursă de energie în Suceava și propune unele soluții de ameliorare a acestora.*

**Cuvinte cheie:** energia biomasei, potențial regional, energie regenerabilă

### INTRODUCTION

The energy derived from fossil fuels arise problems like growing prices, projected shortage, pollution and concerns about climate change. In this context the importance of renewable sources of energy (solar, wind, hydro-electric power, biomass etc.) is heightening. Between the benefits of using these alternative sources of energy can be pointed out especially the decrease of greenhouse gas emissions and increased independence in relation with problematic fossil fuel markets.

In Europe, renewable energy, including bioenergy, plays an important role as a component of future energy supply. Among the Member States of the EU, responsible energy use is promoted by three policy tools: the first one refers to energy efficiency in buildings and end-use applications - Directives 2002/91/EC and 2006/32/EC, respectively (EC, 2006; 2002); the second one is about the trade of greenhouse gases emissions throughout the EU and is enabled by Directive 2003/87/EC, which created the largest multi-country and multi-sector emissions trading bloc in the world (EC, 2003); and the third tool is set out in the recent Directive 2009/28/EC

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repealing the Directive 2001/77/EC (EC, 2001) promoting the use of energy from renewable sources; the directive endorsed a target of a 20 percent share of energy from renewable sources in overall Community energy consumption by 2020 and a minimum 10 percent share of renewable energy specifically in the transport sector.

## **MATERIAL AND METHOD**

The researches were carried out in Suceava County. Data on the level of EU regulation on renewable energy implementation were analyzed, data on forest biomass end-use were collected and compiled from statistics provided by different institutions and the biomass energy potential at the regional level was assessed.

## **RESULTS AND DISCUSSIONS**

The newest EU's energy and climate change legislation (Directive 2009/28/EC) mandates each EU country to raise its share of renewable energies, creating favorable conditions for important investments in renewables, including biomass, all over Europe.

A series of Romanian legislative regulations transposes the European directives regarding the renewable energy: G.D 199/2000 related to the efficient use of energy, with further modification GD 56/2006, and GD 22/2008, GD 1535/2003 representing the "Strategy for the development of the renewable energy sources", GD 1892/2004 on establishing a mechanism for promoting the production of electricity from renewable energy sources, amended by GD 958/2005, which has defined a system of mandatory quotas coupled with a trading system for green certificates; as a result in 2005, in Romania the market for green certificates became operational. The most recent legislative regulation is the GD 22/2008 on energy efficiency and promotion of renewable energy sources for end-use consumption.

In order to achieve the 2020 target, Romania must develop 63.5 percent from the entire potential of its renewable energy sources. This represents an important amount and illustrates the extent of the national effort necessary for achieving the target. Therefore, Romania has to develop approximately two thirds of the total potential of its renewable energy sources. Biomass has the dominant potential among the renewable sources of energy, summing 64.4% of the annual renewable energy potential.

In Romania, wood has been an important source of bioenergy since ever and there is still the predominant form of energy in rural areas. Traditional use of wood generally has a low efficiency (sometimes as low as 10%) and generally goes with considerable emissions of dust and soot.

Romania has a very good theoretical potential of wood waste, especially in rural areas; farmers can use this wood waste like fuel, simple and financially efficient with low investments. This potential can be exploited if efficient conversion methods and new technologies highly efficient are used. For example, the briquetting of wood waste is one of the most used methods for increasing the energetic efficiency of wood waste utilization. So, the wood pellets or briquette can be manufactured and used as

fuel in conventional stove, but with highest conversion efficiency. Due to the on-going expansion of residential areas in suburbs, where the infrastructure is missing, advanced domestic heaters are more and more popular. Based on European latest technology advance the application of strongly improved heating systems (automated, with catalytic gas cleaning and using standardized fuel) emerges. The efficiency of these technologies compared with open fireplaces is considerable: open fireplaces may be inefficient over the year (because caloric energy is lost through the chimney), while advanced domestic heaters can get at 70–90% efficiency, producing in the same time reduced amounts of pollutant emissions (Faaij, 2006).

Mainly used in private households, firewood is often traded informally, so it is difficult to collect data on consumption of fuelwood at regional level. Many processes are available for producing energy from wood biomass and the efficiency of these varies according to the production system. Hence, the traditional use of open fires for cooking and heating, convert only about 5% of the potential energy of wood, the traditional wood stove increase the efficiency to about 36%, the charcoal based systems are 44 to 80% efficient while, finally, wood pellet stove have an efficiency of near 80% (Mabee and Roy, 2001; Karlsson and Gustavsson, 2003).

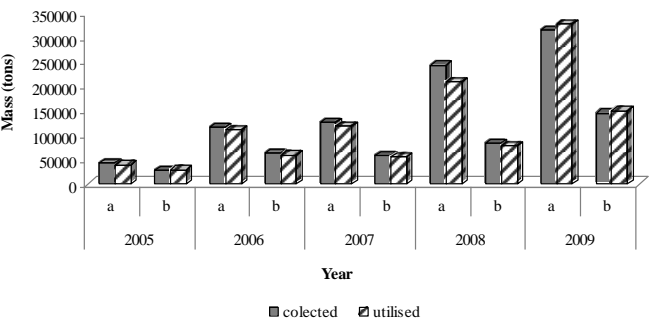
In Romania are used only two categories of wood for energy: the first one - firewood and agricultural waste and the second one - wood waste from industrial processes. The biomass energy potential amounts to 84.74 TWh/year: 15.5% waste materials from wood processing industries and fuel wood, 6.4% sawdust and other wood wastes, 63.2 % agricultural wastes, 7.2 % municipal wastes 7.7% biogas (EC, 2010). In our country, forest energy plantations were established on very limited area in the south-western region. The black liquor and tertiary biomass resources are not used yet in Romania.

The Romanian counties with the most important biomass energy potential, over 1000 TJ each, are Suceava (1602 TJ), Neamț (1269 TJ), Bacău (1164 TJ), Caraș Severin (1163 TJ) and Maramureș (1105 TJ). The high biomass potential results from the large expansion of the forest resources of these counties.

The interest for biomass renewable energy in Romania resulted in some projects all over the country: a “Strategy on Renewable Energy Sources in Romania” that proposed a strategy to increase the use of renewable energy sources, Sawdust 2000 and Wood waste for energy, Romania (WWE) in cooperation with Denmark, both fuel switch project for modernising and making more efficient run-down heat production plants and set up new and modern biomass-based boilers for district-heating different Romanian towns and counties (Gheorghieni, Huedin, Vlahița, Tașca, Întorsura Buzăului, Vatra Dornei, Neamț Brașov and Harghita County); another project is Mofrer (January 2007 - July 2009), its objective being to build a wood-energy network in Transylvania, based on the model used in Belgium and France in the framework of the EUROWOOD cross-border project. In 2009 and 2010 three biomass cogeneration plants became operational in Rădăuți (Suceava), Pângărați (Neamț) and Sebeș (Alba) using wood residues resulting from local timber plants.

Considering that Suceava County has the highest forested area in Romania, the study of the available wood energy potential is appropriate. An ascendant trend of

wood debris amount is recorded during 2005 – 2009 time span, from 41 900 tons in 2005 to 315 135 tons in 2009. A similar trend describes the dynamic of sawdust amount (fig.1). The wood debris is utilized in proportion of 86 – 95% during 2005 – 2008 and exceeds the collected amount in 2009 because of the previous year stocks. The sawdust utilization rates during the same period are even higher. This situation doesn't refer to the less important volumes of sawdust produced by some low capacity sawmills which are not always declared and are dumped on some brook's valleys. A consistent amount of sawdust is used in the in progress projects for urban heat production plants (Vatra Dornei, Rădăuți), and for briquetting for domestic use.



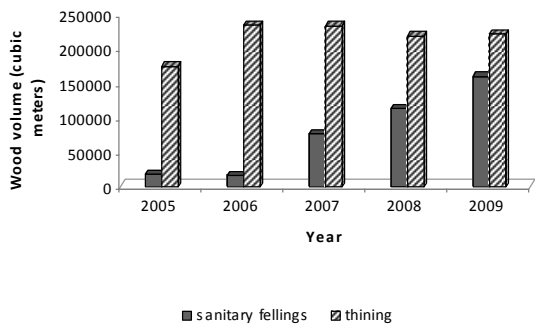
**Fig. 1** - The wood debris and sawdust dynamic during 2005 – 2009 in Suceava County  
a. wood debris, b. of which sawdust

The above mentioned analysis is referring only at the wood debris resulted from the processed timber, additional wood for energy amounts (tops and branches) remain in forest. These harvesting fellings (residues resulting from the harvesting forest trees), added to cleaning and thinning, firewood, and sanitary fellings consist in possible wood energy sources from harvesting activities. The period 2005 – 2009 was set for the analysis in order to minimize the effect of mass windthrow occurred in 2002 on wood supply (fig. 2).

