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CONTENTS

LABOR USE IN GREENHOUSE TOMATO PRODUCTION: A CASE STUDY FROM KUMLUCA DISTRICT OF ANTALYA PROVINCE, TURKEY

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Abstract

Purpose of this study was to determine labor use by gender in greenhouse tomato production in Antalya province, Turkey. The main material of the study consisted of data obtained from surveys, which were conducted by face-to face interviews with tomato farmers in Kumluca district in Antalya province. Simple Random Sampling Method was used to determine the number of farms to be included in the survey. The number of samples representing the population was calculated as 106. Results showed that family labor use per decare in tomato production was 242.63 hours/year. It was determined that 49.87% of family labor was male and 50.13% was female. Foreign labor use per decare was 35.02 hours/year. It was found that 20.36% of foreign labor was male and 79.64% was female. It was found that male and female in the 15-49 age group worked more than other age groups. In family labor use, it was found that males worked more in plowing, irrigation, pesticide application and fertilizing activities, whereas women worked with men in many activities but mostly worked in pruning, rope tying, harvesting and classification. It was found that foreign labor was mostly women and they worked in pruning (disbudding), rope tying, harvesting and classification activities.

Key words: greenhouse, tomato, labor use, gender, age

There is a close relationship between economic growth and labor which is one of the production factors and the population that makes up the resource of the entrepreneur. The effectiveness of use of labor is also important as an indication of the quality as well as quantity of the population in the social, political and economic lives of countries. Natural resources cannot be used directly. Labor which is one of the production factors is required in order to benefit from these resources and to generate capital. Hence, labor is accepted among the active elements of production (Şahin and Miran, 2008).

Agriculture is an important sector in Turkey with regard to the employment opportunities it provides. The share of agriculture in employment is about 18.43% as of 2018 and about 5 million 297 people are employed in this sector (TUIK, 2019). Population makes up the source of family labor in farms as family businesses. Labor in family businesses includes physical and mental activities from production to marketing (Hardwick *et al*, 1999).

Greenhouse production that enables the marginal utilization of small areas by way of high yield per unit area is also one of the important agricultural activities in Turkey since it provides regular labor use throughout the year. Greenhouse production in Turkey started with the establishment of greenhouses in the Antalya province during the 1940's. Greenhouse activities had a slow development until the 1960's. However, greenhouse production increased rapidly afterwards with the use of plastic cover materials. Greenhouse production is carried out extensively in the Mediterranean, Aegean and Marmara coasts of Turkey (Miran, 2005). Of the greenhouse areas in the Antalya province, 63.585 decares (22.45%) is glass greenhouse, 193.443 decares (68.29%) is plastic greenhouse, 13.535 decares (4.78%) is high tunnel and 12.721 decares (4.49%) is low tunnel. Tomato production is ranked first with a share of 51.60% in Antalya province greenhouse production.

The purpose of the present study was to determine was to determine labor use by gender in greenhouse tomato production in Kumluca district of Antalya province, Turkey.

MATERIAL AND METHOD

The main material of the study consisted of data obtained from surveys, which were conducted by face-to face interviews with tomato farmers in Kumluca district of Antalya province. In addition, similar studies carried out on the subject by various

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individuals and institutions, reports and statistics were also used. Survey data cover the 2018-2019 production period. Simple Random Sampling Method was used to determine the number of farms to be included in the survey (Oğuz and Karakayacı, 2017).

$$n = \frac{N * S^2 * t^2}{(N-1) * d^2 + (S^2 * t^2)}$$

$$= \frac{815 * 7818065.98 * 2.7225}{814 * 175105.2364 + (7818065.98 * 2.7225)}$$

$$= \frac{17347017975}{163820347.1} = 106$$

Here; n: sample size (106 farms), S: Standard deviation (2796.08), t: t table value corresponding to the confidence interval (1.65 for a confidence interval of 90%), d: Acceptable error margin (arithmetic mean*margin for error=4184.56*0.1=418.46), N: Total number of units for the sampling framework (815 farms).

It was determined as a result of the calculation using the formula given above that it is required to carry out surveys with 106 farms with reliability limits of 90% and error margin of 10% and the farms subject to the survey were selected randomly. The data obtained from the farms via survey method were tabulated via Microsoft Excel after which the tables were analyzed and interpreted.

RESULTS AND DISCUSSIONS

Table 1 presents an overview of the data related with farms carrying out greenhouse tomato production. The age average of the greenhouse tomato production farmers was 47.55 years, their education level average was 6.44 years and the average number of individuals in their family was determined as 3.76. The average greenhouse land size of the farms was 3.26 decares with full irrigation. Whereas the land averages of the farms that are owned, rented and shared were determined as 2.43, 0.49 and 0.34 decares respectively. Average tomato yield per decare for the farms was 15.80 tons.

The number of individuals in the family, age and gender distributions is effective on the labor input in production (Handayani *et al*,1993). Family population and labor use in farms according to age groups are presented in Table 2. Average working population per farm was 2.25 with 47.48% male and 52.52% female population. It was determined that majority of the working family population was between the age group of 15-49 (68.07%). Family labor use per decare for farms was determined as 242.63 hours/year with 49.87% male and 50.13% female labor. Highest family labor use was obtained for the 15-49 age group (65.10%). Tanrıvermiş *et al*, (2001) carried out a study in which it was put forth that tomato cultivating farms use 213.72 hours/year labor per decare.

Foreign labor use according to age groups and gender are presented in *table 3*. Foreign labor use in farms by age groups was determined as 1.58 individuals with 38.92% males and 61.08% females. Majority of the foreign labor use was determined to be in the 15-49 age group (94.61%). Foreign labor use per decare was 35.02 hours/year with male labor share of 20.36% and female labor share of 79.64%. Highest foreign labor use ratio was determined in the 15-49 age group (91.26%).

Table 1

General characteristics of farms

Features	Average
Farmer's age (years)	47.55
Farmer's education level (years)	6.44
Family population (person)	3.76
Greenhouse land (da)	3.26
Irrigated land (da) (greenhouse)	3.26
Property land (da) (greenhouse)	2.43
Rent land (da) (greenhouse)	0.49
Shared land (da) (greenhouse)	0.34
Average tomato yield (ton/da)	15.80

Table 4 presents the family labor use in tomato production by activity and gender. Greenhouse tomato production activities include giving manure to soil, plough, laying of drip irrigation pipes, irrigation of soil, planting seedling and giving life water, pesticide application for root rot, fertilizer application for rooting, fertilization with drip irrigation, foliar fertilization, irrigation, pruning (disbudding), tie up, pesticide application with drip irrigation, pesticide application to foliar, harvest and classification. Average family labor use per decare in farms was determined as 242.63 hours/year with 49.87% male and 50.13% female labor. Harvest and classification share in total family labor use as 48.69%, irrigation as 10.90%, foliar fertilization as 10.61% and pesticide application to foliar as 10.51%. Activities in farms for which male labor is more dominant were determined as giving manure to soil (51.69%),

plough (94.33%), laying of drip irrigation pipes (56.69%), irrigation of soil (62.28%), pesticide application for root rot (71.76%), fertilizer application for rooting (73.02%), fertilization with drip irrigation (51.78%), foliar fertilization (51.25%), irrigation (67.48%) and pesticide application with drip irrigation (76.21%). Whereas activities in farms for which female labor is more dominant were determined as planting seedling and giving life water (50.74%), pruning (disbudding) (54.04%), tie up (52.56%), pesticide application to foliar (51.71%), harvest and classification (54.71%). Tanrıvermiş *et al* (2001) carried out a study in which it was determined that 47.14% of the labor used per decare in tomato production is spent on harvesting activity (Tanrıvermiş et al, 2001).

Table 5 presents foreign labor use by activities and gender in tomato production. The share of female labor in total foreign labor use per decare was determined as 79.64% and the share of male labor use was determined as 20.36%. It was determined that females work more in activities of planting seedling and giving life water (91.69%), pruning (disbudding) (95.51%), tie up (96.15%), harvest and classification (81.97%).

CONCLUSIONS

In conclusion, it was determined that the total labor use per decare in tomato production is 277.65 hours with 87.39% comprised of family labor and 12.61% of foreign labor. It was also determined that 53.86% (149.53 hours/year/da) of labor use per decare was female labor and that 46.14% (128.12 hours/year/da) was male labor. Average family labor use per decare in farms was determined as 242.63 hours/year with 49.87% male labor and 50.13% female labor. It was set forth that 79.64% of the foreign labor use in greenhouse tomato production activities is female labor while 20.36% is male labor. Accordingly, it was determined that female labor is used more extensively during greenhouse tomato production activities. Hence, it is considered that female labor should be taken into consideration during agricultural research and development projects on tomato production.

Table 2

Family labor use by age groups and gender

Age groups	Working family population by age groups (person)						Family labor use by age groups (hour/year/da)					
	Male		Female		Total		Male		Female		Total	
	P	%	P	%	P	%	P	%	P	%	P	%
7-14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-49	0.71	46.30	0.82	53.70	1.53	68.07	77.51	49.07	80.43	50.93	157.95	65.10
50-64	0.34	50.00	0.34	50.00	0.68	30.25	41.69	51.36	39.49	48.64	81.18	33.46
65+	0.02	50.00	0.02	50.00	0.04	1.68	1.78	50.95	1.72	49.05	3.50	1.44
Total/Average	1.07	47.48	1.18	52.52	2.25	100.00	120.99	49.87	121.64	50.13	242.63	100.00

P: Person

Table 3

Foreign labor use by age groups and gender

Age groups	Working foreign population by age groups (person)						Foreign labor use by age groups (hour/year/da)					
	Male		Female		Total		Male		Female		Total	
	P	%	P	%	P	%	P	%	P	%	P	%
7-14	0.00	0.00	0.01	100.00	0.01	0.60	0.00	0.00	0.46	100.00	0.46	1.32
15-49	0.58	39.24	0.91	60.76	1.49	94.61	7.08	22.15	24.88	77.85	31.96	91.26
50-64	0.03	37.50	0.05	62.50	0.08	4.79	0.05	1.93	2.55	98.07	2.60	7.42
65+	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00
Total/Average	0.61	38.92	0.96	61.08	1.58	100.00	7.13	20.36	27.89	79.64	35.02	100.00

P:Person

Table 4

Distribution of family labor use by activity and gender (da)

Activities	Male		Female		Total	
	Hour/year/da	%	Hour/year/da	%	Hour/year/da	%
Giving manure to soil	0.27	51.69	0.25	48.31	0.52	0.21
Plough	1.15	94.33	0.07	5.67	1.22	0.50
Laying of drip irrigation pipes	1.09	56.69	0.83	43.31	1.92	0.79
Irrigation of soil	1.04	62.28	0.63	37.72	1.67	0.69
Planting seedling and giving life water	2.02	49.26	2.08	50.74	4.11	1.69
Pesticide application for root rot	0.71	71.76	0.28	28.24	0.98	0.41
Fertilizer application for rooting	0.67	73.02	0.25	26.98	0.91	0.38
Fertilization with drip irrigation	4.91	51.78	4.58	48.22	9.49	3.91
Foliar fertilization	13.19	51.25	12.55	48.75	25.74	10.61
Irrigation	17.85	67.48	8.60	32.52	26.46	10.90
Pruning (disbudding)	9.07	45.96	10.66	54.04	19.73	8.13
Tie up	2.57	47.44	2.85	52.56	5.42	2.23
Pesticide application with drip irrigation	0.64	76.21	0.20	23.79	0.84	0.35
Pesticide application to foliar	12.31	48.29	13.18	51.71	25.49	10.51
Harvest and classification	53.50	45.29	64.63	54.71	118.13	48.69
Total	120.99	49.87	121.64	50.13	242.63	100.00

Table 5

Distribution of foreign labor use by activity and gender (da)

Activities	Male		Female		Total	
	Hour/year/da	%	Hour/year/da	%	Hour/year/da	%
Giving manure to soil	0.10	100.00	0.00	0.00	0.10	0.30
Plough	0.64	100.00	0.00	0.00	0.64	1.83
Laying of drip irrigation pipes	0.02	100.00	0.00	0.00	0.02	0.07
Irrigation of soil	0.09	100.00	0.00	0.00	0.09	0.26
Planting seedling and giving life water	0.09	8.31	1.02	91.69	1.11	3.18
Pesticide application for root rot	0.01	100.00	0.00	0.00	0.01	0.02
Fertilizer application for rooting	0.01	100.00	0.00	0.00	0.01	0.02
Fertilization with drip irrigation	0.43	100.00	0.00	0.00	0.43	1.24
Foliar fertilization	0.52	100.00	0.00	0.00	0.52	1.49
Irrigation	0.52	100.00	0.00	0.00	0.52	1.49
Pruning (disbudding)	0.63	4.49	13.29	95.51	13.91	39.74
Tie up	0.07	3.85	1.74	96.15	1.81	5.16
Pesticide application with drip irrigation	0.00	0.00	0.00	0.00	0.00	0.00
Pesticide application to foliar	1.39	100.00	0.00	0.00	1.39	3.97
Harvest and classification	2.60	18.03	11.84	81.97	14.45	41.26
Total	7.13	20.36	27.89	79.64	35.02	100.00

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ANALYSIS OF ENTERPRISE POTENTIAL FOR MEASURING CONTROL EFFICIENCY

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Abstract

Of paramount importance is the analysis of the economic potential of the enterprise, which serves as a way to determine the capabilities of the potential conditions for the stable and effective functioning of the organization in the future. Research needs to be continued based on a comprehensive methodology that provides a clear mechanism and control concept in order to facilitate an effective analysis of the economic potential of the enterprise and the search and development of existing reserves. The approach of authors to the formation of the methodology of economic potential analysis is presented. There are structural elements of the methodology and the connection between them. The algorithm of the analysis of the economic potential of the enterprise for measuring the efficiency of management is substantiated. The presented methodology can be used to analyze the economic potential of the enterprise, to determine the priority directions of the development of components of economic potential, to identify weaknesses and possible risks, and to form an effective control system in order to achieve the established strategic goal of enterprise development

Key words: analysis; potential; control; methodology, risks

Business entity management must anticipate and take into account many factors of the enterprise's external as well as the internal environment. This will allow utmost accurately justify the management decision and to give preference in favor of the best of possibilities. These circumstances determine the priority given to the analysis of the enterprise economic capacity that serves as a way of identifying capacity opportunities, a condition for the stable and efficient functioning of the organization in the future. There is a need to extend the research based on a comprehensive methodology that provides a clear mechanism and concept for control to contribute to an effective analysis of the enterprise economic capacity and the search and development of the existing reserves.

Some organizational and methodological aspects of the business processes control have not been investigated sufficiently. Control of the enterprise economic capacity is one of them. However, when considering this issue in the context of socio-environmental problems of the new paradigm of strategic development, new methodological questions arose. The task is to study the methodological foundations of the enterprise economic capacity analysis to measure the control effectiveness.

MATERIAL AND METHOD

There is a need to extend the research based on a comprehensive methodology that provides a clear mechanism and concept for control to contribute to an effective analysis of the enterprise economic capacity and the search and development of the existing reserves.

Problematic matters of the analysis and estimation of the enterprise economic potential were considered by the scientists such as I. Ansoff, V. Avdeyenko, D. Androshchuk, M. Bayer, R. Bilousov, A. Dibrova (2), P. Drucker, O. Fedonin, V. Gavva, F. Hedouri, N. Krasnokutska, O. Krasnorutskyi (4), E. Lapin, I. Lukinov, A. Mazaraki, K. Mamonov, L. Marmul, Z. Mikoláš (7), M. Meskon, B. Messaoud and Z. Teheni (6), O. Olesyuk, I. Repina, S. Rozumenko, M. Romanyuk, S. Ross, I. Simenko, T. Shabatura, O. Shumanska, D. Rubinfeld, K. Vobliy, O. Volkova, A. Zadoya and others.

Some organizational and methodological aspects of the business processes control have not

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[3] Armenian National Agrarian University, Republic of Armenia.

been investigated sufficiently. Control of the enterprise economic capacity is one of them. However, when considering this issue in the context of socio-environmental problems of the new paradigm of strategic development, new methodological questions arose.

The task is to study the methodological foundations of the enterprise economic capacity analysis to measure the control effectiveness.

RESULTS AND DISCUSSIONS

According to the opinion in the scientific community, any theory inherent in its own original methodology, as well as the absence of a universal methodology is equally applicable in all spheres of scientific knowledge and at any theoretical level. The methodology having proved its research effectiveness in various fields of scientific knowledge, not everyone will be able to study a new subject area in an adequate way.

The methodology of evaluating the enterprise economic capacity is intended to indicate its content and to analyze the composition and dynamics of changes in its qualitative and quantitative parameters based on the system of valuation dominants, approaches, methods, indicators. It is important to note that, unlike theory and concept, the methodology does not give new knowledge and is not a practical ground, but it develops such scientific domains the scientific development cannot do without (Shabatura T., 2014).