Thinning wood volumes are approximately constant during the analyzed period (an average of over 210000 cubic meters per year), a part of which is allocated to energy purposes. A significant increase of sanitary felling volumes can be noticed starting in 2007 justified by the change in technical regulation, which allows up to 5 cubic meters/year/ha cuts. A small amount of wood to energy can derive from harvesting fellings, consisting in tops, branches, bark, summing up to 3000 cubic meters per year.

The cleaning volumes, yearly harvested, are also poor, but relatively similar (table 1); both harvesting fellings and cleaning volumes usually remain in forest because of the low economic value. These can become additional sources of wood-to-energy considering the location and transport costs. In Suceava County, the vast majority of fuelwood is produced locally. Because of the low price (40 – 72 lei), the

fuelwood is a ubiquitous source of energy for rural households. The wood is burned in traditional stoves of low efficiency.



**Fig. 2 -** Sanitary fellings and thinning volume dynamic in Suceava during 2005 –2009

The use of more efficient energy production systems would result in a higher energy amount. An accurate statistic of the local use is not available because a part of the local supply is informally traded in adjacent counties.

*Table 1*  
**Cleaning and harvesting fellings volume trend during 2005 – 2009 in Suceava County (National Forest Administration Suceava)**

Wood source	2005	2006	2007	2008	2009
Cleaning	14100	13283	13131	13218	11964
Harvesting fellings	1040	1771	7113	2749	2635

The official available statistics show that the firewood volume gradually increased from 18 percent at the beginning of the analyzed period to about 35 percent of total harvested wood volume (table 2).

*Table 2*  
**Firewood proportion dynamic during 2005 – 2009 in Suceava County (National Forest Administration Suceava)**

Year	Total cuttings (thousands m³)	Firewood (thousands m³)	Proportion (%)	Year	Total cuttings (thousands m³)	Firewood (thousands m³)	Proportion (%)
2005	812,6	146,3	18	2008	1275,7	395,5	31
2006	898,1	242,5	27	2009	1293,0	452,6	35
2007	1402,8	406,8	29				

At regional level, it can be concluded that the wood energy potential is well used. The present situation might be improved by considering the use of wood to energy from harvesting fellings and cleaning, which currently remains in forest, by increasing the energy efficiency of the production systems and also by an improved infrastructure.

## CONCLUSIONS

In Europe, renewable energy, including bioenergy, is considered an important component of future energy supply, consequently the Directive 2009/28/EC promoting the use of energy from renewable sources endorsed a target of a 20 percent share of energy from renewable sources in overall Community energy consumption by 2020.

In Romania, wood has been an important source of bioenergy since ever and there is still the predominant form of energy in rural areas, but the main problem remains the low efficiency of the traditional use of wood (sometimes as low as 10%); pelletisation and briquetting is a used solution for improving the energetic efficiency. At the same time, due to on-going expansion of residential areas in suburbs, where the infrastructure is missing, advanced, efficient domestic heaters are more and more popular. The interest for biomass renewable energy in Romania resulted in some projects all over the country among the most successful were Sawdust 2000 and Wood Waste for Romania.

As the study of the available wood energy potential of Suceava County reveals, the present wood supply might be improved by considering the use of wood to energy from harvesting fellings and cleaning, which currently remains in forest, by increasing the energy efficiency of the production systems and also by an improved infrastructure. These regional examples is recommended to be reiterated at national level, where modern efficient biomass plants can be established and the demand for wood to energy would stimulate a better utilization of cleaning and thinning which often are postponed because of their poor profitability.

The future development of renewable energy is favored by the legal background in Romania but strongly depends on the evolution of the political and economical climate, which regulates the level of the investments.

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# COMMENTS CONCERNING SELENIUM CONTENT VARIATION IN SOME PLANTS AND FEED PRODUCTS FROM IASI AREA

## OBSERVAȚII PRIVIND VARIAȚIA CONȚINUTULUI DE SELENIU DIN UNELE PLANTE ȘI PRODUSE FURAJERE DIN ZONA IAȘULUI

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**Abstract.** The paper presents results for selenium concentration determination by AAS method in various plant and derived feed (corn seeds, corn green and prepared silage, Sudan herb, soy-green plant, green alfalfa, mown grass alfalfa, hay mowing, straw alfalfa and different mixt sillages) taken from a farm situated outskirts of Iasi, near the plant that provides heat for the city, and from a farm located about 100 km from Iasi. Selenium determination in the feed samples analyzed revealed three distinct situation in relation with selenium recommended optimal content(150-300) ppb as follows: critical deficiency (10-100) ppb Se, marginal deficiency (100-150) ppb, respectively toxic level (300 ppb higher). 52.17% of the feed samples analyzed showed an appropriate concentration with variations ranging from 158.62 to 259.28 ppb Se, while 26.08% of the samples showed selenium deficit content and 21.73% of the samples exceeded the content of the selenium optimal concentration set between 150-300ppb

**Key words:** Selenium, feed plants, Iași

**Rezumat.** Lucrarea prezintă rezultatele determinării concentrației seleniului prin metoda SAA în diverse plante furajere și furaje derivate, recoltate de la o fermă situată la periferia Iașului, în vecinătatea centralei ce furnizează agentul termic pentru oraș, respectiv de la o fermă situată la aproximativ 100 km de Iași. Determinarea concentrației seleniului în probele de furaje analizate a evidențiat trei cazuri distincte prin raportare la conținutul optim recomandat (150-300) ppb Se și anume: deficiența critică (10-100) ppb Se, deficiența marginală (100-150) ppb Se și respectiv nivelul toxic corespunzător concentrațiilor de Se superioare a 300 ppb Se. Un procent de 52,17 % din probele de furaje analizate au prezentat o concentrație adecvată cu variații cuprinse între 158,62-259,28 ppb Se, în timp ce 26,08% din probe au prezentat un conținut deficitar de Se iar pentru 21,73% din probe conținutul în Se a depășit concentrația optimă stabilită la 150-300 ppb.

**Cuvinte cheie:** seleniu, plante furajere, Iași

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## INTRODUCTION

Analysis of soil and feed introduced into food (by considering the biological cycle soil-plant-animal) provide information on any alleged deficiencies or metabolic disorders likely to be detected in livestock (primary failures caused by variation of the nutritional intake compared to recommended level) useful to determine final conclusions in assessing health of the animal organism (Reinds G. et al., 2006)

This paper aims to determine the various forage and feed derived by AAS in order to achieve an alleged balance of exogenous intake through food.

## MATERIAL AND METHOD

Feed samples were collected from two farms, drive D (dairy farm) located on the outskirts of Iasi, near the plant that provides heat for the city and drive R (sheep farm) located about 100 km from Iasi. Samples from 1 to 12 are from farm D and 13 to 23 are from farm R. The selenium concentration was expressed in ppb (mg Se / kg)

## RESULTS AND DISCUSSIONS

The data presented in table 1 and 2, shows a wide variation limit corresponding to deficit status, normal and toxic surplus of selenium concentration in feed.

*Table 1*  
**Average amount of selenium content in feed samples collected from farm D**

Crt Nr	Sample	Optimal Se concentration: 150-300ppb
		X
1	Corn silage(Aron Vodă Area)	55.03
2	Corn silage(Securitate Area)	138.49
3	Grass Sudan(Chirița Area)	504.63
4	Green soybean(Securitate Area)	73.47
5	Prepared corn sillage(Farm, platform)	70.50
6	Alfalfa, 3rd harverst (Aron Vodă Area)	173.39
7	Green alfalfa(Bazin Area)	317.35
8	Corn grains	158.42
9	Silage (grasses 20% leguminouses 80%)	183.38
10	Alfalfa hay wrapped	131.28
11	Hay wrapped	344.4
12	Barley straw	259.28

Regarding the concentration of analyzed feed samples three different cases were identified by reference to the optimum content ((Miron L. et al., 2004) recommended: (150-300) ppb Se (Pârnu Gh., 1992) named critical deficiency (10-100) ppb, marginal (100-150) ppb and toxic concentrations higher than 300 ppb.