The use of control involves the preliminary formation of theoretical foundations and methodology, including the development of the concept of control. The control concept is understood as an integral, which connects all its structural elements with the formalized concept of control the control subsystem. This subsystem is designed to ensure the effectiveness of management decisions and facilitate the optimization of business strategy and management policy as a whole.

The basis of the control methodology is the refinement and adjustment of the system of key indicators that characterize the state of the enterprise as an economic system and the processes of its functioning. The effectiveness of the implementation of the management decisions and the company strategy depends on a well-formed system of analytical indicators that assess the company activity. This system of indicators is formed on the ground of the current indicators of the organization functioning, on the information obtained during the analysis of weak points of production.

Control provides the development of indicators and techniques used in the analysis of competition. The organization competitive environment is constantly changing, which requires the environment monitoring. Changes in the market conditions include changes in the ratio of demand and supply, the change in the average market price, changes in consumer requirements to the quality of goods, etc. To form and plan their own competitive strategy, the information on the state of the market is needed. With this information in mind, the company can identify its own strengths to develop new strategies. Within the framework of this strategy, the weaknesses of the enterprise should be eliminated.

It is worth noting that the set of valuation principles, indicators, criteria, and methods is based on the assessment methodology.

In general terms, the assessment methodology can be submitted in the form of a sequence of follow-up actions;

- formation of categories;
- development of indicators;
- setting the benchmark;
- choice of the assessment method;
- obtaining the assessment result (Tolstaya N., 2013).

In terms of methodology, the capacity of an enterprise is characterized by such interconnected categories as "opportunity" and "ability". Methodological bases of the enterprise economic capacity analysis to measure the control efficiency are presented in *figure 1*.

The capacity analysis is also used as a control method. The enterprise capacity is defined as an opportunity to provide viability and profit in the future. Control task is a constant analysis of the capacity for systematic tracking of the level and efficiency of its use.

It may look like there is a list of well-known methods of management and, consequently, control does not contribute anything new to the field of economic analysis. In fact, the specifics of control is that it integrates the already formed methods into a uniform system and thus provides a new quality of analytical activity. This new quality lies in the complexity of the analysis, the possibility of crosschecking the results obtained by different methods, and the implementation of the principle of complementarity of various methods. This way the implementation of the systematic approach principles in the field of control is expressed. Control is not limited to the use of methods developed within the framework of management. Equally promising are economic-and-mathematical and econometric methods.

The analysis of the former state of economic capacity consists in studying the dynamics of indicators of property status and the sources of asset formation. The analysis of the status of the enterprise economic capacity should be emphasized first, on the study of unused opportunities and growth reserves. A particular benefit in this sense is the analysis of indicators of business activity, balances of working time, the correlation of employees' education and their official duties, etc. That is, the analysis should be aimed at assessing the optimality of the implementation of existing opportunities. The analysis of the potential lies in the study of the enterprise strategic component. Potential is closely linked to the strategic capacity of the enterprise development, which is essentially identical to it. Therefore, the research of economic potential is advisable to conduct by means of strategic analysis.

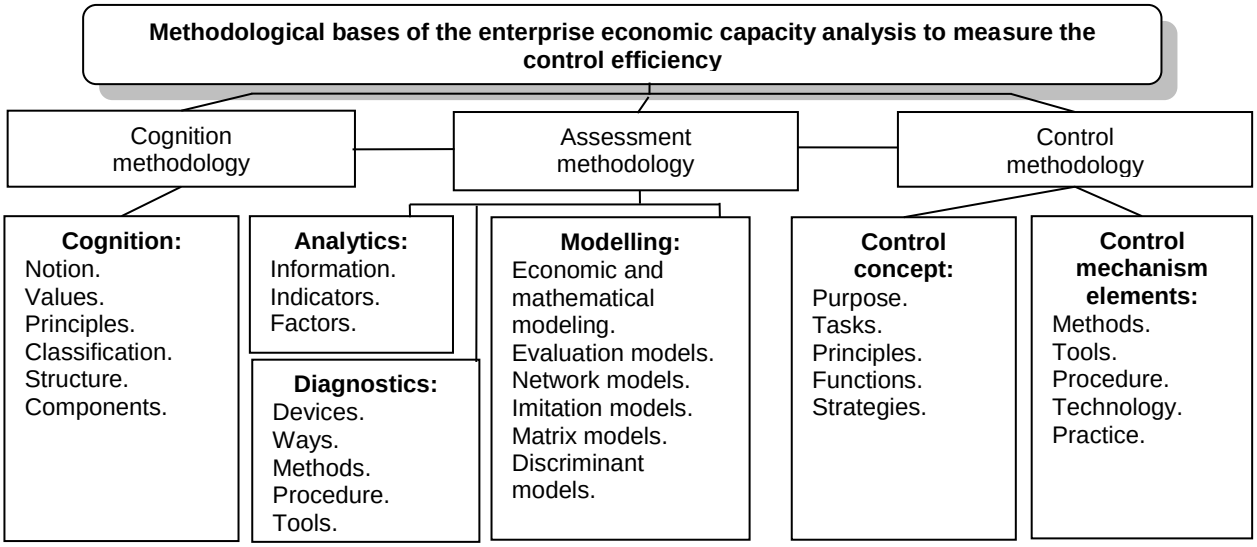

Figure 1. **Methodological bases of the enterprise economic capacity analysis to measure the control efficiency**

Strategic analysis of the economic capacity assessment should combine static aspects (analysis of the state of resources and competences) with the dynamic ones – the processes of search, formation, and development of the strategic potential (ability to see prospects, strategic strength, innovations, etc.).

The strategic analysis of the process of the enterprise economic potential monitoring involves a number of general scientific devices, such as analysis, analogy, induction, observation, planning, comparison, modeling, synthesis, system analysis, evaluation, and classification.

In addition to general scientific devices in the process of strategic analysis, there is a need to apply various techniques, including SWOT analysis, environment profile, SNW analysis, PEST analysis, and others (Panchenko O., 2015).

The ability to coordinate activities vertically and horizontally makes the control ling, regardless of who will perform this function, an effective tool of the modern management, whose activity should be aimed at maintaining and increasing the value of the company and ensuring its long-term sustainable development. The issue of the company stable development, in the end, requires the manager to implement a successful policy at the strategic as well as at the operational level of crisis management. Methodological bases of economic capacity analysis are presented in *figure 2*.

The assessment of the economic potential components is carried out according to the relevant indicators using the theoretical scope of variation and simple arithmetic means. The integral index is calculated as the multidimensional weighted average of the indicators used.

The result is a rating assessment of the economic capacity, which characterizes the relative opportunities of the country's and the region's economic system. Accordingly, the application of the presented fundamentals of the analysis of economic capacity will contribute to a reliable measurement of the effectiveness of control ling, to determine the latent risks of the internal and external environment of the enterprise, to clearly identify the strategic management initiatives.

As far as the informational function of control is the dominant one, which is the constitutive basis to form the information potential for the practical implementation of tasks and management functions (planning, organizational, operational, motivational, control). Respectively, the effectiveness of the control methodology depends on the internal, financial, technical control

of various hierarchical levels of the management system of economic entities..

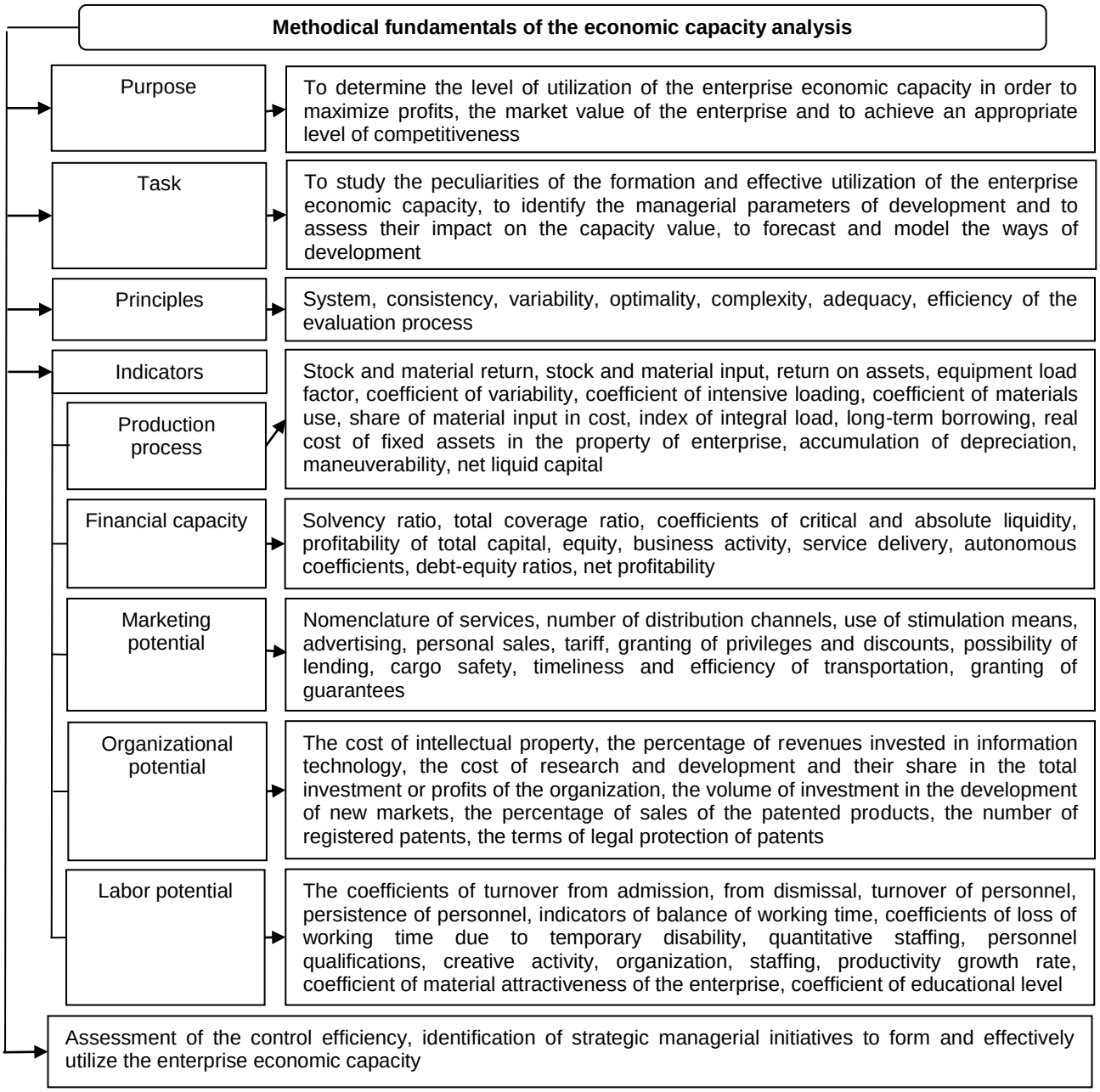

Figure 2. **Methodical fundamentals of the economic capacity analysis**

The effectiveness of the control methodology directly depends on the organization of the technical as well as financial internal control, carried out at all levels of enterprise management. Therefore, control of the enterprise activity involves the simultaneous operation of the complex of control systems based on the results of the internal audit in the areas of financial, technical, marketing and investment activities.

The success of any activity is possible only due to the fulfillment of important requirements that ensure the effectiveness of management decisions, management activities and management in general. The principles are of the greatest significance in the enterprise activities to ensure the realization of the goal. These principles determine the characteristics and content of the management process. To design an effective control system, the identification of adaptive principles is relevant, as follows (Kubrak M., 2017):

1) the principle of activity continuousness, which provides for the continuous management and optimization, the receipt and evaluation of the information necessary for this purpose;

2) a systematic approach, which involves the construction of a system of planning, accounting, analysis and control at all stages of the process of formation, management and effective utilization of the enterprise economic capacity;

3) the principle of timely identification, monitoring of the risks of the internal and external environment that have a significant impact on the level of the enterprise economic capacity;

4) the principle of documentation, which involves the independence of the enterprise when determining the order of accounting, analysis, control, and management decision-making;

5) the principle of priority of strategic goals, which requires control over the justification of perspective directions of development of economic potential in the long-term perspective;

6) the principle of flexibility, which provides for a quick and clear response of the enterprise control to change the conditions of the external and internal environment of the enterprise.

The model of potential management is a set of interdependent analytical, information-and-logic and heuristic aspects, which study is possible in terms of the analysis of information flows relative to the capacity change. It is worth noting the need to provide such an important property of the capacity as adaptability, that is, the ability to adapt certain substructures to the changing environmental conditions of the enterprise functioning.

This causes the synergistic effect of the company's potential components interaction, as well as the development of managerial decisions aimed at eliminating the destabilizing effects of the environment. The algorithm for analyzing the enterprise economic capacity to measure control efficiency is presented in *figure 3*.

Thus, the main trends of the scientifically grounded enterprise capacity management are reduced to the analysis and research of processes characterizing the change in the structure of the main components of the enterprise capacity under the influence of internal and external factors.

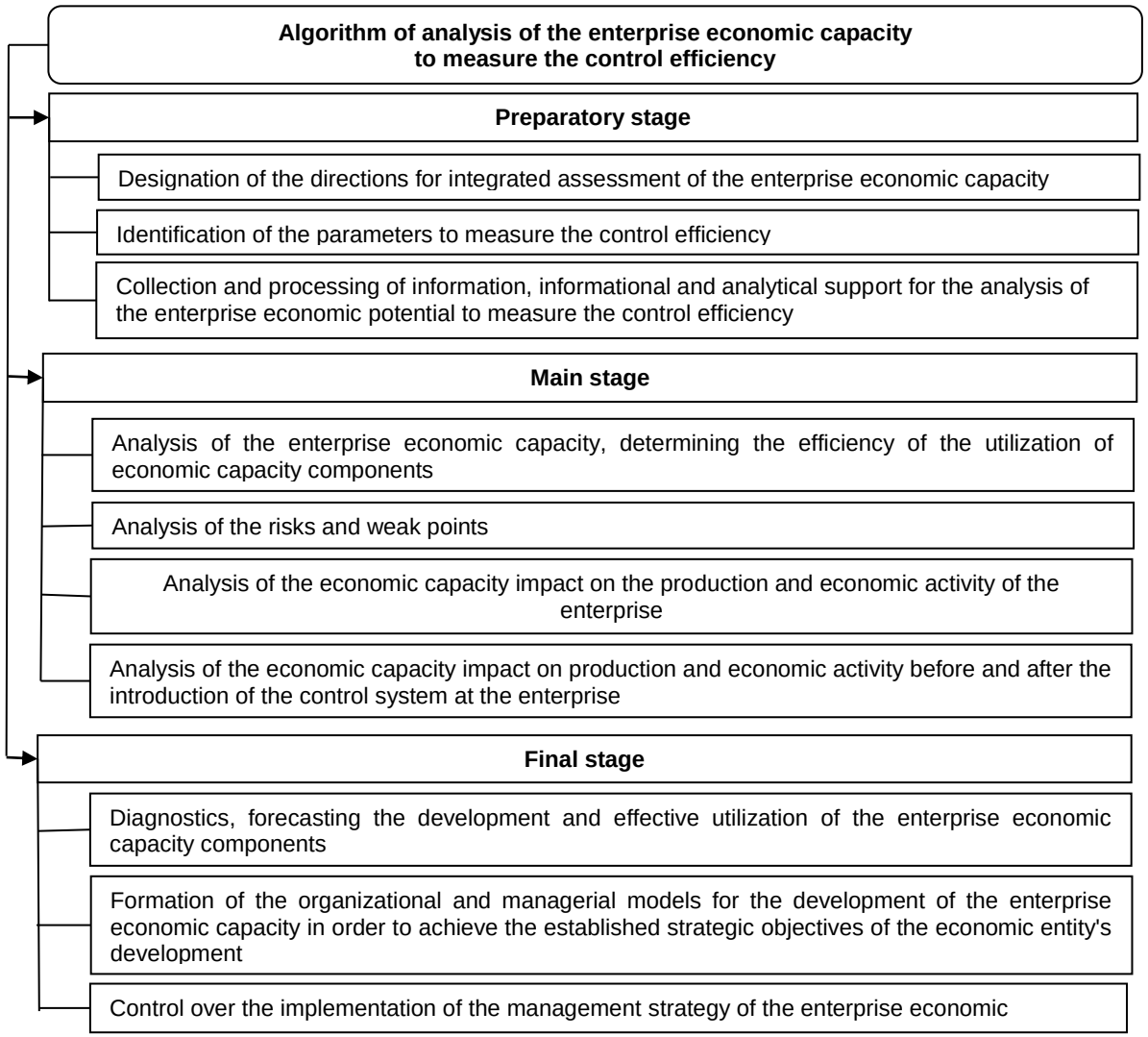

Figure 3. **Algorithm of analysis of the enterprise economic capacityto measure the control efficiency**

It may be the result of changes in the functional components of the enterprise capacity, which directly affect its activities, as well as the influence of external factors on the enterprise functioning. The need to adjust the goals also requires the formation of new compositional combinations of the capacity components of the enterprise (Bykova V., 2017).