Table 2

**Average amount of selenium content in feed samples  
collected from farm R**

Crt Nr	Sample	Optimal Se concentration: 150-300ppb
		X
1	Green corn silage (Canal 2 Area )	329.06
2	Green corn silage –(Cotul beşlegii Area )	205.08
3	Green alfalfa 3 harverst (Pump station Area)	191.1
4	Green alfalfa 1 harverst-(Pump station Area)	148.21
5	Alfalfa hay-Botoşani, 2007	152.5
6	Alfalfa hay-2007	135.68
7	Hay , 2007	306.99
8	Hay, 2006	164.37
9	Bramus hay, 2007	339.2
10	Corn silage, 2006	190.74
11	Complex (flour+bran+sunflower meal)	134.8

Table 3

**Feed sample percent related to Selenium content**

Crt Nr	Concentration Levels	Feed Sample Percent	Feed Type
1	Critical Deficiency : 10-100 ppb Se	13,04%	Corn, green silage Green soybeen Corn, prepared silage
2	Marginal Deficiency: 100-150 ppb Se	13,04%	Alfalfa hay, wrapped Hay alfalfa2007 Complex (flour+bran +sunflower mea
3	Optim Level: 150-300ppb Se	52,17 %	Green alfalfa Corn grains Silage (grass20% leguminouses80%) Straw, barley Hay, alfalfa Hay 2006 Corn silage2006
4	Toxic Level: >300 ppb Se	21,73%	Sudan grass Green alfalfa Hay, wrapped Hay, 2007 Bramus hay, 2007

The data in table 3 shows differences depending on weather and climatic conditions of the considered year (2007/2006) and for the same level/benchmark concentration differences due to varying degrees of availability of this element in soil (Gomes C.D. et al., 2007, Haug A. et al., 2007) and to the different fixing capacity of the forage plant (Kaklewski K. et al., 2008).

Diversity of forage samples collected and analyzed induced a large number of variable factors difficult to be considered for statistical analysis. The Student t

test took into account the feed taken from the two farms, only derived from corn and alfalfa to ensure correct interpretation of data.

The data in table 4 confirm corn capitalization on fertile soils to ensure optimal levels of nutrients required for plant development - which explains the statistically not significant changes ( $p > 0.01$ ) between sample site (D farm/ farm R) for the grains corn Se concentrations (figure 1).

Table4

Selenium concentration in feed from corn

Crt. Nr	Sample	Optimal Se concentration: 150-300ppb
		X
1	Corn, green silage,D	267,07±87.66
2	Corn, green silage,R	96,76±59.01
3	Corn, silage,D	190.74±47.3
4	Corn, silage, R	70.50±8.5
5	Corn, grains, D	179.80±16.6
6	Corn, grains, R	158.42±4.7

Hay instead exploit soils poor in nitrogen and other minerals, which explains the concentration of selenium (table 5) at higher toxic level ( $> 300$  ppb Se) in natural hay collected from both farms (as shown in figure1).

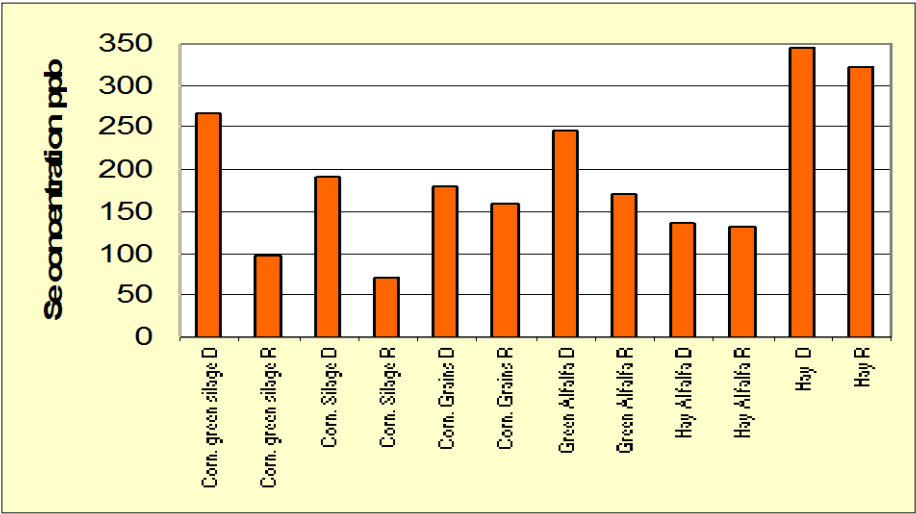


Fig. 1 - Selenium concentration in feed (corn, alfalfa and hay

Significantly concentration above the optimal concentration of selenium (Miron L. et al., 2004) in fibrous feed (hay samples coming from herbs preserved by drying) may be the consequence of dry weather climatic conditions of 2007 compared to 2006 year.

Table 5

**Selenium concentration in feed derived from alfalfa**

Nr crt	Sample	Optimal Se concentration: 150-300ppb
		X
1	Green Alfalfa,D	245,37±101.79
2	Green Alfalfa,R	169,655±30.32
3	Hay Alfalfa,D	135.68±17.5
4	Hay Alfalfa, R	131.28±8.5
5	Hay, D	344.4±48.7
6	Hay, R	323,090±16.6

Samples of alfalfa were characterized by significant differences in selenium content according to the collection site. Morfogeostuctural measurement (Miron L. et al., 2004) showed the selenogen character of the farm D soil, which confirms the high degree of selenium availability in this land area when compared with R farm. On the other hand, data from scientific literature (Pârnu Gh., 1992) sustain the existence of a positive correlation between selenium and protein content of plants which would explain the significantly higher concentrations ( $p < 0.01$ ) for alfalfa (provides significantly protein intake) compared to the corn samples (provides significantly carbohydrate intake).

## CONCLUSIONS

1. Selenium determination in analyzed feed samples revealed three distinct cases in relation to the recommended optimal content (150-300) ppb Se as follows: critical deficiency (10-100) ppb Se, marginal deficiency (100-150) ppb, respectively toxic level (higher concentrations than 300 ppb).

2. Differences between selenium concentrations of the samples may be caused by different degrees of availability of this element in soil, different fixing capacity of the plant feed and the specific of weather and climate conditions for the considered year .

3. Selenogen character of the D farm area land versus R can induce an increased degree of selenium bioavailability to crop plants, which would explain the selenium concentration in the farm D forage plants.

4. Selenium concentration in analyzed hay samples may be the consequence of either specific recovery of nitrogen-poor soils but rich in mineral elements or either dry weather of the considered year (2007/2006).

5. Selenium concentration samples significantly higher in alfaalfa compared to corn can be caused by the increased capacity of the plants with a higher protein content to assimilate selenium.

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# AESTHETICS AND SCIENCE IN KNOWLEDGE SOCIETY: THE CULTURAL ADVENTURE OF SCIENTIFIC IMAGINARY

## ESTETICĂ ȘI ȘTIINȚĂ ÎN SOCIETATEA CUNOAȘTERII: AVENTURA CULTURALĂ A IMAGINARULUI ȘTIINȚIFIC

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**Abstract.** *Knowledge society represents a type of social organization in which scientific imaginary dynamics has a quite important cultural influence, shaping the image of reality for large categories of people. In a society characterized by ambivalent postmodern attitudes regarding technology, even the emergence of new esthetical trends is sometimes influenced by scientific progress and by the birth of new types of forms. Therefore, giving the contemporary people tendency to search harmony in fiction just the way they searched harmony in nature in the past, the study of scientific imaginary dynamics could represent a good departure point in understanding some of the recent esthetical trends.*

**Key words:** aesthetics, scientific imaginary, knowledge society

**Rezumat.** *Societatea cunoașterii reprezintă un tip de organizare socială în care dinamica imaginarului științific are o influență destul de importantă în plan cultural, modelând imaginea despre realitate pentru categorii sociale largi. Într-o societate caracterizată prin atitudini postmoderne ambivalente față de tehnologie, chiar apariția unor noi tendințe de ordin estetic este câteodată influențată de progresul științific și de nașterea unor noi tipuri de forme. De aceea, ținând cont de faptul că omul contemporan se refugiază astăzi în ficțional așa cum se refugia în trecut în natură pentru a găsi armonia, studierea dinamicii imaginarului științific ar putea reprezenta un bun punct de plecare în înțelegerea unora dintre tendințele estetice recente.*

**Cuvinte cheie:** estetică, imaginar științific, societatea cunoașterii

### INTRODUCTION

The social character of art and science has been a largely discussed topic long ago and still today it is a quite important one, since global transformations of contemporary society tend to impose the redefinition of art and science themselves. One reason for that could be the fact that art and science have the capacity to influence the way people form their image about surrounding world using their emotional sensitivity, but also their capacity of reasoning. We will try to present the relation between art and science, focusing on their capacity of influencing the way in which knowledge society projects

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the image of reality. However, before starting our presentation, we consider proper to make the distinction between „real” and „reality”, in order to make our path easier and to avoid some ontological confusions. Therefore, we will call „physical real” that level of existence of the external universe that has properties which are independent from the states of human mind. In the same time, we will call „reality” the image of the „physical real” produced within human society.