CONCLUSIONS

The methodology for analyzing the enterprise economic capacity to measure the control efficiency is the most important stage of epistemological research. The complex methodology of the enterprise economic capacity will allow it to be analyzed to measure the control efficiency in order to perform the following tasks:

1) to study the peculiarities and problems of the formation and utilization of the enterprise economic potential;

2) to identify managerial parameters of the enterprise economic capacity development and the analysis of their influence on its volume;

3) to forecast the ways of the enterprise economic capacity development and the volumes of its utilization.

The presented methodology can be used to analyze the enterprise economic capacity, to identify the priority directions of the development of the economic capacity components, to determine the weak points and potential risks, to design the information platform that will ensure the implementation of the priority tasks of control in order to achieve the established strategic goals of the enterprise development.

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ECONOMIC EFFECTIVENES SPECIFIC TO SOME MARKETING TOOLS

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Abstract

The research presented in this paper aims to determine the specific effectiveness of marketing tools within an agricultural product processing company. In order to carry out this research, the objectives were established: 1. to determine the perception of the quality components of the food products; 2. determining the relevance of the textual information provided through the marketing tools; 3. determining the relevance of the textual information provided through the marketing tools; 4. determining the relevance of the graphic elements to the customers perception regarding the quality components of the food products. This research is necessary for the company to know the relevance of its actions and the marketing tools it uses, where and what it has to improve.

Key words: quality perception, marketing tools, practical model

Online communication is a constant of modern marketing and efficiency is unanimously recognized (Alchus J., 2013). Social networks are vectors for communicating information to clients and customers (Polger M.A. and Sich D., 2019; Zaglia M.E., 2013).

In tourism, communicating with customers through online tools is a practice that has become conventional but with many possibilities for improvement (Vargas-Sanchez A. and Saltos A.E., 2019). In some cases, these are again associative forms (Moraru R.A., 2018; Ochkovskaya M., 2016).

But it is necessary to establish the level at which these tools meet the expectations of companies (Galeș D.C. and Bodescu D., 2018; Paniagua J. and Sapena J., 2014)

MATERIAL AND METHOD

The purpose of the research presented in this paper is to determine the efficiency of using marketing tools within the company. The purpose derives from the following objectives: 1. Scientific documentation on the efficiency of the use of marketing tools; 2. Determining the relative importance of food quality components; 3. Determining the relevance of the textual information provided through the marketing tools used by the company; 4. Determining the relevance of the graphic elements with respect to the food quality components; 5. Determining the efficiency of using the marketing tools used by the company.

The current research plan comprised research methods and tools such as: scientific documentation, the development of a questionnaire and its application through the method of priorities.

1. This method consists in comparing the importance of each component with each of the others.

The number of subjects investigated was 50, potential consumers of the company's products. According to Mrs. Doctor Geneviève Cauzes-Valette, seven components can be distinguished that define the quality, namely:

- Nutritional quality - which represents the contribution of food to the diet of each consumer;
- Hygienic quality - which means that the product does not contain toxic or harmful substances to the body, on the contrary they are healthy;
- Functional properties - these are very important because consumers are increasingly focusing on the fact that the product is practical and satisfies certain needs;
- Organoleptic quality - this is closely related to the sensory pleasure that the consumer acquires with the product;
- Social quality - reflects the way in which a person chooses, cooks and eats a certain type of food. Depending on this, that person will be part of a certain reference group;
- Symbolic quality - refers to the list of consumable products specific to a certain culture, in the case of Romanian culture;
- Humanistic quality - consumers expect food products to be cultivated and made using ecological methods (Cazes-Valette G., 2006).

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2. After the questionnaire was applied, the data obtained were processed and the scores for each of the components and data interpretation were established.

3. Next, the extent to which the promotion tools used by the company are in accordance with the components of the quality preferred by the customers was determined. For this we analysed the label of one of the products, the official website of the company and its Facebook page. In the first phase, the textual information provided through each of the three promotion tools was analysed. The text of each of the instruments was taken and the membership of each of the quality components was established. The weight of the used text suggesting each of the components was weighted and the information from the questionnaire of the potential clients with the information given by the text was overlapped and analysed.

4. In the next stage, the relevance of the graphic forms to the needs of the customers expressed through the quality components was determined. This was done by interviewing potential customers in the sample as to what their graphical forms suggest. They were presented with each of these graphical forms separately and the most suggestive quality components were identified again, these components being taken two by two according to the principle of the priority method.

5. The relevance of the use of the graphic forms in relation to the quality components of the food products was determined.

6. The efficiency of using the marketing tools was determined by interpreting the data obtained in the present research.

RESULTS AND DISCUSSIONS

Some of the following variants were chosen, which represent the components of the food quality on the most important, each taken separately with each of the others and a point was awarded: 1. The nutritional quality of the product; 2. Hygienic quality; 3. The functional properties of the product; 4. Organoleptic quality; 5. Social quality; 6. Symbolic quality; 7. Humanistic quality. After applying the questionnaire, scores were obtained for each of the food quality components (*figure 1*).

The highest percentage, ie 19%, has the hygienic quality and functional properties of food. This means that respondents place the greatest emphasis on hygiene because it is directly responsible for the health of consumers. Functional properties are very important for consumers. They must meet their needs and must meet the expectations of consumers. When a product does not successfully meet the consumer's needs, it will no longer purchase that product again (*figure 2*).

In the second place, with a percentage of 17% is the organoleptic quality. In order to appreciate the sensory quality of a particular food product, the senses intervene. Respondents greatly appreciate a food that satisfies all their senses before being consumed.

With a percentage of 15%, nutritional quality is in third place. This quality component occupies a very important place among the preferences of the respondents because the consumption of a certain product must cover the nutritional requirements necessary for the body.

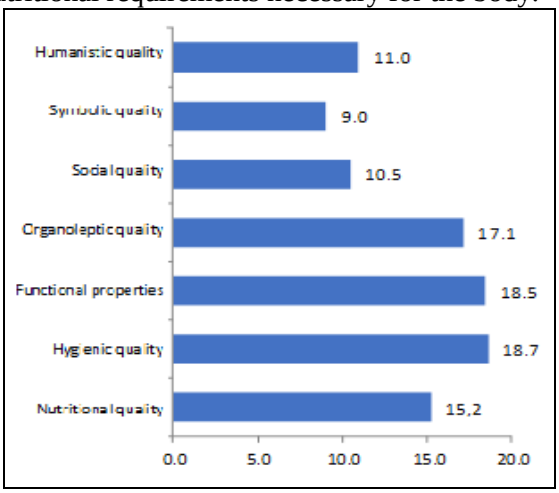

Figure 1 **Determining the relative importance of food quality components**

In the continuation of the present research it was determined the extent to which the promotion tools used by the company are in accordance with the quality components preferred by the clients.

I started with the label of one of the products, namely the cheese label. A total of 88 words were used for its label.

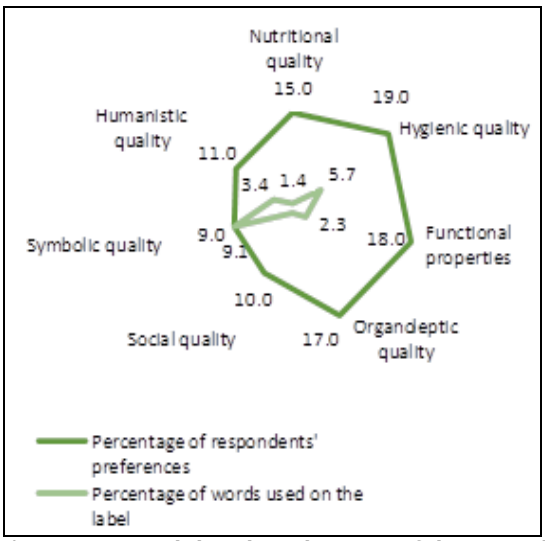

Figure 2 **Determining the relevance of the textual information provided through the marketing tools used by the company**

Of the total words used on the label, 10 are for nutritional quality, 8 for symbolic quality, 5 for

hygienic quality, 3 words for humanistic quality and 2 for functional product properties (*figure 3*).

After comparing the percentage obtained after questioning the potential customers regarding the preference regarding the components of the quality of the food products with the words used for each component on the part of the label of one of the products of the company, it is observed that the highest percentage, 9.09% holds it symbolic quality and this is closer to the respondents' preferences. The second percentage is held by the hygienic quality with a value of 5.68%, followed by the humanistic quality with 3.4% from which it appears that the company does not pay much attention when describing its products as being obtained through ecological processes. The last places are the functional properties and the nutritional quality with 2.27%, respectively 1.36%. So, the company allocates most words for symbolic quality when discussing product labelling.

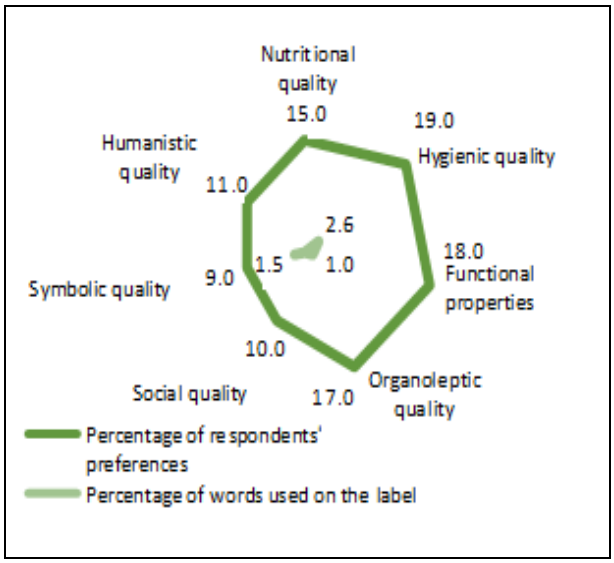

Figure 3 **Determining the relevance of the graphic elements to the quality components of the food products**

The second marketing tool analyzed is the facebook page. The company is no longer active on this page as of June 20, 2012. I took the text from the official Facebook page of the company and tried to establish the belonging to each of the components of the quality of food.

Following the analysis of the text on the Facebook page of the company it is observed that out of 194 words used only 5 belong to the hygienic quality, 3 belong to the symbolic quality and 2 words belong to the functional properties of the products.

After comparing the percentage, words used on the Facebook page for food quality components and respondents' preferences, it can be seen that the company uses very few words for these, and even for some components it does not use at all.

A percentage of 2.57% of the text is used for hygienic quality, and respondents put this component first, 1.54% is used for symbolic quality, and respondents put this component last and 1.03% is used for the functional properties of foodstuffs, and respondents chose them as the most important for them.

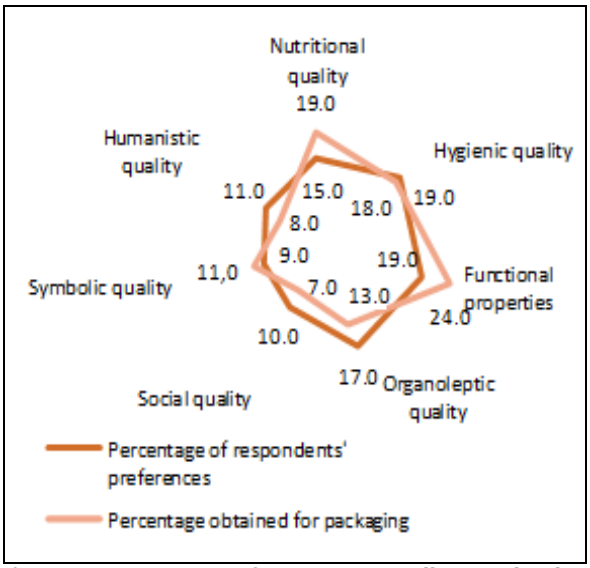

Figure 4 **Customer preferences regarding packaging components and suggestion**

Therefore, the company does not effectively use the official Facebook page of the company as a promotional tool (*figure 4*).

The third promotional tool analyzed was the official website of the company. Again, I retrieved the text from the site and got a cumulative 194 words just like on the official Facebook page. The text used on the site is the same text as on the Facebook page, without any difference.

After determining the extent to which the promotion tools of the company are in accordance with the structure of the quality components of the food products, the relevance of the graphic forms to the preferences of the potential customers was determined. For this I chose an image with one of the products of the company and I asked again the persons questioned previously to choose which component of quality is more important in the order of priority when it comes to the product and its packaging, taken each of them with each of the others (*figure* 5).

The first place among the components suggested by the image of the company product is occupied by its functional properties. When they look at this product they are convinced that the product would meet their needs as a result of their purchase and consumption.

The nutritional quality obtained a percentage of 19% which means that the packaging and the product itself gives consumers all the details about the nutritional values of the product. The next quality, hygienic quality has a percentage of 18%, which means that the respondents are convinced that the product was made under hygienic and safe conditions and all the norms have been observed.

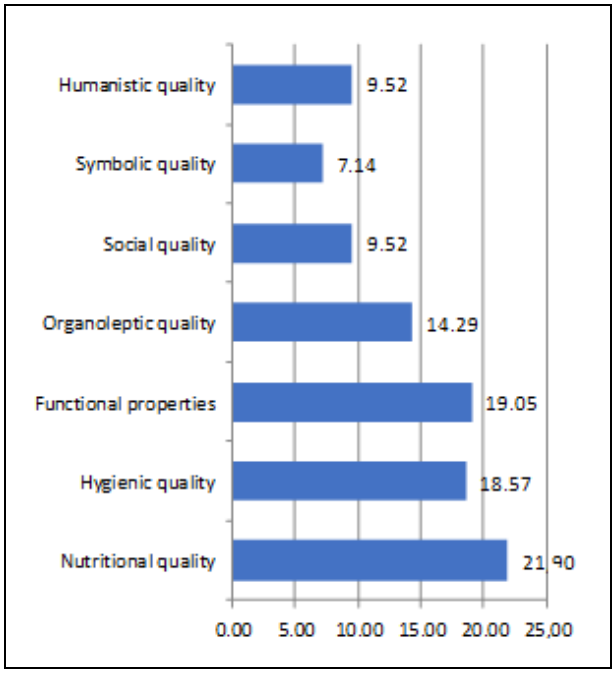

Figure 5 **Determining the relevance of the use of graphic forms in relation to the quality components of food products.**

The fourth place is held by the organoleptic quality with a percentage of 13%. Consumers are not very convinced of the image of the product when it comes to their senses and their satisfaction.

The last places are the symbolic quality with 11%, the humanistic quality with 8% and the social quality with a percentage of 7% from which it appears that the company has to work on these aspects of the packaging. The company efficiently uses its packaging and products to promote them. The preferences of the customers are very close to each component of the quality of the food products to the preferences of the customers in terms of what the product and the packaging of the company suggest.

CONCLUSIONS

On the label, most of the words used by the company are allocated for symbolic quality, which is very close to the consumer's preferences.

On the Facebook page and the official website, most of the words used are for hygienic quality.

In order to increase the level of relevance of marketing tools, the researched unit must improve all textual and graphic contents.

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KNOW YOUR CUSTOMERS FOR THE PURPOSE OF PREVENTING AND COMBATING MONEY LAUNDERING

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Abstract

It is very important for a financial institution to know its customers: their main type of activity, the countries where they conduct business, their links with politically exposed persons, their partners, etc., in order to avoid the implication of the Bank in schemes of money laundering which can cause reputational risk and fines from authorities. The purpose of this scientific research is to highlight the importance of the process of „Know Your Customer" (KYC) for financial institutions during the stages of money laundering process, to identify the risks of non identification the customers, to present the risks connected to the customers from sanctioned countries in order to elaborate a strong anti-money laundering (AML) program, adopting prudent and healthy banking practices.

Key words: know your customer; identification, anti-money laundering risk, sanctions, AML program.

Combating money laundering became an international problem. Countries from all over the World are meeting at different forums, round table to discuss about this negative phenomenon proposing ways of combating money laundering.

Financial Action Task Force (FATF), who is the „policy- making body", which sets standards and promote effective implementation of legal, regulatory and operational measures for combating money laundering, terrorist financing and other related threats to the integrity of the international financial system defines money laundering as „*the processing of criminal proceeds (money, other assets) to disguise their illegal origin*".

In other words, money laundering is the process by which criminal groups try to hide the origin and real possession of income from their criminal activities. In order to enjoy the results of illicit activities, be it drug, arms trafficking, smuggling, fraudulent bankruptcy or fraud in the financial and banking spheres, etc., criminals need to find a way to hide or conceal the illicit nature of their earnings and put them in the legal financial circulation.

The purpose of a large number of criminal activities is to generate profit for the individual or group that commits the offense. Money laundering is the processing of these crime outcomes in order to hide their illegal origin. This process is critically important because it offers to the criminal an opportunity to enjoy the proceeds of crime without revealing their origin and thus without the offender facing trial for the offenses committed.