## **MATERIAL AND METHOD**

Giving the fact that reality, in our acceptance, is an emanation of human mind, more precisely an emanation of human mind in its social dynamics, we can talk about a veritable historical evolution of reality as an image of the physical real, each age having specific characteristics regarding its image of the universe, which constitute an entire world of meanings. In this respect, the term „world” retains for us this social character of human reality.

As to the Art, it expressed since immemorial times the conceptions about human being and its place in the universe that evolved in different historical periods. Starting with the first cosmogonies represented through paintings and sculptures and ending with the subtle relations between the esthetical preferences of some famous contemporary painters and scientific theories like Non-Euclidean Geometries or Theory of Relativity, one can easily observe that the majority of important art works are in some way connected to the general view regarding the place of human being in universe, an aspect that had also great influence upon the way in which human condition was understood in different periods of time.

It is enough in this context to remember the comparison between Renaissance painting and religious painting. This way we can understand better the long history of philosophical positioning that made possible the identity construction of European culture. Quite important artists in the past, from Igor Kandinsky up to Pablo Picasso and Salvador Dali have exploited, within their entire effort of building an artistic reality as a substitute for the real, some of the specific elements that characterize the scientific paradigms popular in their epoch. For example, we can refer in this sense to the non-Euclidean geometries and the Theory of Relativity.

Thus, Art proved to be capable of influencing the information transfer between artistic imaginary and social imaginary. This kind of subtle influences took place in both ways, an art work like Picasso's *Guernica* being a good example of transposition of some historical events, like the massacre that took place in the Spanish War and became a cross point of social imaginary, at the level of the artistic imaginary.

As to imaginary, we use to oppose it to the real in everyday language. We make use of this distinction when accusing a person, for example, of deluding us in some respect by telling us “imaginary things” instead of “real things”. As a matter of fact, generally speaking, European civilization is quite a suspicious one regarding any imaginative excess of individuals, any such a person being in danger to be considered in a precarious mental state, especially if one can prove that imaginary interposes excessively between its consciousness and the surrounding “real”. In fact, Europe spent quite a long time trying to eliminate mythological and religious imaginary from the consciousness-nature equation (I. G. Barbour, 1990).

On one hand, the process was a gradual one and coincided with the rise of modern thinking, but also with a desacralization of the world. Ioan Petru Culianu is one of those authors that deplore the decreasing capacity of modern people to control their fantasy, their imaginative processes, and the direct implication of this phenomenon being that such people could be manipulated easier (I. P. Culianu, 1994). On the other hand, the imaginary processes of contemporary people are quite influential, especially if we take into account the importance of artistic imaginary nowadays. Still, in comparison with Renaissance, we are today the witnesses of a naturalization process of human imagination, a phenomenon firstly detected by George Santayana (J. H. Randall, 1954). At the same time, the same process of naturalization played a crucial role in the rising of modern scientific methodology in Europe, an event that triggered another fascinating process: the refinement of scientific representations and of different types of imaginary implied in the development of human knowledge (Jacqueline Russ, 2002).

Fact is that other cultures, many of them oriental, no less refined than the European one, missed the opportunity of inventing an experimental science just because they had troubles in distinguishing the imaginary from the real. It seems that, in order to attribute constructive power to human phantasy as regards the effort of understanding the world, is quite important to admit the fictional character of human phantasy products. Making the distinction between real and imaginary represents, in fact, the first step in understanding the positive role played by imaginary in the development of human knowledge. In this respect, some oriental cultures, like the Indian one, for example, oftenly ignored the fictional character of human consciousness conceptual products and, by doing that, had real troubles in distinguishing between the human consciousness products and the physical real. Without this distinction, such cultures had difficulties in getting rid of mythical imaginary and were not able to develop a methodology for improving the descriptions of the surrounding world using pragmatic criteria and, therefore, did not develop a veritable descriptive imaginary with positive impact upon scientific knowledge (J. L. Bodinier; J. Breteau, 2000).

On the contrary, in European culture, in the periode of modern science development, there was a taff competition between descriptive imaginary on one hand and mythological and religious imaginary on the other hand. Giving the fact that imaginary things always lay between rational and irrational, between cultural and individual, when investigating the imaginary realm one has to adopt a wide perspective regarding the complex interaction among human consciousness, human reasoning and the surrounding world. Here we have to remember what we have mentioned previously, that the term „world” retains for us the social character of human reality, because, in fact, descriptive imaginary is culturally modelated, due to the fact that different societies privileged different manners of conceiving the physical real, favourising in this process some specific types of representations in front of other types, just because the first seemed to be more culturally plausible and suitable to describe or to represent the world. The goal was always that of building a form of harmony in consonance with the mythological cosmogony and religious of those societies in the specific hystorical moment of their development. That is why the historical moment of European culture when modern science was developed had a cultural and theological background that favoured the epistemological rationalistic optimism that made possible the modern scientific discourse, and such a background should not be ignored when analyzing the rise of modern science and its descriptive structure or ideology.

Speaking about the interaction between human consciousness and the world, a crucial role here was played by human capacity of signifying the surrounding environment, of identifying harmonious shapes and intelligible structures, because the effort of knowing the world has an underlying aesthetical character that unifies the simplicity of mathematical formalism with the harmony and elegance of modeled shapes of nature. And this character is reflected by most of the theories in natural science, making us to understand more and more clear that the universe became interesting for human mind just because, at first, it impressed aesthetically human sensitivity. And this situation can be observed in the science of Ancient Greeks that were so obsessed by the harmony and order of the kosmos, but also in the science of the XVII-th century where nature could be known just because God, in his kindness, made it accessible for human mind aesthetically but also epistemologically.

## **RESULTS AND DISCUSSIONS**

It is time to emphasize some convergence points between scientific imaginary and artistic imaginary. First, we have to observe that we are going to deal with two types of descriptivism. Both artistic reality and scientific reality are made of descriptions and lay on a transfiguring principle that puts them in relation with the physical real, whose image they intend to be. Whereas artistic descriptions have an expressive force based on subjectivism that has a symbolic, expressionist or surrealist nature, the scientific descriptions are based on conscious objectivism that has a realist nature, but having also an important fictional component, more or less visible, in case of experimental Physics, but most of all in case of theoretical Physics. Of course, this fictional component is a utilitarian and provisory one, as we mention earlier.

What actually unites these two types of descriptions is their arbitrary character, in the sense that they are both used in the effort of configuring a reality as an image of the real and within this effort some aspects of the real are arbitrary emphasized as essential and become important, whereas others are ignored. Both Art and Science are rich in such arbitrary descriptions of the real, both Art and Science develop types of discourse that contribute significantly to the emergence of an arbitrary shaped image of the real (R. Frigg, M. C. Hunter, 2010).

What distinguishes them one to the other is the general character of their analysis of the real: while Science is trying to develop objective analysis, Art is basically subjective in its endeavor. Scientific and artistic paradigms influence a lot the style of this effort and quite often, what was neglected in some period of time becomes important in another period and sometimes is declared essential later. That is why we can talk about a veritable historically evolving matrix of generating significance, valuable for every artistic and scientific paradigm separately.