In this sense, it is very important that the financial institutions to know their customers, their sources of incomes, which type of activities they perform in order to be sure that the flows of money which come to the financial institutions from these customers are from legal activities, not from ilegal activities (primary offences), such as:

- *Drug trafficking*
- *Terrorism*
- *Abduction of minors*
- *Sexual abuse of minors (child prostitution)*
- *Corruption*
- *Fraud, misappropriation of public subsidies*
- *Counterfeiting or falsification of seals, stamps, hallmarks or trademarks*
- *Theft*
- *Abuse of trust*
- *Fraud and deception*
- *Tax crime*
- *Breach of the law concerning water protection and management, etc.*

Thus, in this scientific research will be analyzed: the importance of the process of "Know Your Customer" for financial institutions, the reasons why financial institutions perform this process of identification the customers, the ways of identification the customers, the risks which may be faced by the financial institutions, in case when non proper identification measures of customers are applied within financial institutions.

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MATERIAL AND METHOD

This scientific article is realized after the research of the specialized economic literature in the field of anti-money laundering, the Moldova's National Money Laundering and Terrorist Financing Risk Assessment for 2017.

In the same time, the legal regulations (both local and international), taken into consideration at elaboration this scientific article include but are not limited to:

a) Law on Preventing and Combating Money Laundering and Terrorist Financing no. 308 of 22.12.2017

b) Directive (EU) 2015/849 of the European Parliament and Council of 20/05/2015 (the "IV Directive") on prevention of use of the financial system for the purpose of money laundering or terrorist financing, which amends (EU) regulation no. 648/2012 of the European Parliament and Council, and which revokes directive 2005/60/EC of the European Parliament and Council and directive 2006/70/EC of the Commission;

c) Order no. 15 of 08.06.2018 regarding the approval of the Guidelines on the Identification and Reporting of Activities or Transactions Suspected of Money Laundering

d) Order no. 17 of 08.06.2018 regarding the approval of the Guidelines on the Identification and Monitoring of Politically Exposed Persons

e) Regulation No. 200 of 09 August, 2018 on requirements for prevention and combating money laundering and terrorist financing in the activity of banks;

The research methods which were used at elaboration this scientific research are: analysis and synthesis, induction, deduction.

RESULTS AND DISCUSSIONS

The fight against money laundering has a double motivation. On the one hand, this is motivation to combat organized crime and its expansion on a global scale. On the other hand, this is preservation of integrity of financial markets and market economy.

The financial institutions shall enter into business relationships and provide banking products and services depending on the client quality, which is assessed based on the Bank's risk appetite correlated to the reputational risk.

The acceptance of clients is based on the principle, according to which the financial institutions enters into business relationships only with persons that carry out legal activities and that make known the nature and purpose of the banking transactions, which they carry out (Cox D., 2014).

Only after the financial institution knows very well the customer, understands the customer's activity, the source and destination of funds, then the financial institution can initiate the business relationship with the customer.

The process of Know Your Customer is a continuous process, which means that the financial institutions need to update on regularly basis the documents related to the customer during the whole business relationship (Sullivan K., 2015).

The identification process need to be applied to the whole database of customers, beneficial owners as well as to the occasional clients.

The measures of identification shall be applied under a risk-based approach, taking into account the type of client, business relationship, products and services requested.

According to FATF guidance published on October 2014: **"Risk Based Approach for the Banking Sector"** - *"Risk Based Approach to AML/CFT means that countries, competent authorities and financial institutions are expected to identify, assess and understand the ML/TF risks to which they are exposed and take AML/CFT measures commensurate to those risks in order to mitigate them effectively" (*FATF, 2014*).*

The concept of risk based approach also was reflected by the Wolfsberg Group, in 2006, when was published the **„Wolfsberg statement. Guidance on a risk based approach for managing money laundering risks"**, which stipulates that: *„A reasonable designed risk based approach will provide a framework for identifying the degree of potential money laundering risks associated with customers and transactions and allow for an institution to focus on those customers and transactions that potentially pose the greatest risk of money laundering" (*The Wolfsberg Group, 2006*).*

Despite the fact, that there are many definitions, explanations regarding risk based approach, there is no universally accepted methodology regarding what represents the risk based approach, in this sense, the financial institutions deciding their own methodology they want to use in identification and management of the risk.

All the financial institutions have their own Know Your Customer Policies, where are stipulated which customers are accepted by the financial institution to conduct business with and which customers are not accepted by the financial institution.

The financial institutions apply gradual customer acceptance procedures depending on the risk associated with different client categories, the

potentially higher risk of some clients; determine higher level of approval of those customers.

For many financial institutions, from customer acceptance policy is prohibited:

a) to enter into business relationships with intermediaries that cannot provide the Bank with the necessary information about the holders of accounts they manage;

b) to open and operate either anonymous accounts for which the identity of the holder is not known and evidenced in a proper way or accounts under fictitious names;

c) to open accounts for individuals or entities known by official notification or public sources to be convicted of corruption, misappropriation of public funds, money laundering, tax evasion or other economic crimes;

d) to enter into business relationships with individuals/legal entities whose beneficial owner is unknown or kept deliberately unknown; also the Bank shall not initiate the business relationship with potential clients who for the identification purposes provide the Bank with false or insufficient information or submit to the Bank the documents/contracts/etc. which they wish to bring through the Bank and against which there are grounds of suspicion of falsification and/or fraud; in such cases, the prior opinion of the Back Office, Legal and Compliance & AML Departments is required, etc.

The customers during the identification process in the process of establishing the business relationship or in the process of updating the Know Your Customer file are classified as: Low, Medium and High Risk according to different criteria.

In the category of High risk customers are included, but not limited:

- Non-governmental organizations (NGOs);
- Clients that do not appear personally to identify themselves when initiating business relationships with the Bank (accounts opened by proxy, excepted salary projects);
- Activities frequently involving cash in considerable proportions;
- Clients that have a negative reputation on the market;
- Real estate agents;
- Lawyers, notaries or other independent self-employed professionals and accountants;
- Corporate clients whose beneficial owners/majority shareholders are politically exposed persons;
- Clients - insurance and reinsurance companies whose activity is complex and unusual;
- PEPs; etc.

In the process of establishing the business relationship with the financial institution, the high risk customers are approved by the Anti Money Laundering Officers, but also some of them are approved at the level of the Top Management of the Financial Institution (FATF, 2013; FATF, 2019; The Wolfsberg Group, 2017), namely the Politically Exposed Persons (PEPs) due to the fact that PEPs are risk holders, because of:

- ✓ ***Bribery***
- ✓ ***Money Laundering***
- ✓ ***Terrorist financing***

According to the Transparency International's Corruption Perception Index, the corruption in the public sector is highest in emerging economies, because of high level of bribery (LexisNexis,2018). In this sense, from the figure 1 is revealed that the highest level of corruption in the public sector was registered the following countries: Somalia, South Sudan, Syria, Afghanistan, Yemen, Libya, North Korea, Guinea Bissau, Equatorial Guinea.

The lowest level of corruption in the public sector was registered in the following countries: New Zealand, Denmark, Finland, Norway, Switzerland, Singapore, Luxembourg, Netherlands.

Figure 1. **The countries rated highest and lowest for public sector corruption**

Source: LexisNexis2018, https://p.widencdn.net/vhrpoa/US-EDDM-Pep-Talk

Thus, from the information above, we can conclude that PEPs are high risk customers, which need to be approved by the Top Management of the financial institution.

Identification of PEPs is performed by the employees from Front Office of financial institutions by collecting the information from customers through self-declaration, where they

indicate that they are PEP or not and also by checking the customers in the International Databases of PEPs (Thomson Reuters World Check lists, Lexis Nexis Lists, etc.) by Front Office and AMLO.

Before establishing the business relationship with the customer, it is very important to classify correctly the customer from AML point of view, giving the right risk category.

In the process of identification, the customers, the checking of customers in the PEPs lists and in the lists of sanctions and embargoes (UN, EU, OFAC, etc.) is very important, because this determine the financial institution to accept only customers which are not sanctioned or included in some crime lists.

The non-proper identification of customers can generate problems to the financial institutions, by receiving fines from the regulator or from other state/international authorities, because of accepting international unacceptable clients (for example accepting a terrorist as a client).

In the last 10 years, according to Fenergo website **$26 billion** in fines has been imposed for non-compliance with Anti-Money Laundering (AML), Know Your Customer (KYC) and sanctions regulations to financial institutions.

Among the financial institutions which received big fines for AML/KYC in the last years, we can mention:

- ✓ **Standard Chartered Bank ($1.1bn or £842m)** - for poor money-laundering controls and breaching sanctions against countries including Iran.
- ✓ **The Belgian unit of ING Group NV** (**350,000 euros or $394,485**) - for violating legislation against money laundering.
- ✓ **Mashreqbank PSC ($40 million)** - for poor AML Controls
- ✓ **UBS, in 2018, agreed to pay $15 million total** - for failing to report suspicious transactions in non-resident alien (NRA) customer accounts in its San Diego, California branch office.
- ✓ **Danske Bank (200 billion euros or $225 billion)** - for a money laundering allegations at its Estonian branch.
- ✓ **Nordea Bank** was fined with more than **$5 million.**

Thus, from the information mentioned above, we can reveal that the cost of non-compliance with AML regulations is very high, because of fines applied to financial institutions, but also because this is a reputational risk for the financial institutions, which very negatively influences their activity.

CONCLUSIONS

It is necessary that all the financial institutions to realize that the process "Know Your Customer" is essential in doing business.

When the financial institution knows its customers, it can manage the risks connected to these customers.

The process of "Know Your Customer" is a continuous process, being performed before the establishment of the business relationship with the customers and during the entire business relationship with the customers.

A non-proper identification process of customers can determine application of fines to the financial institution from the regulator or from other state/international authorities.

Therefore, in order to avoid the financial institution to be used by the criminals to launder their results of illicit activities (drugs, arms trafficking; tax crime; sexual abuse of minors; piracy, etc.) it is very important for each financial institution to apply the concept "Know Your Customer" in the process of establishment new business relationships with customers, as well as during the entire business relationship with customers, identifying the source of funds, the purpose and nature of transactions.

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LOCAL ORGANIC WASTES - IMPORTANT SOURCE FOR SOIL FERTILITY REMEDIATION

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Abstract

Soil fertility and productivity restoration may be ensured partially from the local sources of organic matter as: byproducts of livestock sector (cattle, pigs, sheep, goats, horses and poultry manure), crop wastes (straw, organic crop residues, green fertilizers), alcoholic beverages production wastes (wine yeast, vinasse, distillers grains). The mentioned wastes are biologically and chemically very active, are in permanent transformation, have the strongest and diverse pollutant load. At the same time, they contain elements essential for plant life that help improve soil fertility and increase crop productivity.

Key words: crop productivity, organic waste, soil fertility

Soil is the main natural resource of the Republic of Moldova. Food security, economic potential, and people' well-being of our country are based on soil. Unfortunately, soils of the Republic of Moldova for many years are subject to different forms of degradation, the main being humus loss, compaction, soil structure degradation, nutrients deficiency, loss of biodiversity and different forms of soil erosion. Soil erosion is one of the main soil threats that can be observed in different parts of the country. According to the Land Cadaster of the Republic of Moldova on 01.01.2010 the area of the eroded soil was about 880 thousand ha or 40% of the agricultural land. The area of heavily eroded soils with low productivity is over 110 thousand ha. These soils are widespread in the central and southern part of Moldova. During the last 40 years the surface of the eroded soils has increased by about 283 thousand ha or 7.0 thousand ha annually. The annual damage caused by erosion is estimated at 2.5 billion lei or 200 million US dollars.

Restoration of eroded soils under the current economic and management conditions is possible partially and gradually by use of local organic fertilizers in conditions of a well-managed anti-erosion background. This actions requires large quantities of organic matter, which play an important role in remedying the agrophysical, agrochemical and biological properties of the soil and in the mineral nutrition of the plants.

Use of local organic wastes as fertilizers will also have a positive effect on the other forms of soil degradation, that are not less harmful and requires similar attention from both agricultural producers and the government.

Since the agrarian reform (1990), agricultural production is formed, in most of cases, on the base of soil natural reserves. These resources are being exhausted from year to year, and the crops are becoming lower. Chemical fertilizers are introduced at minimal necessary quantities, enough only for crop production, and usually are represented by nitrogen fertilizers. Organic fertilizers are sometimes applied only at smallholder's farms. In these conditions it is necessary to resume the application of local organic fertilizers produced from various organic wastes. Thus, two major social-economic problems would be solved at the same time: conservation of agricultural soil fertility and elimination of organic wastes as sources of environmental pollution.

In this regard, the Institute of Pedology, Agrochemistry and Soil Protection "Nicolae Dimo" (IPAPS) has developed procedures and technologies of production and rational application of organic fertilizers, but unfortunately, these recommendations are less applied. In these conditions, we consider it is appropriate to remind about organic wastes as the valuable reserves of organic matter that can maintain and increase soil fertility, instead of being an environment pollutant, which happens in most cases.

The main purpose of this paper is to draw the attention of agricultural producers to the application of local (cheap) organic wastes for

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fertilization of agricultural crops in order to maintain soil fertility and increase crop production.

MATERIAL AND METHODS

Estimation of the influence of different fertilization methods with local organic wastes on the agrochemical and agrophysical properties of the degraded soils were carried out during the years 2010-2019 by the collaborators of the group Organic Fertilizers and Soil Fertility of IPAPS. The present paper is written basing on the researches within six field experiments founded in 2010 at the Experimental Station for Pedology and Erosion of IPAPS in Lebedenco commune, Cahul district; at the long-term Experimental Station of IPAPS in the village of Ivancea, Orhei district and the technological-experimental station "Codrii" in Chisinau.

RESULTS AND DISCUSSIONS

The main local sources of organic matter in the Republic of Moldova are animal by-products (livestock manure from cattle, pigs, sheep, goats, horses and poultry), plant residues (straw, organic crop residues, green manure) and wastes from the production of alcoholic beverages (wine yeasts, vinasse, distillers grains).

Table 1 shows the average values of the chemical composition of the local organic wastes in the Republic of Moldova.

Table 1

Average values of the chemical composition of local organic wastes with natural moisture in the Republic of Moldova (2010-2019)

Organic waste	Water content, %	Organic matter content, %	Total N, %	N-NH4, %	Total P2O5, %	Total K2O, %	Sum NPK, kg/t	N:P:K
Cattle manure	52.9	17.2	0.56	0.03	0.43	1.04	20.3	1:0,8:1,9
Pig manure	57.4	18.2	0.82	0.20	0.71	0.73	22.6	1:0,9:0,9
Sheep and goat manure	43.5	27.1	0.86	0.09	0.56	1.29	27.1	1:0,7:1,5
Poultry manure	51.0	26.0	1.46	0.48	2.39	1.16	50.1	1:1,6:0,8
Horse manure	54.6	16.7	0.73	0.04	0.48	0.84	20.5	1:0,7:1,2
Unfermented straw	12.0	81.0	0.74	0.08	0.20	1.81	27.4	1:0,3:2,4
The city sludge	47.8	43.5	0.88	0.24	1.18	0.39	24.5	1:1,3:3,9
Solid wine yeasts	48.0	47.0	1.50	3.29	0.70	2.50	47.0	1:0,5:1,7
Liquid wine yeasts	95.2	7.0	0.21	1.21	0.10	0.75	10.6	1:0,5:3,6
Vinasse	98.0	13.3	0.02	0.67	0.02	0.12	1.6	1:1:6,0
Distillers grains	93.0	6.2	0.28	0.14	0.12	0.11	5.1	1:0,4:0,4

Manure is considered to be the most representative and most spread organic fertilizer, with outstanding agrochemical and agronomic value. Currently, 2.5 million tons of manure is produced annually at the country level, making up 70% of the total quantity of local fertilizers. Unfortunately, manure is practically unused in recent years. Statistical yearbooks, which collect data from all types of agricultural producers, show that in 1990 out of 17.6 million tons of manure accumulated in the republic were incorporated only 10 million (55%). In 2010, the utilization rate was very low, on average 10 kg of manure per hectare, in comparison with 10 t/ha/year - the minimal recommended amount for one hectare necessary to maintain a neutral balance of humus in the soil.

Most of the manure remains and accumulates from year to year near the livestock farms, in private households or anarchically discharged on the roadside, on the banks of streams, creeks and other places absolutely contraindicated. These huge and ever-increasing quantities of manure have become the main source of environmental pollution in rural areas, especially of drinking water. Currently about 87% of the country's wells are characterized by a nitrate concentration above the maximum allowable norm (12 mg N-NO3 / l). The causes of such situations are the lack of knowledge regarding the fertilizing proprieties of the manure.

The main advantages of manure use are: improvement of the physical, chemical and biological properties of the soil; return of elements essential for plant life into the biological circuit and money saving from acquisition of mineral fertilizers; obtaining a crop increase of 100 cereal units from each ton of manure with a 60-90% profitability; prevention of environmental pollution with nutrients. Manure is recommended for basic fertilization of field crops and multiannual plantations. In crop rotations they usually follow sugar beet and fodder crops, corn for grain and for

silage. The application doses are 20-60 t/ha depending on the state of the soil, the crop needs and the amount of accumulated wastes (Plamadeala V., Bulat Ludmila, 2017).