Being populated with “common places” that characterize the circulation of social representations, both scientific and artistic imaginary depends on specific features characteristic for different historical periods in the human



society development. Such characteristics can be observed in Science and Art, from Galileo Galilei to Niels Bohr on one hand, and Hieronymus Bosch to Edward Munch on the other hand, for example. One should not be so surprised that the general opinion regarding what is considered to be beautiful and what is considered to be true suffered dramatic change on the transition from ancient agricultural society to industrial society, from industrial society to post-industrial society and finally, from post-industrial society to knowledge society (Pekka Himanen, 2001).

## CONCLUSIONS

Nowadays the reciprocal influence between Science and Art manifests at two levels, giving the fact that network society, which is highly dependent on information technology as regards the transgressing of temporal and terrestrial barriers, is in a continuous expansion. And such a reciprocal influence has less to do these days with Greek Kalokagathia and more with the specific tension of the contemporary dialog between aesthetical and epistemic components of reality.

At the first level, we have the import of some scientific elements into the contemporary discourse, such as fractal patterns, cognitive unconsciousness, laser techniques, holography etc.

At the second level, we have the transference of some principles concerning the effort of configuring a reality as an image of the physical real, which is intelligible from a social point of view. Thus, both scientific reality and artistic reality became multi-dimensional, highly dynamic, built around notions like chaos, quantum decoherence, astronomical and mathematical singularities etc. They became multilayered at the level of the meanings embedded in scientific and artistic discourse and highly dependent on the transformations and dynamics of the network society.

Taking into account all those aspects maybe is not so surprising that nowadays contemporary people have the tendency to search the ultimate meaning and harmony in the world of fictional descriptive representations the same way they tended to search harmony in nature, cultivating aesthetics of the garden centuries ago.

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# RESEARCH ON REINFORCING PLANTED EMBANKMENTS - ASSOCIATION OF GEOSYNTHETIC MATERIALS WITH THE VEGETAL MATERIAL

## CERCETĂRI PRIVIND CONSOLIDAREA TALUZURILOR VEGETALIZATE- ASOCIEREA MATERIALELOR GEOSINTETICE CU MATERIALUL VEGETAL

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**Abstract.** *The research refers to the assessment and analysis of two case studies, with different field situations. Both studies refer to the landscape arrangement of two sites, one with a sloping land (less than 40%), other relatively flat, but with the need to create an artificial embankment over 50% slope. The proposed theme consists in the optimum exploitation of the land that is destined to landscape design through modeling and consolidating the slopes with different inclinations, followed by planting on the embankment resulted from a vertical systematisation of the land. The purpose of this research is to verify in practice the result of two different technologies for building embankments with different declivities using geosynthetic Tenax materials associated with plant species meant to consolidate the embankment. The two technologies use materials agreed by the Ministry of Environment and do not endanger the ecosystem of the studied area. The results of the research contribute to the widening of the spectrum usage of the geosynthetic materials applied for consolidating the existing embankments in the landscape design, and to verify in practice the viability of the embankment strengthening systems and supervising the development of some consolidation embankment species over a year.*

**Key words:** reinforced soil, anti-erosion, embankment, species of upholstered plants.

**Rezumat.** *Cercetările se bazează pe evaluarea și analiza a două studii de caz, cu situații de teren diferite. Ambele studii se referă la amenajarea peisagistică a două situri, unul dintre ele având terenul în pantă (sub 40%), celălalt relativ plat, dar cu necesitatea creării unui taluz artificial, cu pantă de peste 50%. Tema propusă constă în exploatarea optimă a terenului destinat amenajării peisagistice, prin preluarea și consolidarea pantelor cu înclinații diferite, urmată de vegetalizarea taluzurilor rezultate în urma sistematizării verticale a terenului. Scopul acestei cercetări este de a verifica rezultatul punerii în practică a două tehnologii diferite de consolidare a taluzurilor cu declivități diferite, folosind materiale geosintetice din gama Tenax, asociate cu specii vegetale consolidatoare de taluz. Cele două tehnologii folosesc materiale agreeate de Ministerul Mediului și nu pun în pericol ecosistemul zonei studiate. Rezultatele cercetărilor contribuie la lărgirea spectrului de utilizare al materialelor geosintetice folosite la consolidarea taluzurilor existente în amenajările peisagistice, precum și la verificarea în practică*

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*a viabilității sistemelor de consolidare a taluzurilor și urmărirea dezvoltării unor specii consolizatoare de taluz de-a lungul unui an.*

**Cuvinte cheie:** pământ ranforsat, antierozione, taluz, specii tapisante.

## INTRODUCTION

The study was based on the analysis of two different climatic zones: one in the plain on the outskirts of Bucharest, the other on the hill, respectively Ramnicu Valcea. Both fields are relatively small (about 2000 sqm), and belong to different landscape arrangements.

For both works we consulted with specialists in building works and antierosion and separate specialized project were made.

Research topic is not new, similar studies with the same theme have been made in many countries with problems of erosion and stabilize slopes (California, India), using materials and methods similar to those applied in the two cases studied in this paper.

## MATERIAL AND METHOD

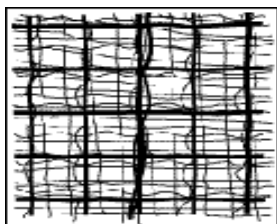
Peculiarities that differentiate the two case studies are given different gradient fields, respectively solve different solutions for each landscaping site.

Different projects were carried out for the two case studies were adapted to conditions typical of each site and subsequently materialized through the implementation of two different technologies to strengthen the embankments (Geo.Co.M International, 2005).

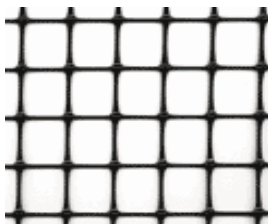
For the plain site, the solution to achieve the link between the terrace of the building located at level 1 and level 0 of the garden, involved building a slope with an inclination of 68 degrees. The technology used was the realization of „reinforced earth”. The creation of the vegetation embankment was achieved with deciduous shrubs category dendrological material, resin shrubs and deciduous trees category (Iliescu A.F, 1985, 1987, 1998; Mailliet. L, Bourger. C. 1993).

For the hill site embankment stabilization solution was achieved by straightening the slope method „consolidated earth”. The creation of the embankment was made by roller turf grass and planting trees and shrubs – here and there where it was needed.

Materials used in the first case were welded Buzau mesh of 100 mm mesh, geogrid material Tenax Multimatt RS (fig. 2), Tenax material reinforced geomattress R (fig 1), reinforced concrete coupons, deciduous shrub of the *Euonymus* species, *Cotoneaster*, *Cornus*, *Mahonia*, *Acer* tree species, *Corylus* and *Vinca* species.



**Fig. 1 – Reinforced Geomattress material (Tenax R)**



**Fig. 2 – Geogrid material (Tenax multimatt RS)**



**Fig. 3 – Geocell material (Tenweb)**

For the hill site, the materials used were:

- Tenweb Geocell Material (fig.3),
- Tenax R, Geomattress material
- Iron Concrete coupon
- Dendrological material of the species: *Cotoneaster*, *Cornus*, *Pyracantha*, *Juniperus* (Iliescu A.F, 1998)
- Rollers of turf grass with perenial grass species brazdă înierbată cu specii graminee perene (*Lolium*, *Festuca*, *Dactylis*, *Poa*) (Iliescu A.F., 1987).

## RESULTS AND DISCUSSIONS

To strenghten the slope of 68 degrees embankment, using reinforced earth technology, the execution started with the total excavation of land across the field, follower by leveling and compacting the land. Reinforced earth system involved the following steps:

1. Running an cutting the length of the geogrid to the project, lost formwork bending embankment and slope preparation anchors. After leveling and compacting the foundation layer has been installed and the first layer suttering sections were linked together, Geogrid was turned to the seen of the embankment and anchored.

2. Horizontal layer of geogrid was installed and anchored to an end with the clip to form a U shape, turnedon the undersied of the casing and leave a final anchorage area over the framework. This final portion is equal to the return length seen in the project (fig. 4).

3. The soil was spread over the geogrid, compacting in layers of approx. 30cm. In order to achieve a density of land greater than 95%. Up to a distance of approx. 0.5m from the embankment line slightly to use a roller or a vibrating plate, the remains will be compacted using a standard compactor working in the direction parallel to the slope.