The second very important source of organic matter is straw – byproduct of cereals growing. According to the statistical data, their annual amount makes 1.3 million tons. At present the straws, unfortunately, are not used. The most part of them is destroyed by burning directly in the field. It is an unacceptable action from the economic, ecological and moral point of view. Stubble burning leads to the loss of the source of organic matter so necessary for our soils; destruction of humus, nitrogen, sulfur in the soil; destruction of soil organisms; release of carbon, nitrogen, sulfur oxides, etc. into the atmosphere, causing the phenomenon of acid rains, reduction of oxygen content in the atmosphere and destruction of the planet's ozone protective layer.

The direct damage caused to the soil and the atmosphere by stubble burning is estimated at 17000 lei/ha. While the use of straw as an organic fertilizer has numerous benefits. First of all, humus content increase by 100 kg per 1 t of straw. Nutritive elements content also increases as follow: nitrogen - by 50 kg/1 t of straw; available phosphorus - by 10 kg/1 t of straw. The productivity of crop rotation increase by 130 kg cereal units per 1 t of straw. Soil water capacity increase by 13 mm per 1 t of straw. The profit is equivalent to 1600 lei/t of straw (Rusu Al., 2017).

The technology of applying straw as an organic fertilizer consists of straw shredding with the shredders KSK-100, E-281, KS-1,8, PON-5, and uniform distribution on the soil surface for mineralization of the organic substance of the straw. Because the straw is poor in azote it is recommended to add to each ton of straw 10 kg/ha of nitrogen, total 30-40 kg/ha. Fertilized soil is worked with disks, and ploughed late autumn (Rusu Al., 2009).

Green manure is also an important source of organic matter for soil. The following plants can be used as green manure: legume crops (peas, vetch, lupine, sainfoin, clover), some gramineae (rye, oats, raygrass) grown separately or in the mix. Green manure is recommended to be incorporated in the soil at the fenophase with a maximum biomass when plants are turgescent which coincides with their flowering. Prior to incorporation, the vegetable mass is rolled or chopped to promote the decomposition and mineralization of plants. Being incorporated into the soil the green fertilizers have the following effects:

- a significant input of organic matter with an essential role in the soil humus balance;
- green manure fertilizing effect is equivalent to 30-40 t/ha of manure;
- it is an important supply of nutrients, especially nitrogen due to its fixation from the atmosphere by legume crops
- stimulates biological activity of soil by increasing the number and efficiency of the ammonifying and nitrifying bacteria;
- physical ameliorative role, such as stabilizing of soil structure, restoration of the aerohydric regime of the soils;
- protection of soils from the erosion;
- significant increase of crop production.

Another source of organic matter, no less important for increasing soil humus reserves, are wastes from alcoholic beverages factories: wine yeasts and vinasse (from the wine factories) and distillers grains (from the ethyl alcohol production). The mentioned wastes are very active biologically and chemically. They are in permanent transformation and have the most powerful and diverse pollutant load. At the same time, they contain elements essential for plant life. In order to maintain a balanced level of nutrients in the soil, it is necessary to recover them from wastes and reintegrate them into the agricultural circuit by transforming and using them as fertilizer. The direct contribution of the organic matter from these fertilizers is also appreciable. It contributes to the increase of humus content, improvement of soil structure, water permeability increase and erosion and drought resistance (Siuris A., Plamadeala V., Ciolacu Tatiana, 2016).

Alcoholic beverages factories from the Republic of Moldova annually forms on average about 17 thousand tons of solid wine yeasts, 36 thousand tons of vinasse and 45 thousand tons of distillers grains. They contain about 28 thousand tons of organic matter, 180 tons of nitrogen, 82 tons of phosphorus and 257 tons of potassium. These wastes must be included in the agricultural circuit by their use as fertilizer.

Research conducted by IPAPS in 2011-2018 has shown that the above-mentioned wastes improve soil fertility of the chernozems and increase the productivity of agricultural crops. Fertilization with these wastes leads to an increase in organic matter content by 0.15-0.39%. Significant increase in nitric nitrogen (0.47-5.50 mg/kg), mobile phosphorus (0.20-0.64 mg/100 g soil) and exchangeable potassium (6.0-15 mg/100 g soil) was observed (Siuris A., 2017a).

The use of solid yeasts and vinasse ensures an annual increase of grape production (Sauvignon), respectively of 2,4 t/ha and 1,1 t/ha.

The applied distillers grains determines the annual production of 1200-1600 kg/ha of cereal units or an increase by 50-65% compared to the unfertilized control. It is worth mentioning that the physico-chemical composition of the wines obtained from the Sauvignon variety corresponds to the requirements of quality wines. The wines are characterized by good organoleptic qualities and correspond to the normative acts. The applied distillers grains increases the harvested mass of protein and fat by 50-60% compared to the control (Siuris A., 2017b, Siuris A., 2017c).

Based on the research carried out by the IPAPS during the mentioned period and the previous years, seven technologies models have been developed:

1) Preparation, storage and use of mixed manure from different animal species;
2) The valorization as fertilizer of the city sludge;
3) The direct valorization as fertilizer of unfermented straw (Rusu A., 2009);
4) The valorization of solid wine yeasts as a fertilizer (Siuris A., 2017c);
5) The valorization of liquid wine yeasts (Siuris A., 2018);
6) The valorization of vinasse (Siuris A., 2017b);
7) The valorization of distillers grains (Siuris A., 2017d).

We will mention that the rational production and use of organic fertilizers will solve two major problems: the first - ecological, by reducing the pollution of the environment with nutrients and the second - increase of soil fertility.

CONCLUSIONS

Fertilization of agricultural crops with local wastes contribute greatly to the quantitative and qualitative increase of the production, to the improvement of the physico-chemical properties of the soil, to the reduction of the degree of pollution of the environment (soil, groundwater, atmosphere) and of the final product.

Due to the application of local organic waste, significant financial benefits are obtained, due to the reduction of the costs of purchasing chemical fertilizers and the reduced quantities of used fertilizers.

The reduction of environmental pollution at the chaotic storage of organic waste will be achieved by using them as organic fertilizers for soil fertilization.

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Palamarciuc Nicolae – coordinating engineer

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THE IMPACT OF FISCAL PRESSURE IN THE VITI-VINICULTURAL SECTOR AND ITS ROLE IN THE DEVELOPMENT OF RURAL AREA IN THE REPUBLIC OF MOLDOVA

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Abstract

The wine sector is one of the strategic branches of the national economy of the Republic of Moldova. In this respect, ensuring a dynamic and balanced development of it, increasing the competitiveness and economic efficiency of the wine products, increasing the export potential of the country - all these need to be regulated by an effective and easily applicable legislative and normative framework. The absence of a coherent strategy at national level in the field of winemaking, in order to penetrate the product and promote it on the EU market, leads to the need to examine the impact of taxes on the financial situation of entities in the wine sector, to study the processes of taxation of entities in correlation with various indicators that characterizes economic and financial activity. All decisions in the field of the entity's economic policy, the modification of the product range, the replacement of the retail market and the deployment of other important measures require the forecasting of possible fiscal aspects. The underestimation of the expected fiscal consequences can lead to unpredictable situations for businesses in the wine sector. However, it is important for the entity not only to know the size of future tax payments, in the event of any changes in the indicators of its economic activity, but also to take measures to obtain economic indicators of the activity that would ensure its optimal taxation.

Key words: fiscal pressure, viti-vinicultural sector, rural area.

Maintaining a decent standard of living and employment capacity in rural areas and improving the quality of rural life should be one of the main priorities of the Republic of Moldova. In this process, an important role is the viability of the wine sector, the consolidation of the local economy and local communities in the rural areas, the development of villages and peasant households. The sector in which Moldova enjoys international renown is the wine sector as well as the wine industry which is traditionally the strongest sector of the national economy. The cultivation of vines in the Republic of Moldova is a traditional activity of great economic importance, developed harmoniously, as a result of the favorable natural conditions that the vines have on the territory of our country.

MATERIAL AND METHOD

From the series of scientific research methods were used: comparative and structural analysis, synthesis, induction, deduction, historical and logical method, methods of statistical data processing, and other methods. The information base used in the drafting of the article includes national legislative and normative, data from the National Bureau of Statistics, State Tax Service of Republic of Moldova, websites of international organizations.

RESULTS AND DISCUSSIONS

The wine complex, being a functional subset of the country's economy, has a special impact on the social, economic, ecological. The wine complex includes not only economic agents, but also directly contributes to the increase of the quality of life.

By studying, analyzing and treating the problems in the wine complex of the Republic of Moldova, it is necessary to achieve certain scientific results, to materialize certain aspects of the concept of the development of the complex, to highlight the factors and the circumstances that underlie some successes, unsuccessful in the economy of the producer of grapes, the processor requires thorough investigations into the theoretical and practical aspects of the demand for grapes, the supply of wines. (Băncilă, N., Mihalachi, R. 2015). Grape prices in the Republic

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of Moldova are distorted, they are shifted from equilibrium prices. Consumers of grapes being smaller in number, through certain informal contracts is a monopsony. Grape producers, through the informal monopsony, are forced to market their grapes below the level of productive expenses. In addition, the grape producer is pressured by unjustified high costs to the production factors

Currently, wine companies face some difficulties: outdated assets, lack of investments, lack of diversification of the export market, insufficient quantity of quality marketing wine and inefficient management.

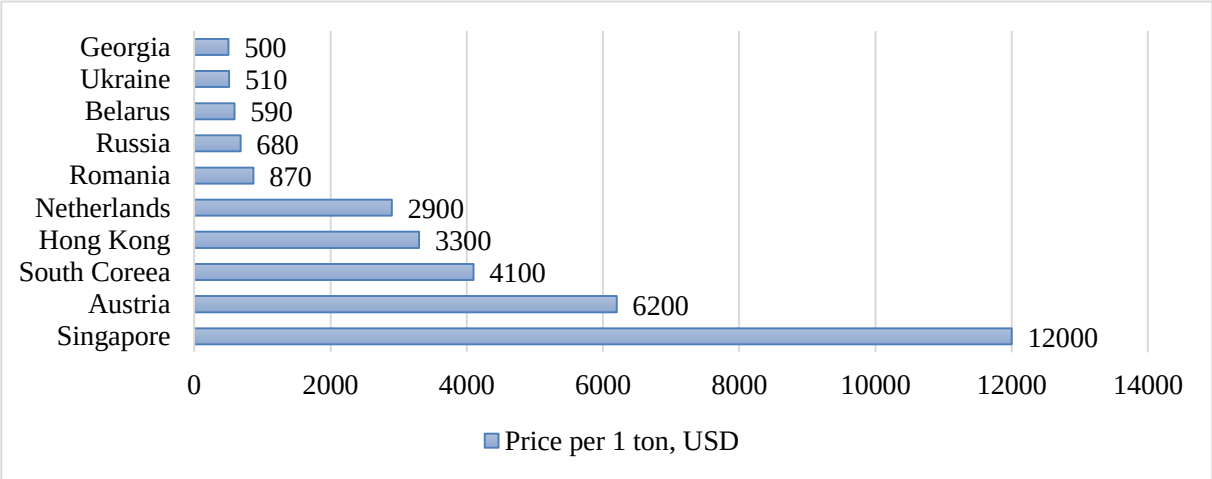

Figure 1 **The level of Moldovan wine prices on foreign markets**

Source: National Bureau of Statistics

The economy of the wine-growing complex of the Republic of Moldova in the context of European integration must undergo certain quantitative, qualitative, structural changes. In this context variants of development of the country's agriculture are needed, changing some accents. The wine-growing complex must develop differently compared to the situation when the Republic of Moldova provides the population of some countries with sweet alcoholic beverages, with a high degree of alcohol.

Not every state can be characterized by the existence of a rational fiscal policy and an efficient mechanism for its implementation. One of the indicators that allow to evaluate the effectiveness of the fiscal policy implementation at the macro level is the fiscal pressure index.

Currently, an important component of effective financial management within institutions is fiscal planning and efficient management of fiscal pressure.

The fiscal policy has a special role in stimulating the social-economic activity by having a significant influence on the process of attracting investments, especially in developing countries, of which the Republic of Moldova is also a part, which grants to foreign investors numerous tax facilities, such as: tax exemptions for the first years and proportional reductions in the following years; reductions in consumption taxes if the resulting goods are sold on the domestic market; advantageous depreciation regime etc. (Batîrmurzaev, E. 2005)

It is important to note that the tax system of the Republic of Moldova also provides for the possibility of offering taxpayers significant exemptions and tax preferences, including in the form of tax exemptions, tax deferrals, regardless of the level of income obtained. Often, such preferences are received only by entities with a relatively high income. If the state expresses its initiative to support the entrepreneur, we can confirm a correct behavior, but for the purpose of uniform distribution of fiscal pressure - on the contrary. Therefore, it is necessary to adjust the aggregate indicator of fiscal pressure. (Griciuc, P. 2017.)

Taxpayers who do not have privileged taxation conditions, pay more to the budget than the average calculated value of the taxpayer. Carrying out the activities regarding the reduction of the fiscal pressure, I emphasize the need to improve the fiscal administration, as well as the new qualitative level of the relations between the tax authorities and taxpayers.

The fiscal pressure indicator has an essential value for solving a series of tasks, which refers to:

-elaboration of the fiscal policy;

-conducting comparative analysis of fiscal pressure in different countries;

-formation of the social policy of the state;

-forecasting the economic behavior of the economic subject. (Bulgac, C 2014)

Therefore, the problem of defining, establishing and maintaining optimal fiscal pressure on the economy plays an important role in the construction and improvement of the fiscal system of any state.

Table 1

The taxes paid by the economic agents in the wine sector during the years 2013-2017, lei,

N/o	Name of payment	2013	2014	2015	2016	2017
1	Real estate tax, including:					
	- of legal entities	345878.32	349838.06	407808.90	325702.08	466206.02
	- paid by the legal and natural persons registered as an entrepreneur from the estimated value of real estate	1369160.69	1156681.61	997766.55	1356621.15	2841333.94
2	Land tax, including:					
	-on agricultural land except tax from peasant households (farmer)	2151191.05	1982722.77	1940439.10	1802987.31	1624383.32
	-on land other than agricultural land	236747.06	202835.13	172894.75	234064.23	169968.30
3	The tax for spatial planning	1058726.34	985895.71	843604.83	1024343.73	891435.32
4	The application fee of the local symbolism	578724.39	683898.43	700758.46	929684.75	1644488.33
5	The fee for commercial and/or service units	564516.87	594211.08	611999.08	752465.06	650731.02
6	The accomodation fee	174576.00	122514.00	27431.34	170910.00	113271.00
7	The fee for advertising devices	53450.87	642557.48	637881.17	704233.19	423418.88
8	The fee for water	288687.39	277475.19	238275.87	269675.01	239858.54
9	The fee for the explotation of underground constructions for the purpose of performing the entrepreneurial activity, other than those for the extraction of useful minerals	1800.68	2204.49	-	313.38	1058.75
10	The tax for the use of roads by vehicles registered in the Republic of Moldova	1899199.68	1784331.33	2130634.93	2364012.61	2332654.48
11	The tax for the use of roads by motor vehicles whose total mass axle or whose dimensions exceed the permissible limits	48332.14	-44683.97	3265.52	1414.39	14728.90
12	Value added tax	42111675.90	44633315.36	55903508.22	59924249.89	80159239.52
13	Excise	61924602.27	44089077.00	44962153.66	63813912.32	80198384.04
14	Income tax	22680866.29	14826864.99	21557246.00	41443238.49	44940167.77

The source: State Tax Service of Republic of Moldova

Analyzing the fiscal pressure at the economic units in the wine sector and identifying the mutual relation between the level of fiscal pressure and the financial indicators regarding the activity of the economic subjects, we find that it is necessary to determine the possibilities of reducing the fiscal pressure for the entities, in order to increase the net profit obtained by economic agents operating in the wine sector. This is possible through so-called tax planning or tax optimization.

The administration of the tax rate constitutes the well-determined impact on the entities in order to orient their actions, through tax payments, towards all the economic and organizational relations - legal between the state and the entities. Fiscal planning is a key element of the institution's management, which is achieved through the reduction of fiscal pressure with the help of legal actions in the interest of the taxpayer, the state and other persons. Most specialists in the field consider that the main direction of tax planning is to optimize (reduce) the entity's tax payments.

CONCLUSIONS

In order to ensure a sustainable growth of entities in the wine sector, to assign them the status of competitive enterprises, to make investments in their development, it is advisable to highlight, the influence of financial performance on the level of fiscal pressure generated by the results of economic activity, and conversely, the influence generated by the level of taxation on the results of the economic and financial activity of the entity.

In particular, the need to introduce the term "critical point" of the optimal fiscal pressure in each branch is outlined in the fiscal methodology, which would allow the possibility to solve a wide spectrum of problems faced by the entities in the real sector of the economy in Republic of Moldova. And if the level of fiscal pressure of the company exceeds the critical point established for the sector to which this entity belongs, then an objective argument for requesting the postponement or cancellation of a part of the fiscal obligations appears.