**Fig. 4** – Installing armed layers with Buzau Mesh



**Fig. 5** – Fixing the arming



**Fig. 6** – Fixing the armed embankment

4. The remaining geogrid was turned, tensioned and fixed with clips (fig. 5).

5. The necessary operations were repeated to install each successive layer until completion (fig. 6).

6. A layer of geomattress was installed on the embankment line, which was then filled with finely grinded soil to insure the vegetal soil will stick to the embankment (fig.7).



**Fig. 7 – Plant material installed on embankment**

To strengthen the embankment using reinforced soil technology construction work began with stripping the land and preparing the substrate on which to install Tenweb geocells network installed in the hole to the ground with small particle size (fig. 8; 9; 10).



**Fig. 8 – Installing the geocell network**



**Fig. 9 – Filling the geocell with soil**



**Fig. 10 – Fixing the geocell network**

Over the geocell layers, the reinforced geomattress Multimat was installed which is designed to reduce by more than 50% the amount of eroded soil (compared with the ground naked devoid of vegetation)

Both at the top and bottom, fixing trenches were made, upstream and downstream, made out of geocomposit material according to the project (fig. 11). The geomattress was placed in the upper trench and it was fixed with U shaped clips (8mm) – the length of the anchor arms being of 15-30cm depending of the substrate composition. The geomattress roll ran down the embankment and the anchor trench was filled with vegetal soil.

Overlap between adjacent strips was 10cm, while the overlap between two adjacent rolls were 150cm. In making the overlay we took into account the



direction of water flow so that it will not divide the overlapping parts (fig. 11; 12; 13).

The geomatress strip was then fixed with clips 1,5m apart to assure a better contact between the geomatress and the support layer.



**Fig. 11** – Joining the geocell strips



**Fig. 12** – Midway stage of filling the geocells with soil



**Fig. 13** – The final stage of filling the geocells with soil

The geomatress was filled with vegetal grinded vegetal soil, than the roller turf grass was placed and the the dendrological material planted according to the project (fig. 14 and 15)



**Fig. 14** – The resulting green embankment



**Fig. 15** – The embankment with turf grass.

## CONCLUSIONS

1. For the two types of slopes were adopted different stabilization solutions, depending on the configuration of the land, site condition, soil texture and climatic condtions.

2. For the solution based on stabilization of large slope over 50 degrees, we opted for „reinforced soil technology”, which resulted in an embankment with a slope of 68 degrees, consisting of layers of compacted and reinforced soil with a network grid mesh (of Buzau) and geogrill.

3. Settlements made after one year of its establishment was 0.1cm, which concluded that we used an appropriate method to strngthen the embankment.

4. Vegetative planting material, irrigated with a network of automated dripping system, properly developed, after a year of achievement managing to cover the entire area around the slope.

5. For the solution based on stabilizing the embankment through the reinforced earth' technology, we achieved a slope under 40%, completely vegetized even since the embankment was created. After a year, with automatic irrigation system, the vegetation had developed harmoniously, managing to supplement the stabilization through the surface developed root network.

6. Both methods of embankment consolidation confirm the viability of stabilizing slopes using geosintetic materials associated with plants specialized in slope consolidation.

7. The two different technologies have responded appropriately to the conditions of the terrain. The study shows that over a year there were no requirements regarding repair works or loss in dendrological material.

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# TRADITIONAL ECOLOGICAL JOINTS USED IN MODERN FURNITURE CONCEPTS

## ÎMBINĂRI ECOLOGICE TRADIȚIONALE FOLOSITE ÎN CONCEPTELE MODERNE DE MOBILIER

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**Abstract.** *Theoretical and practical research made on ecological concepts and Romanian traditional products from different areas of the country have brought to light the idea of reinventing such concepts of products friendly to the ecosystem by means of their constructive nature, their technology and the materials used. This research underlines the ecological role of traditional types of wood joints and the possibility of adapting them to create new types of multifunctional furniture. These joints could be the base of various pieces of landscape furniture, created in a rustic as well as modern style.*

**Key words:** ecologic joints, tradition, design, wood

**Rezumat.** *Cercetările teoretice și practice întreprinse asupra conceptelor și produselor ecologice tradiționale românești din diferitele zone ale României, au adus în prim plan ideea de a reinventa astfel de concepte de produse prietenoase cu mediul prin natura lor constructivă, tehnologică și a materialelor folosite. Lucrarea evidențiază rolul ecologic al îmbinărilor tradiționale și posibilitatea adaptării acestora în crearea unor noi tipuri de mobilier peisagistic, create atât în stil rustic, cât și în stil modern.*

**Cuvinte cheie:** îmbinări ecologice, tradiție, design, lemn

### INTRODUCTION

Today's society is preoccupied with the respect towards nature, care for the environment and future safety. By respecting and applying the principles of eco - design, this paper presents aspects in approaching the design of ecologic products through material, technologies and jointing systems. It also deals with analyzing product concepts and characteristic joints by means of traditional Romanian technologies (belonging to certain geographic areas), re-shaped so as to correspond to modern requests (Pralea Jeni, 2009).

These joints represent the basis of various landscape furniture, created not only in a rustic style, but modern at the same time.

### MATERIAL AND METHOD

The methods used for obtaining this material consist in theoretical and experimental research, visits to museums, interviews with persons involved in the eco-designing area, curators, etc. After conducting certain studies based on the design

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and the making of eco-furniture in series, the conclusion drawn is that in order to produce this type of eco-furniture, one must come back to the lifestyle specific to the Romanian people. (Pralea Jeni, 2009; Pralea Jeni, Sficlea Magda, 2010)

Furthermore, in order to go deeply into this type of study the first thing imposed is studying the object's origin, in this case the type of furniture and the means by which it was initially processed. (Pralea Jeni, 2009)

The aim of the many researches was the study of Romanian traditional objects, the methods by which they were crafted and the concept types which could be borrowed in order to produce contemporary furniture in an ecological manner. Thus the Romanian traditional objects can offer alternatives for the types of joints used presently in the furniture industry. These joints are made with the aid of metal elements, which can be replaced with traditional joints which entirely made from wood. Romanian traditional objects give the possibility of creating, by interpreting as well as adapting certain elements, joints and solutions, contemporary ecological\_furniture.



**Fig. 1** – Examples of traditional wood joints (The Wood Museum in Campulung Moldovenesc, Suceava) (Photo-designer Ilarion Constantin Balan)

## RESULTS AND DISCUSSIONS

In order to produce eco-furniture there are some essential aspects which should be underlined, such as fixed and removable joints which represent part of the ensemble of a piece of furniture. Wood joints represent innovative methods of assembling, or setting up two or more wooden elements for the purpose of fixing and forming an element/subset/whole set. These joints can be fixed or removable. Removable joints are made with nails and screws or they can be entirely made of wood, such as the wooden spigot type joint or the wedge joint. The fixed joints are made as a whole element without the possibility of removal. In this category we can also mention the finger joint, the dovetail joint or any other which implies the use of adhesives. (fig. 1, fig. 2).

The furniture elements include types of joints which ease assembling the parts which form the furniture. Different types of grip, swinging (trim), sliding or closure are used. Presently these elements are made of metal, called fittings. The research undergone had the aim of eliminating the metal elements and replacing them with wooden ones (fig. 3). In the case of more complex fitting, there is the eagerness to come up with an ecological\_solution of replacement.



**Fig. 2** – Examples of fixed (immovable) joints (The Wood Museum in Campulung Moldovenesc, Suceava) (Photo designer Ilarion Constantin Balan)



**Fig. 3** - Examples of removable joints (The Wood Museum in Campulung Moldovenesc, Suceava) (Photo designer Ilarion Constantin Balan)

The wooden ring type joint is one of the most frequently used for the production of wooden containers. These objects are made from caved boards placed in a circle. The grip and fastening of these are made with the help of a wooden ring, this being the best option of wood fastening. The ring (fig. 4) is made of elastic fibered wood (wicker, sage) and is processed by soaking, thus enlarging its flexibility. After bending by mould (casting), it is clipped by overlapping the two heads, provided with wooden structures which have the role of fastening the ring (in popular terms these called buffers), and after it is let out to dry the ring acts as a vise, thus the result of fastening the walls. This type of joint gives the object impermeability.



**Fig. 4** – Examples of wooden ring type joints (The Wood Museum in Campulung Moldovenesc, Suceava; Ethnographic Parc "Romulus Vuia", Cluj Napoca) (Photo designer Ilarion Constantin Balan)



**Fig. 5** – 3Dimensional exemplification of the joint type

The fixed tenon joint (fig. 6) can be found not only in objects of reduced size, but also in large ones. This joint is formed by the main part (which is crossed by the spigot) in which a second element is overlapped (the base of the joint). The main part is fastened onto the other wooden base with a wooden spigot. To this category one might add the fastening with nails as well. The two types however differ one from another in many respects. In the case of the wooden spigot joint, the spigot pierces the cut part while in the case of the nail type joint, the sectioned part is not fully imbedded. Both types of joints are removable, except for the joint made with nails, in the case when they are glued with adhesive or sectioned at the level of the part in which they were pressed, removal and/or replacement thus being impossible.



**Fig. 6** – Examples of the wooden spigot type joints (The Wood Museum in Campulung Moldovenesc, Suceava, Village Museum, Suceava; Ethnographic Parc "Romulus Vuia", Cluj Napoca) (Photo designer Ilarion Constantin Balan)



**Fig. 7** – 3dimensional exemplification of the joint type

As for the old types of wooden spigot joints, they have been today redesigned – built on the same principles, but adapted to today's requirements (fig. 7).

The wedge joint (fig. 8) is mostly common to items of household use; this type of joint is not removable and in most cases it is used to fasten two wooden parts (fig. 9). In some parts of the country this type of joint was overlapped with the dovetail joint with the purpose of strengthening its resistance. This consists of introducing the wooden arrow into a cavity which has a profile, which is part of the dovetail joint, this way creating a stronger one.



**Fig. 8** – Examples of wooden spigot joints (Ethnographic Parc "Romulus Vuia", Cluj Napoca) (Photo designer Ilarion Constantin Balan)



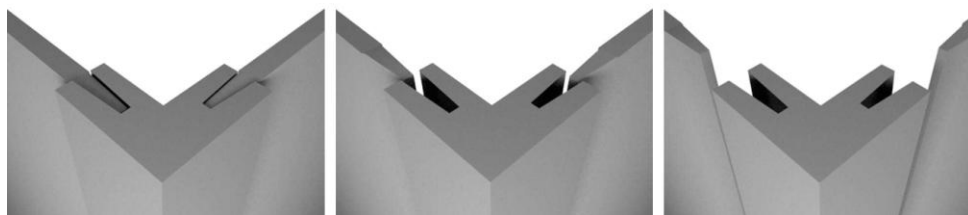
**Fig. 9** – 3dimensional exemplification of the joint type

The overlapped spigot type of joint (fig. 10), due to the complex procedure of making (fig. 11) is rare in comparison with other types of joints. In most cases, this type of joint is used in interior furniture. It is also encountered in the making of different types of trunks and it is rarely used for other types of objects.



**Fig. 10** – Examples of overlapped spigot joints (The Wood Museum in Campulung Moldovenesc, Suceava; Ethnographic Parc "Romulus Vuia", Cluj Napoca) (Photo designer Ilarion Constantin Balan)





**Fig. 11** – 3dimensional exemplification of the joint type

## CONCLUSIONS

The advantages of using wooden joints in the process of making furniture are ones of ecological nature as well as economic and aesthetic. The ecological aspect is supported by the fact that the details are made entirely of wood; therefore the furniture is 100% eco.

From an economic point of view, wood is cheaper and the remains resulted after the fabrication process can be recycled (for example in the making of smaller elements which will become part of the joints).

Aesthetically, using wood gives a nice classy touch to the furniture. These joints could be the base of various pieces of landscape furniture, created in a rustic as well as modern style.

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# NATURAL VENTILATION EVOLUTION AND INFLUENCE ON BUILT LANDSCAPE

## EVOLUȚIA VENTILĂRII NATURALE A CLĂDIRILOR ȘI INFLUENȚA ASUPRA PEISAJULUI CONSTRUIT

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**Abstract.** *In the context of sustainable concerns of European Conventions in Landscape held in Florence in 2000, the paper points to a green alternative solutions for the rehabilitation of the build environment. It's about researching and promoting millennial solutions, used since ancient times for natural ventilation. These solutions of bioclimatic architecture is today an inspiration to create a sustainable, unpolluted built landscape.*

**Key words:** sustainable landscapes, naturalventilation, bioclimatic architecture

**Rezumat.** *În contextul preocupărilor sustenabile ale Convenției Peisajului European ținută la Florența în anul 2000, lucrarea de față aduce în atenție o alternativă la soluțiile verzi de reabilitare a mediului construit. Este vorba de cercetarea și promovarea unor soluții milenare, folosite încă din cele mai vechi timpuri pentru ventilarea naturală. Aceste soluții de arhitectură bioclimatică constituie azi sursă de inspirație pentru a crea un peisaj construit sustenabil, nepoluat.*

**Cuvinte cheie:** peisaj sustenabil, ventilare naturală, arhitectură bioclimatică

### INTRODUCTION

Degradation currently facing urban areas imposed daring solutions "green" rehabilitation of the polluted environment. Many of them are related to the sustainable improvement ventilation of constructed interior and exterior spaces. In light of these concerns, the paper points to a green alternative solutions for the rehabilitations of the build environment. It's about researching and promoting millennial solutions, used since ancient times for natural ventilation. These solutions are now a source of inspiration to create a sustainable build landscape, unpolluted. Creating this kind of landscape is in attentions of European Conventions in Landscape held in Florence in 2000. In the present paper will highlight aspects of comfort and natural ventilation of buildings in different climates and terrain, thus creating certain types of vernacular architecture that we find in different part of the world, depending on climatic conditions have brought them. In the past and today, one of the means to remove excessive heat from the building was ventilation. Ventilation of buildings is required to maintain an acceptable level of oxygen in the air needed for life, but also to prevent the

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increase the increase of CO<sub>2</sub> and other harmful gases and particles that can result from human activities, objects and materials used in buildings interiors (Gallo C.et al., 1998).

If, in the beginnings, natural ventilation was used only to achieve certain minimum conditions of comfort, in the eighteenth century and nineteenth-century she ventilate small dwellings and public buildings has become a social problem for public health. Therefore, professionals in constructions science and medicine have begun to assess and bring public attentions to need to ensure fresh air in buildings both quantitatively and qualitatively, using the most effective methods not proved always the most efficient.

## MATERIAL AND METHOD

Since ancient times, the form and the function of buildings were subordinated to the climate type where these were built, and especially to the thermal comfort and adequate indoor ventilation. Consequently, the paper examines and highlights, in chronological order, some of the characteristics of different types of architecture, according to rules of natural ventilation, heating or cooling of buildings and their relationship with the environment.

## RESULTS AND DISCUSSIONS

In what follows, we track how the populations subjected to extreme geographical conditions have succeeded to solve inventive problems of adaptation to high or low temperatures, depending on the type of climate or the nuance of geographical and cultural characteristics of the area. Will be stressed as the main settlement on bioclimatic considerations in different geographical areas.

In cold climates, the most important factor for human habitation is to maintain acceptable indoors heat conditions. Concern to minimize heat loss led to construction of the hemisphere, resulting in maximum volume in a form with minimum external surface. In these areas meet semi or fully buried underground constructions. In most examples of vernacular architecture in cold lands, it's giving up the possibility of solar heating or lighting for better insulations and protection for strong winds. Thus, the Eskimo igloo type houses, with no windows, receive light through the translucent wall of ice blokes, and when is needed better insulations or less light, the interior walls are covered with seal skins. Entering of the igloo is protected by a wind tunnel with a parapet witch could be covered at need with animal skins. The interior space is layered so that stead of sleeping is located on the highest stage, where the air is warmer (fig. 1).