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STUDIES ON THE PRODUCTION PROCESSES MANAGEMENT IN A VEGETABLE FARM

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Abstract

The paper reveals the results of a study undertaken in a agricultural unit based in Bălcăuți commune, Suceava county. The unit currently exploits an area of 986.22 ha of arable land, which places it in the category of large, industrialized and efficient agricultural units. The company that manages the agricultural unit practices an efficient management, having increased the area exploited from 18.17 ha in 2015 to a size of 986.22 ha in 2019. The unit is in the national top of potato producers. These results were possible both due to the efficient management and due to the favorable pedo-climatic conditions of the area for the potato crop. The dynamics of the arable areas allocated for the crops are determined according to the scientific rotation of the crops and according to the demands and the prices on the specific market. Since the start of the activity, the management of the company has made several decisions aimed at optimizing the financial indicators, the most important being the construction and commissioning of a hall for storing the primary agricultural products and their storage and subsequent sale at higher prices. Due to these decisions, the unit benefited from an increase in profit from 140,560 lei in 2016 to the value of 967,565 lei, which means a percentage increase of over 588%. A series of additional decisions are proposed in this paper that could further increase productivity, efficiency and optimize the company indicators.

Key words: management, financial indicators, work efficiency

Romania is in the top of the European Union countries in terms of the number of farms, about one million farmers developing this activity, unfortunately most of them working in the inefficient system of subsistence agriculture (National Rural Development Programme 2014-2020). At the same time, Romania has over 7.6% of the agricultural area exploited in the whole European Union. The agricultural production sector is particularly important and extensive. A high share of the population operates in agriculture and in fields related to agriculture. In 2017, the labor force employed in agriculture, forestry and fisheries was over 19%. (National Institute of Statistics, 2018).

For these reasons, in order to increase efficiency, it is necesary to increase the number of large, efficient, high-performance, possibly integrated farms, which to include as large and compact surfaces as possible (Brezuleanu S. *et al*, 2017). The present paper aims to analyze the evolution of an agricultural unit from its establishment, in 2015, until the present time. The agricultural unit is located in the perimeter of Bălcăuți commune, Suceava county and has activities in the primary production of vegetable sector. The analysis focuses on the financial indicators and their evolution during the studied period, correlated with some technical indicators. It follows the evolution of production processes and management, which proves to be an efficient one, given the increase of the area exploited annually from the surface of 18.17 ha, in 2015, the year of establishment, to the surface of 986.22 ha, in 2019.

Due to the size of the exploited area, of 986.22 ha, according to the 2019 area declaration submitted at the Agency for Payments and Intervention in Agriculture, the unit is in the category of large, economically efficient farms.

The company has a wide range of technical equipment and other assets for the exploitation of arable land and a number of nine crops (wheat, corn, sunflower, rape, soybeans, peas, potatoes for consumption, potatoes for seed, barley).

The agricultural unit is among the most important potato producers in the whole country, being nominated on the 16th place nationwide in 2018, with an area of 70 ha cultivated with potato for seed and potato for consumption.

From the undertaken studies, it was found that the unit sold the obtained production, during 2017 – 2019 at prices between 0.44 lei / kg (in the

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case of maize) and 1.3 lei / kg (in the case of soybean).

Also, the turnover per employee was 266,274 lei in 2017, which evolved to the figure of 444,577 lei in 2018, due to the increase of the exploited area, the efficiency, the modernization of the technical means, the improvement of the management etc.

MATERIAL AND METHOD

The necessary studies for the elaboration of the present paper were carried out during the years 2018 – 2019, using primary data as the main source of information. In this regard, a series of interviews took place at the headquarters of the agricultural unit under study, in the Bălcăuți commune, Suceava County. The specific documents of the company on the evolution of the crop areas during 2015-2019, the financial accounting documents regarding the evolution of the economic indicators, the evolution of the technical capacity in terms of the investments made and aspects were analyzed thoroughly.

On the other hand, data from secondary sources, respectively Romanian and foreign specialized literature have been used, available and applicable at a national level.

Both the data obtained from the analysis of agricultural unit documents and those from the specific literature have been processed and interpreted in order to highlight the development of the studied unit.

RESULTS AND DISCUSSIONS

Since its establishment, in 2015, the agricultural unit subject of this paper has developed activities regarding the exploitation of arable land on the territory of Bălcăuți commune, Suceava county and neighboring communes. The intention of the unit management was to purchase as much available land as possible, offered for sale by the local owners, in accordance with the general tendency of the Romanian farmers. However, to date, the company has developed mainly on areas taken over by lease, the share of the purchased areas being insignificant. This is due to the fact that most landowners are conservative in terms of land sale, which is a common problem throughout the country. On the other hand, the local owners willing to dispose of the land do not, in the vast majority of cases, own the updated property documents, these documents being an indispensable condition for trading any area.

Within the agricultural unit, the crops rotation is practiced scientifically, technically and economically, according to the market situation. Crop rotation is an indispensable prerequisite within an agricultural unit for its good results. Technically, once the crop has been harvested, it is necessary to determine, based on specific arguments, the crop that will take the place of the previous crop on the respective area, so that the soil can be prepared in optimum conditions and the next crop will rise to a maximum level of efficiency as a ratio between expenditure and quality / quantity obtained per ha.

Based on the crop rotation decided by the unit, the area evolution of the main crops, from the establishment up to 2019 can be seen in *figure 1*.

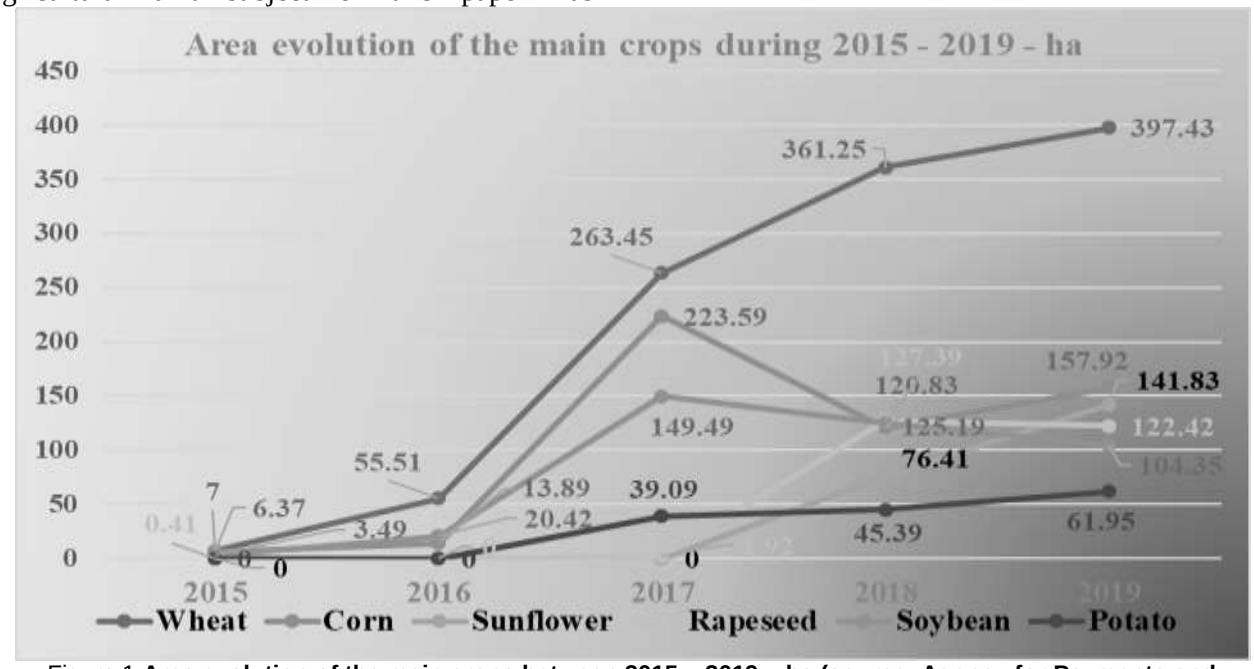

Figure 1 **Area evolution of the main crops between 2015 – 2019 – ha (source: Agency for Payments and Intervention in Agriculture – A.P.I.A.)**

As can be seen, the wheat crop benefited from the highest growth during the analyzed period, with a rise of 374% from 2016 to 2017, from 55.51 ha to 264.45 ha, and with 37.12% from the year 2017 in the year 2018, from 263.45 ha to 361.25 ha.

Regarding corn crop, it has increased by 1509% from 2016 in 2017, from 13.89 ha to 223.59 ha, and subsequently had a decrease of 45.96% from 2017 to 2018, from the area of 223.59 ha to the area of 120.83 ha.

As for the area allocated to the sunflower crop, due to its importance on the market, it benefits from an annual increase of the allocated areas, within the limits of technology-related constraints in crop rotation. This is because, as is known, the sunflower crop is more demanding in terms of soil nutrients.

It can be observed that in some years some crops had no area allocated within the crop's rotation structure. For example, in the same case of the sunflower crop, this happened because the crop has high demands on the soil and leaves the soil relatively poor in nutrients. More specifically, the land leased by the unit had been previously cultivated with the sunflower crop, in certain situations, in which case the company used those specific land areas for other crops, in order to regenerate the land.

On the other hand, in the area allocation for certain crops, the context, the quantity of product existing and the price conveyed for the respective products on the market were also taken into account. A year with an extra production of a particular crop can cause its lack in the next year on the market.

Given the data of the economic unit that have been presented above, it can be stated that it is part of the category of large units, with efficient and industrialized productions, especially in the context in which the unit registered in A.P.I.A. with a area size of 986.22 ha.

The unit has registered profit every year, according to the balances drawn up and issued by the unit. The most relevant indicators in the balance sheets were centralized in the table 1

Table 1

Work efficiency within the studied unit

Year	**2016**	**2017**	**2018**
Exploited area size– ha	89,82	787,09	943,26
Employees number	1	3	8
Turnover – lei	266.274	1.883.198	3.556.616
Profit – lei	140.560	151.066	967.565
Turnover per employee – lei	**266.274**	**627.732**	**444.577**
Turnover per exploited ha – lei	**2.964**	**2.392**	**3.770**
Profit per employee – lei	**140.560**	**50.355**	**120.945**
Profit per exploited ha – lei	**1.565**	**192**	**1.026**

There is a general increase of the analyzed indicators values. Thus, regarding the indicator "turnover per employee", we can see an increase from the figure of 266,274 lei turnover per employee in 2016, to the figure of 627,732 lei in 2017 and 444,577 lei in 2018.

It can also be observed that the year 2017 has a higher value than the year 2018, a value that is not correlated with the size of the farm in terms of the number of ha exploited. The reason why the increase in turnover per employee is decreased in 2018 compared to 2017, while the size of the farm expressed in ha is higher, is given by several factors. One of the factors is the climatic conditions. These were more favorable in the agricultural year 2016 - 2017 so that the registered productions were better this year. On the other hand, part of the production obtained in 2018 has been capitalized by a gap after harvesting, the related collection for this production being made after the end of the financial year 2018. For this reason, part of the production revenue obtained in 2018 is will reflect in the financial year 2019, within the balance sheet that will be finalized at the beginning of 2020.

As for the profit indicator, it does not show a sustained annual growth, as can be seen. However, this evolution of the profit value does not correlate with the performance of the economic unit studied. The figures of the registered profit are some correlated with the investments made during the course.

However, one of the problems which the company is facing is the lack of a sufficient number of tractors and, especially, a suitable storage space for cereals.

For this reason, the authors propose the acquisition, through a European funds E.A.F.R.D. financing project the purchase of an additional tractor, or even two tractors, to complement those already owned by the company.

Also, in order to increase the profit, an investment is proposed in a storage and conditioning space – cereals conditioning, which will allow the unit to keep the production with a certain lag after harvesting, after the prices rise on the market, and possibly with a plus added value through seed conditioning and selection.

CONCLUSIONS

- The company taken into study is a primary producer in the vegetable sector.
- As of 2019, it exploits an area of 986.22 ha of arable land, which places it among the large, industrialized and efficient agricultural units;
- The company executive that manages and owns the farm practices an efficient management, proven among others by increasing the exploited area from 18.17 ha in 2015 to the area of 986.22 ha in 2019 (Fig. 1, Tab. 1);
- The company is among the top potato producers at national level, according to the National Potato Federation in Romania;
- The dynamics of the areas allocated within the unit is made according to the scientific rotation of the crops and the requirements, respectively the prices on the market;
- The average yields were, in the agricultural years subject of the present analysis, between 2,400 kg / ha (green peas crop, in 2017) and 5,300, kg / ha in corn crop, in 2017. As regards potato crop, the production amounted to 45,000 kg / ha in 2017;
- The analysis of the prices on the market, studied for the main cereal crops and oil plants between 2014 – 2018 reveals a price range between 0.46 lei / kg in 2018 and 0.62 lei / kg in 2016 for corn and at the same time between 1.64 lei / kg in 2015 and 1.34 lei in 2014 for rapeseed;
- The revenues from the sale of the production were between 335,085.22 lei (the year 2016) and 4,559,322.59 lei, in the year 2018. These revenues were mainly due to the exploited areas, the unit increasing the total area allocated annually (Tab. 1);
- Having analyzed the main financial sheets of the company and other accounting and assets documents, the authors propose that an investment should be made by the company. Thus, the company owning the farm could and should attract an added value by the activity of the company by building a structure for storing the gross production from the moment of harvest until the market price rises. Moreover, the company could attract added value by conditioning and selecting the obtained seeds of the crops and selling them at a higher price.
- Also, the company should invest in some technical resources composed of tractors and other machinery as its turnover and profit allow these measures.
- These proposed investments could be made on the whole investment of the company or by a financing project in the next financial exercise, between 2021 – 2017.

ACKNOWLEDGEMENTS

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THE ECONOMIC IMPACT OF TOURISM ACTIVITIES ON AGRITOURISM FARMS

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Abstract

The fact that the rural zones are characterized by a high level of unemployment and a lower standard of living determines the orientation of the local population towards another income sources than agriculture. One of the farmers' favorite options to diversify the agricultural activities is the agritourism. The international reference literature mentions a series of determining factors that may positively or negatively impact the economic effect of tourism activities on the farms. The lack or insufficiency of the economic data regarding the agritourism businesses and the fact that the most part of researches on this topic is conducted on regional level lead to very different estimations of the value and importance of agritourism. The economic impact of agritourism is, in generally, favorable for the agricultural household. In the case of small farms and of those that fight for survival, the involvement in tourism activities is very important in order to increase the total income. Within the agritourism household, the contribution of the tourism activities to the generation of total income and its profit depends on the following: the farm's size and characteristics, the development stage and the type of the agritourism business carried out, the entrepreneur's knowledge and abilities in agritourism, as well as the features of the geographical region where this occurs. The revenues obtained from food services, accommodation and marketing of agricultural and handicrafts products have a significant contribution to the total income generated by the tourism activities. Regardless the size of the agritourism farm, the agriculture remains the main source of income, the tourism activity being complementary to the agricultural one. Still, between tourism and agriculture may occur also a competitive relationship regarding the use of some resources, fact which could diminish the economic benefits for the agritourism farm.

Keywords: agritourism, economic impact, determining factors, total income

INTRODUCTION

The changes that occurred in the agricultural sector in recent decades (rising competition, increasing production costs, falling prices for agricultural goods, losing or reducing subsidies) and the difficulties faced by the inhabitants of the rural areas (high level of unemployment, lower standard of living, declining revenues) have made agritourism an increasingly popular option for farmers, being considered as a potential solution to improve their economic-social situation.

The primary motivation for farmers choosing to diversify their agricultural activities by providing tourist services is of economic nature. (Moraru R.A. *et al*, 2016). The most frequently mentioned economic objectives of the farmers involved in tourism activities are related to the increase of revenues, the more efficient use of agricultural resources and the reduction of financial debts (Nickerson N. *et al*, 2001; McGehee N.G. and Kim K., 2004; Ollenburg C. and Buckley R., 2007; Barbieri C. *et al*, 2008; Barbieri C., 2010).

The majority of agritourism studies had been focused on the characteristics of demand and supply, on the defining of the agritourism product (McGehee N.G. and Kim K., 2004; Jolly D. and Reynolds K., 2005; Ollenburg C. and Buckley R., 2007; Tew C. and Barbieri C., 2012) and on the analysis of entrepreneurial motivations (Nickerson N. *et al*, 2001; McGehee N. *et al*, 2007; Barbieri C., 2010; Tew C. and Barbieri C., 2012; Moraru R.A. *et al*, 2016) or visitors' motivations (Che D. *et al*, 2006; Sotomayor S. *et al*, 2014). Despite the fact that the research on agritourism has grown, the specialized literature is modest regarding the economic impact on the agritourism service providers, both due to the complexity of the set of motivations that stimulate the association between tourism and agriculture, and the diversity of agritourism activities, their degree of extension at the farm level and the degree of farmers' involvement (Nickerson N. *et al*, 2001; McGehee N.G. and Kim K., 2004; Ollenburg C. and Buckley R., 2007).

Agritourism comprises a large variety of activities for tourists (such as: recreational self-

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harvest, horseback riding, on-farm rodeos, hunting and fishing, petting zoos, special local events like festivals and so on) (McGehee N.G. and Kim K., 2004; Brown D.M. and Reeder R.J., 2007; Barbieri C. and Mshenga P.M., 2008), with great differences from one country to another and even between regions of the same countries, both in terms of agritourism practices (Kizos T. and Iosifides T., 2007) and its development stages (Arroyo G. *et al*, 2013). Therefore, the evaluation of economic benefits on farm households is difficult and uneven, the results being influenced by a great diversity of regional particularities. They are extended with the disagreement regarding the definition of agritourism, as well as with the insufficiency or lack of economic data about entrepreneurs in agritourism.

MATERIAL AND METHOD

The basic objective of the present paper is to highlight the main economic benefits of agritourism on farms, presenting at the same time the factors that influence the meaning and magnitude of the economic impact of adding tourist activities to those specific to the agricultural sector.

In order to collect as much as possible data and information related to the purpose of the paper, the international specialized literature has been reviewed and analyzed. The research methodology included several stages of scientific documentation (bibliographical study): finding information sources, classifying them, data collection, content analysis. In order to assess the economic impact of tourism and recreation-related activities, both direct and indirect benefits were taken into account, the main criterion being the analysis of the incomes of agricultural households. The economic benefits of agritourism involvement are very briefly presented in the specialized literature and they constitute an area of disagreement.

RESULTS AND DISCUSSIONS

The specialized literature mentions a number of factors that may affect, in a positive or negative sense, the economic impact of tourism activities on farms. The understanding of this impact and the knowledge of which are the determinants and how they act are important issues for the strategies of sustainable development of the rural communities.

Some studies among farmers in the US states of Virginia (McGehee N. *et al*, 2007) and Montana (Nickerson N. *et al*, 2001) as well as from Australia (Ollenburg C. and Buckley R., 2007) pointed out that the main factors stimulating the involvement in agritourism are of economic nature: the better use of farm resources, family employment, mitigating income fluctuations and obtaining additional income. Through agritourism, farmers have the opportunity to supplement their income generated by agriculture, increase the volume of sales of agricultural products, gain new market segments and better adjust to its requirements (Nickerson N. *et al*, 2001; Brown D.M. and Reeder R.J., 2007; Barbieri C., 2010; Tew C. and Barbieri C., 2012).

In the same time, besides the economic motivations, the social ones are important for the agritourism entrepreneurs, such as: satisfying a hobby (Nickerson N. *et al*, 2001), desire to spend more time with family (McGehee N.G. and Kim K., 2004), educating the public about rural areas and agriculture (Nickerson N. *et al*, 2001; Ollenburg C. and Buckley R., 2007; Barbieri C., 2010) and so on. Also, the agritourism brings environmental benefits, by: conserving natural resources and facilities, maintaining rural landscapes or promoting ecological agricultural practices (Brown D.M. and Reeder R.J., 2007).

According to Sznajder M. *et al* (2009), the numerous functions performed by the agritourism can be included into three categories: Economic functions, Socio-psychological functions and Spatial and Environmental functions (*figure 1*).

Given their contribution to the overall farm household income, the tourist activities are complementary to the agricultural ones because, on the one hand, provide additional income to those from agriculture (Ashley, C., 2000; Nickerson N. *et al*, 2001; Veeck G. *et al*, 2006), and, on the other hand, they are much less exposed to natural hazards that very likely in agriculture (Bagi F.S. and Reeder R.J., 2012). Moreover, the revenues generated by tourist activities have the role of mitigating the risk factor in agriculture, usualy being destined to support the agricultural activities carried out by the agritourism farm (Tanrivermiş H. and Şanli H, 2007). The agritourism reduces, first of all, the dependence on some factors that cannot be controlled by the farmer (weather, for example) (Fuller A.M., 1990; Carter S., 1998; Veeck G., Che D., Veeck A., 2006).

But, between tourism and the agricultural activities, there may also be a relation of competition regarding the use of financial resources, labor force and working time (Sznajder M. *et al*, 2009). Especially during the summer, when the tourist activities intensify, there may be some problems related to the use of the working capital (Tanrivermiş H. and Şanli H., 2007). The development of the agritourism activity may also imply the exclusion of some land surfaces from

agriculture, which means diminishing the volume of the agricultural production obtained (Sznajder M. *et al*, 2009).

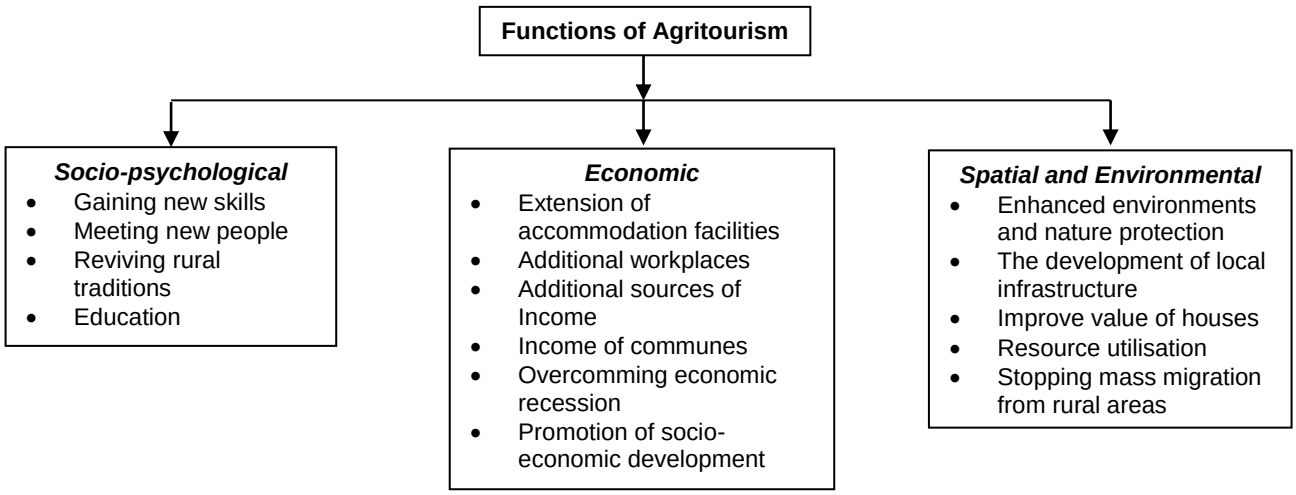

Figure 1 **Functions of Agritourism**
(Sznajder M. *et al,* 2009)

However, some tourism activities can use and exploit more efficiently pieces of land which are less suitable for crop production or animal husbandry (Bagi F.S. and Reeder R.J., 2012). For example, through the generated economic benefits, the tourism stimulates the farmers to conserve some of the agricultural land and the associated natural facilities (watercourses, forests, wildlife), being able to obtain financial gains from hosting activities for which tourists show a high degree of interest: bird watching, hunting, fishing, photography (Bagi F.S. and Reeder R.J., 2012). As a consequence, the association of agriculture with tourism does not necessarily affect the agro-zootechnical production or has a insignificant influence on it (Veeck G. *et al*, 2006; Bagi F.S. and Reeder R.J., 2012).

Various specialized studies, conducted mainly in the USA, have shown that the economic impact of agritourism on the farms profit is positive, but non-homogeneous, the size of the economic benefits being very different from one farm to another. Thus, according to the research conducted in Michigan, Veeck G. *et al*, (2006) found that the tourism activities are, for most farms, an additional source of income. The same fact is derived from the analysis carried out by Barbieri C. and Tew C. (2016), according to which the profit of Missouri farms increased significantly as a result of their involvement in agritourism: in about 25% of cases, the incomes of the farms doubled, while half of the operators in agritourism declared that the total incomes were increased by 50%. On the other hand, McGehee N.G. and Kim K. (2004) observed that the economic impact of tourism activities is much lower, the agritourism contribution to the increase of the total income of the farms being, on average, about 5%. This is in line with the study conducted in Germany by Oppermann M. (1995), who found that farmers' incomes increase only to a small extent due to agrotourism.

On the other hand, a survey conducted across the US in 2007 on the management of agricultural resources, revealed that, on average, the agritourism farms had 66% higher production costs and a relatively low total net income compared to that obtained by the other farms (USDA, 2007). Consequently, it can be appreciated that not in all situations the economic success of the agritourism is assured, since the characteristics of the geographical region in which the agritourism attractions are located can have a significant influence.

The fact that the agriculture is the main source of income for the agritourism farms also emerges from the research conducted in the Cappadocia Region from Turkey by Tanrivermiş H. and Şanli H. (2007). They showed that 73.5% of the total annual income obtained by the farmers involved in tourism activities is generated by agricultural activities, while 26.0% comes from tourism, this being the second most important source of income for the agritourism household. The accommodation activity contributed 35% to the income from tourism-oriented activities, more than half (55.1%) of them being provided by the pottery business, the Cappadocia Region being well known for its long tradition in the ceramic production and pottery workshops.

The hypothesis that agritourism is a source of additional income for those involved in this

sector has also been confirmed in Poland. Thus, a study carried out by Jeczmyk A. *et al* (2015) among the Polish farmers offering agritourism services, showed that, on average, the revenues from tourism accounted for 28.4% of total farm income. For 16.7% of the agritourism farms, more than half of the annual income of the agricultural household has been generated by the tourist activities, while 47.8% of the farmers reported an agritourism related contribution to the total income below 20% (*table 1*).

Table 1

Share of income obtained from agritourism and from meal services offered to agritourists in the region Great Poland (Jeczmyk A. *et al,* 2015)

Agritourism income		Meal services income	
% of annual farm household income	% of farm households	% of annual agritourism income	% of farm households
10-20	47.8	<20	32.4
20-30	14.4	20-30	20.3
30-40	12.2	30-40	9.5
40-50	8.9	40-50	31.0
>50	16.7	>50	6.8

The revenue earned from the meal services offered to agritourists had a significant contribution to the total revenue received from agritourism activity. In Poland, the proportion of incomes from meal services in the overall income obtained from agritourism was below 20% in about one third of agritourism farms, while for the other 60,8% of farms was situated between 20% and 50%. Only in 6,8% of cases this proportion exceeded 50% (*table 1*). The same study reveals that agritourism activities are currently run by women (Jeczmyk A. *et. al.*, 2015), which is in line with the opinion of other authors who support this fact (Nilsson P.A., 2002).

When is assessed the economic impact of the tourism and recreation-related activities on agritourism farms, it is necessary to take into account not only the direct but also indirect benefits. An important indirect economic effect of combining tourism activities with the agricultural ones is the increased demand for local products (fresh or processed by traditional methods) offered to consumers by the agritourism farms through roadside stands or pick-your-own operations (Martinez S., 2010). Besides generating supplementary sales of agricultural commodities, the agritourism can also contribute to promoting and increasing the visibility of the farm (Tew C. and Barbieri C., 2012).

For the young people in the rural area, the tourism activities are more attractive than the agricultural ones, because, although they generate lower incomes, they are produced faster and easier than in the case of agriculture (Tanrivermiş H. and Şanli H., 2007). In addition, the tourism-related activities not only support the productive capacity of agritourism farms, but also determine the acquisition of new skills by those involved in tourism, skills that can be transferred to other activities (Ashley, C., 2000).

Among the determining factors of the economic effects produced by the agritourism activities on farms profitability, the specialized literature mentions, most frequently, *farm characteristics* and *the characteristics of entrepreneurs in agritourism* (Nickerson N. *et al,* 2001; Alsos G.A. *et al,* 2003; Brown D.M. and Reeder R.J., 2007; Ollenburg C. and Buckley R., 2007; Barbieri C. and Mshenga P.M., 2008; Tew C. and Barbieri C., 2012). The physical attributes of the land, agricultural activity performed, farm positioning (distance from urban centers, abundance of natural amenities and local attractions) and type of farm, as well as the skills and knowledge of the operators in agritourism, have the ability to influence both the rate of participation in agritourism and the income obtained by farmers from tourism activities (Alsos G.A. *et al,* 2003; Barbieri C. and Mshenga P.M., 2008). The importance of the geographical location of the agritourism farms near the urban centers and its favorable impact on the income obtained by the farmers were also emphasized by Bernardo D. *et al* (2004) and Bagi F.S. and Reeder R.J. (2012).

According to some experts, the most suitable types of farms for agritourism activities would be the horticultural farms (vineyards, orchards, vegetable farms) and zootechnical farms (Brown DM and Reeder RJ, 2007; Schilling BJ *et al*, 2014), farms with increased labor resources (Barbieri C. *et al*, 2008), small lifestyle farms (Schilling BJ *et al*, 2014), farms with internet access and farms using conservation practices (Schilling BJ and Sullivan KP, 2014).

In order to maintain the potential of bringing in additional income for the farm household, the agritourism must be managed by entrepreneurs with adequate knowledge of the tourism market (Nickerson N. *et al,* 2001; McGehee N.G. and Kim K., 2004). Barbieri C. and Mshenga P.M. (2008) consider that the main characteristics of farmers in a positive correlation with the improvement of economic results refer to: primary occupation, business associations membership, gender, age, race, business practices and access to capital. In general, the agritourism farms are more successful when they are operated by young males which participate in networks and business associations, have as primary occupation the agricultural activity, benefit from an easier access to capital

and possess the experience, knowledge and skills in business (Barbieri C. and Mshenga P.M., 2008).

The size of the agricultural business overwhelmingly determines the proportion in which the tourism activities contribute to the total income. This was demonstrated by Schilling B.J. *et al*, (2014), based on a study related to the economic effect of agritourism on the farm profit in New Jersey (USA) in the year 2007. By comparing the net income of similar farms which are involved or not involved in agritourism, Schilling B.J. *et al*, (2014) found that the profit obtained by the large farms (with gross income> $ 250,000) is not influenced by the agritourism activities, while for the small and intermediate farms (with gross income < $ 250,000), in which the operator has farming as the primary occupation, the involvement in agritourism has a significant impact on the profit. In the case of small lifestyle farms (with a gross income <$ 250,000, primary occupation other than a farmer) the economic impact is also favorable, but more modest.

The results obtained by Schilling B.J. *et al* (2014) confirmed the findings of a previous study (Schilling B.J. *et al*, 2012), which showed that the agritourism did not improve the financial performance of the large farms, because they were usually involved in agritourism for other reasons than the economic ones (for example: to educate the public about environmental and agricultural issues or to satisfy a hobby). But, in the case of the farms struggling to economically survive, the incomes derived from the development of tourism activities are particularly important (Bagi F.S. and Reeder R.J., 2012), the agritourism constituting a significant strategy capable to contribute to the increase of the economic viability of small farms (Schilling B.J. *et al*, 2014).

Based on a study in California, George H. *et al* (2011) concluded that the agritourism impact on farms profitability varies greatly not only depending on the farm size, but also on *the characteristics of the region* where they are located and *the type of agritourism activities* carried out. A similar conclusion was reached by Schilling B.J. *et. al.* (2014), showing that the agritourism farm profitability and the size of the potential profit are also influenced by the location and type of the agritourism business.

In the same time, the revenues brought by the tourism activities and the profitability of the agritourism depend, to a large extent, also on the *stage of development of the agritourism business*.

Thus, as the farmers gain experience in managing their relations with tourists, the additional revenues generated by tourism increase (Tew C. and Barbieri C., 2012). This statement is also confirmed by Barbieri C. and Mshenga P.M. (2008), who argue that each additional year of tourism activity brings a financial addition to the total income of farmers.

CONCLUSIONS

The effect of the agritourism economic impact on farmers' incomes indicates that the tourism activities are not an alternative to the agricultural activity. The tourism-oriented activities are complementary activities for agriculture, generating additional revenues that contributes to the increase of the overall income obtained by the agritourism household. The revenues earned from food services, accommodation and marketing of agricultural and handicrafts products have a significant contribution to the total income generated by the tourism activities. Besides the supplementary income, entrepreneurs in agritourism are stimulated by other direct economic benefits: the better use of farm resources, family employment, mitigating income fluctuations. The agritourism determines also indirect economic effects, such as generating additional sales of agricultural commodities, promoting the agritourism attractions and increasing the visibility of the farm. The economic impact of agritourism is, in generally, favorable for the agricultural household. In the case of small farms and of those that fight for survival, the involvement in tourism activities is very important in order to increase the total income

The economic impact of the tourist activities on the farm profitability are affected by several factors: the particularities of the farm and of the geographical region in which it is located, the skills and knowledge of the entrepreneur, the size of the agricultural business, the development stage of the agritourism business and the type of agritourism activities carried out.

Between tourism and agriculture may occur also a competitive relation regarding the use of some resources, fact which could diminish the economic benefits for the agritourism farm.