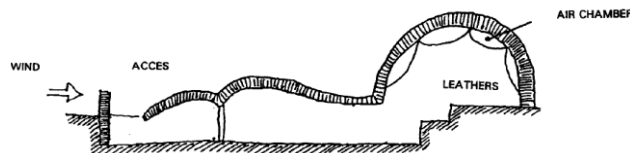
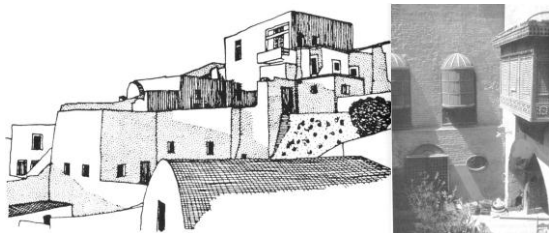


Fig. 1 - Construction adapted to cold climate. Igloo Eskimos (Gallo C.et al., 1998)



**In summer and /or a warm climate**, you can apply three levels of action in designing buildings to achieve thermal comfort in the most convenient way. So we talk about avoiding heat in first step, then passive cooling, which is achieved mainly through natural ventilation. If these methods are not sufficient to provide comfort, are complemented by the third method of giving action only applies to the modern era, namely the use of mechanical equipment just if they are necessary and efficient. Passive cooling is more dependent on climate than passive heating. Therefore, passive cooling strategies in hot and dry climate are different from those of the hot and humid climate (Lechner N., 2009).

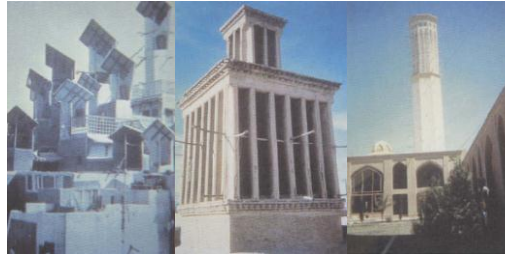
Even during antiquity (Egypt, Mesopotamia, Greece and Italy) and until recent times, the principal of architectural composition in regions with **hot dry weather** concentration sought shade in a protected outdoor space. Introversion is used to a living space with outdoor patio or courtyard type, protected and shady portico, as they were and small ponds or fountains, creating a favorable microclimate. Building of this type today are specific to North Africa, Near and Middle East, Islamic civilization in general. This creates a landscape of white fortress-looking building with few and small window or door openings, separated by narrow streets which are protected from excessive heat by the shadow left by high walls. Building were upstairs balconies/ loggias covered with braided straw to shade Islamic streets but also to create a rest area facing the street, protected from heat and prying eyes (fig. 2).



**Fig. 2** - Buildings adapted to warm dry climate. Santorini, Greece (left); Mashrabiya in Cairo, Egypt (right) (Lechner N., 2009)

Another important factor is how the massive walls and type of construction materials (usually stone or earth bricks) contribute to a comfortable indoor climate both day and night. Thus, massive wall with high thermal inertia, not only delay the passage of heat from outside to inside, but during the day store it inwards to release it at night, when the outdoor temperature drops quite a lot in these climates. The process takes place in the sense of cool night store and release it inside late, just when the heat of the day is more powerful. In urban sites or other places where there is wind of different intensities or different direction can be used to capture air currents with wind tower (fig. 3), which have their openings at the top in all directions or just prevailing wind direction, a way found even today. These towers would be based on porous ceramic pots or pools, and facilitator of cooling air that enters the room through evaporation. In the same

way that there could be penetrated by air ducts in the basement of building or even deeper in the earth where water supplies are kept at optimal temperatures.



**Fig. 3 - Wind towers** (Gallo C.et al., 1998)

Massive dome structures encountered in unicellular homes in village in Iran, Afghanistan, or Kirokitia-Cyprus are also an appropriate strategy in the dry tropical climate zones. In addition to the thermal inertia afforded by their massiveness, their occupants will benefit from cooler air through the vertical stratification of air, hot air is exhausted through an opening to the top, but that, due to the shape warming is happening partial on the side exposed to the sun only, and radiant cooling at night is done all over the dome. In Cappadocia, Turkey (fig. 4 left) were carved thousands of homes in tuff cones, because they offer protection against heat and extreme cold. Community residents from Mesa Verde, Colorado (fig. 4 right), built the village in a very large fault rock that shade the entire settlement. In areas where no stone huts, were built with massive walls, roof and floor (Navajo population in southwestern North America) or mud from the floor (the village of Spain or Mexico)



**Fig. 4 - Dwellings dug into volcanic tuff cones, Cappadocia-Turcia (left); Dwellings village built under a fault rock, Mesa Verde-Colorado (right);** (Gallo C.et al., 1998)

In **hot humid climates**, where humid exceeding 80%, is aimed the upper shading of constructions and removal of moist air around the building and the building itself. Traditional building type in these regions is that high ground by means of columns, walls of light materials being perforated with multiple holes and shaded using very wide eaves. Thus houses were well ventilated and spaced apart to allow good ventilation wind out. Pile dwelling of up to 3 m, were built in wetlands or near water, in some countries in Asia, Africa, Central and South America, they reflect the concerns and lifestyle of people in these areas. Niger's population built their huts Zarma cylindrical timber of soil and plant material from the wall and conical roofs, no windows, only advance through a door, built

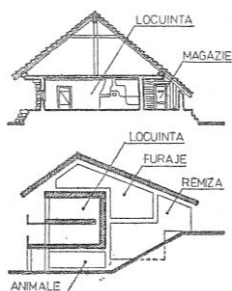
on wooden poles to the ground, and being apart from each other, all contributing to good ventilations (I.S.Lebedev, Jurov C., 1985). Traditional Japanese homes are perfect model of symbiosis between the needs of comfort and safety of human and natural environment with wet tropical climate and strong seismicity. Built on one level, the high ground of natural materials, Japanese homes had walls of the frames lighter board that was caught between waxed paper, slide the entire side of the building opening onto the garden or the other spaces. One to three verandas with high slope roof and wide eaves protect the house from excessive heat and humidity. Like the Japanese homes, the homes in US Gulf of Mexico (fig. 5, left), are built on the same principles of natural ventilation and humid removal: light wooden structures were lifted off the ground and had large openings in doors and windows so to allow cross ventilations, and air layering rooms facilitated high vertical evacuation, and also through holes in the ceiling and roof openings in the gable or dormer windows. In these case, deep verandas have a defining role in the shading of walls exposed to maximum sunshine during the day. Many of these concepts have been incorporated in to the neoclassical architecture, popular in South America and Europe in the nineteenth century. Classical portico was used to shade windows and high doors and stairs, and continued with a centrally located skylight or tower, creating a strong chimney effect, facilitating cross ventilation to all rooms (fig. 5, right) (Lechner N., 2009).



**Fig. 5 -** Building adapted to worm-humid climate. House in Louisiana, (left); Neoclassical house in Waverly (right), S.U.A. (Lechner N., 2009)

**Temperate climate** make the most difficult problems in terms of ensuring thermal comfort and ventilation, due to large temperature differences from summer to winter. The first houses protected against the cold, were attested by archaeological excavations since the period of the primitive. These houses have much wood in their structure material, so using the thermal inertia of the earth and the roof tilted slightly raised above the ground protect very well against strong winds from the plain. In various areas of the temperate climate found ingenious related solutions to housing construction. In general facades were entering and living rooms facing south, protected from sun and rain by a porch wide eaves of the roof. In the northern part of the house roof down closer to earth and it is shelter to various storage spaces of food or feed, or even kitchen. In France as in Transylvania homes were divided into two or even three levels so that all dependencies needed a wise households were embedded under the same roof (Lebedev I.S., Jurov C., 1985) (fig 6). More elaborate buildings of the nineteenth century built in temperate zones (fig. 7) are designed to respond optimally to both

types of climate. The compact design of house with medium size windows which prevent heat lost in winter, but allow ventilation in summer. The chimney of the fireplace have double role: both to create the effect of summer heat circulation, as evacuating hot or foul air of the building, and also to evacuate smoke from the fireplace and to store heat in winter. Each room has openings on all four sides, thus facilitating cross ventilation and roof turret may have different names depending on its destination: light, lantern, dome, pinnacle or just to dress and representativeness of the building.



**Fig. 6 -** Traditional house in Moldova (top), house in Bricon – France (below). (Lebedev I.S., Jurov C., 1985)



**Fig. 7 –**Residence of the Governor Williamsburg, Virginia, S.U.A. (Lechner N., 2009)

## CONCLUSIONS

When the depletion of conventional energy resources has created an acute crisis, has returned in very short time to the principles of sustainability. In this regard, given that natural ventilation principles have remained the same for thousands of years, the past twenty years, ventilation and energy conservation were the main topics of research in the design of buildings.

In the context of sustainable concerns of European Conventions in Landscape held in Florence in 2000, the paper points the bioclimatic architectural solutions as an alternative to green solutions build landscape rehabilitation.

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