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RURAL DEVELOPMENT APPROACH IN ROMANIA'S SUSTAINABLE DEVELOPMENT STRATEGY 2014-2020

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Abstract

In recent decades, Romania has faced enormous challenges in meeting its economic and social potential, agro-food and forestry, and rural areas. Gross domestic product per capita was and is much lower than the European Union average and significantly lower in all rural areas, demonstrating a very slow economic growth process. In terms of development, rural areas are significantly different from urban areas and are characterized by persistent structural weaknesses (the large number of people employed in agriculture, the aging of the population, a large number of subsistence holdings, etc.); low added value of agri-food products; low labor productivity and productivity; poor entrepreneurship for the development of economic activities, low access to credits; a non-functional land market; a modest export orientation; insufficient investment in research and development; the continuous increase of regional disparities; a high share of the population at risk of poverty and social exclusion, etc.

The present analysis aimed at highlighting the structural and dynamic evolutions of the main indicators that characterize the agriculture of Romania during the period 2011-2016, namely: macroeconomic indicators; production structures; cultivated areas and livestock; agricultural crop and animal production; prices of agricultural products.

In Romania, the first Sustainable Development Strategy was implemented between 1997 and 1999 and was revised in 2008 (Sustainable Development Strategy 2013-2020-2030). In 2013, the National Strategy for Regional Development 2014-2020 was developed, which includes several aspects of ensuring sustainable development. In 2014, the Strategic Guidelines for Sustainable Development of the Carpathians (2014-2020) were approved.

Key words: tools, financing, agriculture, objectives, strategies

The national financial aids for agriculture The national financial aids for agriculture support were reduced and directed towards the prices control for the basic products and for supporting the consumption, or towards subventions granted for inputs purchase. The use of some inadequate mechanisms of agricultural policy, lacking the performance objectives, determined the maintenance of the agriculture's subsistence character and has not allowed the formation of the sector of the middle commercial farms. In such conditions, it was aggravated the dual character of the Romanian agriculture, being developed a subsistence agriculture and large agricultural enterprises, which could not compete on the European market, and this leaded to the increase of self-consumption and to calling the food imports.

In other respects, the paper aims to highlight a number of such impact assessment tools in the form of a set of indicators able to provide an overview of the direct and indirect measures stemming from the integration process on agriculture, as well as on the influence of CAP mechanisms on agricultural performance at regional level. Impact assessment at the regional level is all the more important because, on the one hand, the agricultural policy measures implemented in our country are related to the level of the whole agriculture, without taking into account the regional particularities and, on the other hand, to be applied decentralized requires essential information to substantiate them.

MATERIAL AND METHOD

The methodological and scientific support in this paper was based on a series of direct and indirect documentation such as: observation, analysis (qualitative, quantitative, and historical), synthesis, comparison, systemic, monographic, statistical, figures and tables in the full and complex exposure and rendering of phenomena and economic processes studied.

The theoretical support of the research focused on the study of important scientific papers

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in the field of economy and management, with reference to the fiscal administration and the current problems in the public finances

RESULTS AND DISCUSSIONS

Thus, Romania adhered to the European Union, with profound structural issues at the level of the agricultural sector. In our country, the number of subsistent and semi-subsistent farms is very high, predominating the agricultural exploitations leaded by the elder farmers, and the food industry is insufficiently developed in order to assure an outlet market for the basic agricultural products. The conclusions drawn (Kneafsey M. 2001) have been compared to identify the positive and negative aspects to which the organic holdings have been exposed financially. (Boggia A. *et al*, 2014; Muscănescu A., 2013; Ungureanu G. *et al*, 2013).

The needs identified at the date of planning the funds for the period 2007-2014 were multiple, among them finding: the modernization and restructuring of the non-performing exploitations; increase of labour productivity and of the level of education and competitiveness of agriculture; support of associations and incorporation of groups of producers, the modernization and restructuring of the small enterprises from the agro-alimentary processing sector and from the forestry sector, with weak scale economies, the reduced use of the capacities and the low level of compliance with the European standards, etc (Henke R., 2014).

In such conditions, the main objectives aimed along with the implementation of CAP 2007-2014 were the formation of the commercial sector of the middle family farms, reduction of the number of agricultural farmers and creation of jobs for non-agricultural activities. In order to reach such objectives, there were applied measures of agricultural policy concerning the market and measures for assuring the rural development.

The assessment of the implications of such mechanisms of communitarian support becomes this way an important issue for the elaboration and promotion of the efficient agricultural policies. The high number of exploitations of small dimensions, the low level of absorption of the communitarian funds due to the weak capitalization and bureaucracy, the dependence of the economic performances on the volume of subventions, the low productivity of agriculture, especially for small and middle exploitations, etc. are only several of the issues that should be dealt by the Romanian agriculture, especially in relation with the use of the communitarian support, creating long term negative effects on the performances of the agricultural exploitations and on the development of the agricultural sector. (El Benni N., Finger R., 2014, Dona I. *et al*, 2014).

The 2014-2020 IMF, approved in November 2014 (Council of the European Union, 2014), reveals a reduction in agricultural policy spending over the coming period. The amount allocated to the CAP amounts to 362.8 billion euro's, 37.8% of the total EU budget (less than 47.1% in 2007-2014). Thus, in 2020, the CAP budget will account for 35% of EU spending, 5% less than in 2014 (Table 1).

Table 1

CAP expenses for the period 2014-2020 (2011 constant prices)

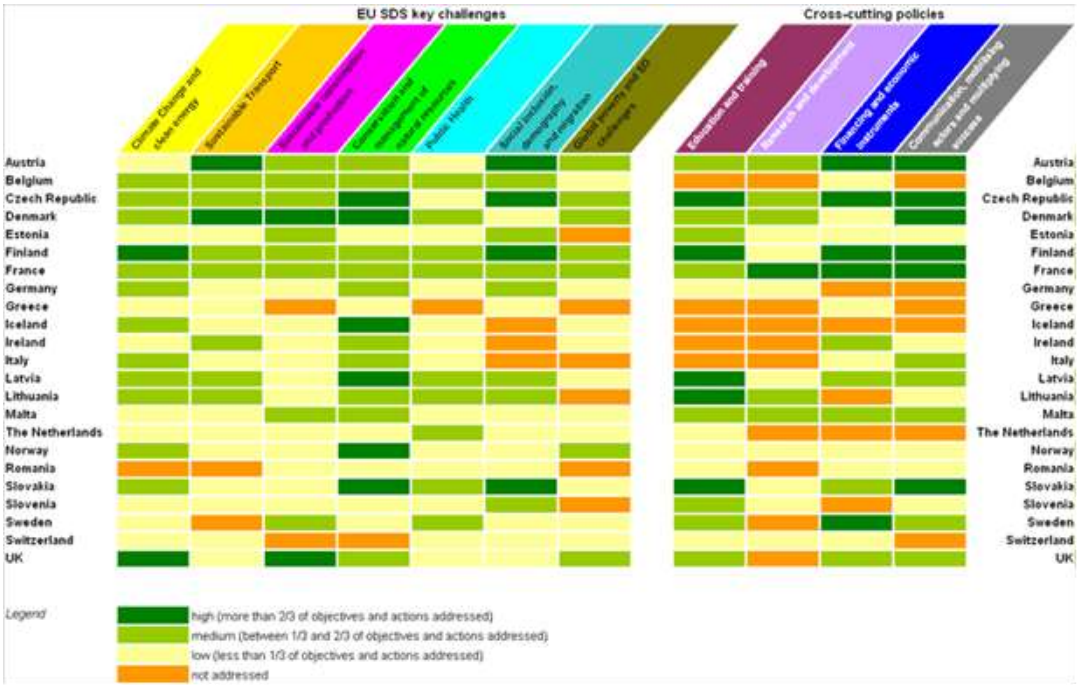
	2014	2014	2015	2016	2017	2018	2019	2020	Total
Competitiveness for growth and jobs	18.0	15.6	16.3	16.7	17.7	18.5	19.7	21.1	125.6
Economic, social and territorial cohesion	52.4	44.7	45.4	46.0	46.5	47.0	47.5	47.9	325.1
Sustainable growth: natural resources	59.6	55.9	55.1	54.3	53.4	52.5	51.5	50.6	373.2
Security and Citizenship	2.5	2.1	2.1	2.2	2.2	2.3	2.4	2.5	15.7
Global Europe	9.1	7.9	8.1	8.3	8.4	8.6	8.8	8.8	58.7
Administration	0.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4	61.6
Compensation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grand total	141.6	134.3	135.3	136.1	137.1	137.9	139.1	140.2	960.0
CAP spending in the EU budget -%	**40.3**	**40.5**	**39.6**	**38.8**	**37.9**	**37.0**	**35.9**	**35.0**	**37.8**
EAGF - %	**72.4**	**74.4**	**74.4**	**74.5**	**74.5**	**74.5**	**74.4**	**74.4**	**74.5**
FEADR - %	**23.3**	**23.0**	**22.9**	**22.8**	**22.7**	**22.7**	**22.6**	**22.6**	**22.8**

Source: Dona et.al, 2014, based on data from the European Commission

The Commission's Multiannual Financial Framework confirms that the structure with two pillars of the CAP is retained by EUR 277.8 billion allocated for direct payments and market measures in Pillar I, while EUR 84.9 billion is earmarked for rural development expenditure under Pillar 2. The Commission proposes and another € 3.5 billion for agricultural crisis management measures to be financed outside of the multiannual financial framework. (Henke R., 2014). This leads to the establishment of an emergency mechanism to combat crisis situations in order to provide

immediate support to farmers in an accelerated procedure. (Dona I. *et al*, 2014, Ungureanu G. *et al*, 2013**).**

The changes introduced by the Fisher Reform have led to: a change in the profile of Pillar I of the CAP, with a substantial increase in direct payments; increasing the weight of Pillar II in financial terms, but at the same time broadening its objectives; increasing the dependency of CAP reform processes on the EU budget and on the financing system (*figure 1*).

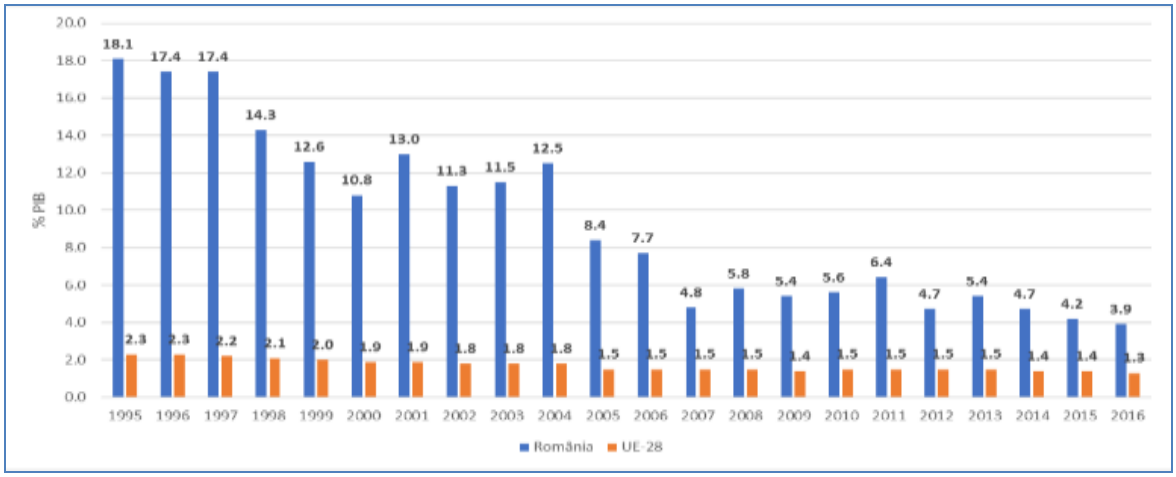


Sursa: DG Agri, 2018

Figure 1 **CAP spending and CAP reforms (current prices 2018)**

Synthetically, the Fisher Reform, with regard to supporting systems and mechanisms, introduced the following changes:

The evolution of VAB in agriculture decrease in 2007-2016 from 4,8 % of GDP (PIB) at 3,9 % of GDP, but the net added value per hectare was much lower than the one recorded in small-scale firms (*figure* 2). On the other hand, labour productivity reached very high values of approx. 20000-30000 euro / AWU, respectively approx. 3-7 times higher than in 2007, while on small farms, although rising, labour productivity is approx. 2700 euro / AWU.



Source : Eurostat

Figure 2. **The evolution of VAB in agriculture**

As a result, the contribution of agriculture to GDP halved in the decade 1995-2005 (from gross value added (VAB) of 18.1% of GDP to 8.4% of GDP in 2005) and had a similar following the accession to the EU, so that the share of VAB from agriculture to GDP is almost half of the level registered in 2005 (*figure 2*) in 2016.

The analysis of economic performances shows that in 2014, without receiving subsidies, most farms would have lost, except for small farms with lower consumption of inputs (*table* 3). In 2014, the income rate varied between 54.1% and 90.7%, while without subsidies the income rate reached only 25.6-65.7%. (Dona I. *et al*, 2014**).** Major increases in economic performance compared to 2007 were recorded mainly on farms with a standard value ranging from 8000 to 100000 euro/exploitation. The need to increase the competitiveness on the European Agricultural Market, the creation of an integrated rural development program to accompany the reform process, the simplification of the legislative framework at the European level and the substantial decentralization in implementing the measures shall lead to a reform in phases, whose effects shall mark the entire European construct. (Boggia A. *et al*,, 2014**).**

Table 2

Evolution of income rates, per standard value categories, for the period 2007-2014

	2007		2014		2014/2007 (+/-) Percentage points	
	Income Rate (%)	Income rate without subsidies (%)	Income Rate (%)	Income rate without subsidies (%)	Income rate	Income rate without subsidies
2 000 - < 8 000 EUR	46.1	29.9	67.8	50.6	21.7	20.7
8 000 - < 25 000 EUR	12.1	-4.5	90.7	65.7	78.6	70.2
25 000 - < 50 000 EUR	19.9	1.2	84.5	56.7	64.7	55.5
50 000 - < 100 000 EUR	10.3	-11.3	70.3	38.8	60.0	50.2
100 000 - < 500 000 EUR	21.1	-6.2	54.1	25.6	33.0	31.8
>= 500 000 EUR	13.4	-11.7	54.1	30.3	40.7	41.9

Source: processing by FADN (RICA)

Therefore, although Romania's GDP fluctuations are less influenced by the shocks from the agricultural supply, the negative contribution may be noted even in the years of economic growth. Romania has the largest number of agricultural holdings in the EU of 3.6 million in 2013, which is equivalent to the decentralization or dissemination of labor resources between them.

In 2014, the most important subsidies were direct payments, followed by other grants and complementary national payments (Table 3).

Table 3

Subsidies structure, per standard value categories, 2007 and 2014

	Plant production subsidies	Animal production subsidies	Rural development	Intermediate consumption subsidies	Decoupled payments	Other subsidies
2007						
(1) 2 000 - < 8 000 EUR	1.5	51.7	0.0	6.1	25.4	15.4
(2) 8 000 - < 25 000 EUR	1.4	74.0	0.0	6.3	12.6	5.8
(3) 25 000 - < 50 000 EUR	0.3	76.6	0.0	4.8	9.9	8.4
(4) 50 000 - < 100 000 EUR	1.5	46.3	0.0	12.4	18.0	21.8
(5) 100 000 - < 500 000 EUR	5.0	23.6	0.0	19.8	20.7	30.8
(6) >= 500 000 EUR	3.0	26.6	0.0	21.9	17.9	30.6
2014						
(1) 2 000 - < 8 000 EUR	0.3	2.1	16.4	0.1	64.0	17.1
(2) 8 000 - < 25 000 EUR	2.7	13.3	12.0	0.8	53.4	18.0
(3) 25 000 - < 50 000 EUR	0.5	11.0	5.2	1.6	62.6	19.0
(4) 50 000 - < 100 000 EUR	0.0	4.6	4.3	2.6	67.7	20.7
(5) 100 000 - < 500 000 EUR	0.4	1.6	5.3	4.3	67.1	21.2
(6) >= 500 000 EUR	0.6	7.4	7.8	4.0	51.5	28.7

Source: FADN processing (RICA)

Performance of agricultural holdings by sector

The performance of farms in the field crops, grazing livestock crops and mixed farms was increasing during the period 2007-2014, (Dona I,

Toma E., Dobre C., Roman, L, 2014**)** but the net added value per hectare in the vegetal sector was highest in the horticultural sector (Table 4). On the other hand, labor productivity reached very high values in the livestock sector (about 118 thousand euro / AWU), 243.5% more than in 2007, and in field crops (about 16 thousand euro / AWU) where the increase was 515.8%. The analysis of economic performance shows that in 2007 without receiving subsidies the farms in the field crops and granivores would have lost, while the wine sector had a negative income rate due to the unfavourable climatic conditions (*table 6*). In 2014, the income ratio varied between 26.5% in horticulture and 85.5% in the dairy cow sector, while without subsidies the income rate reached only 22.1-62.6%.

Table 4

Evolution of the net added value per hectare and labour productivity, per sectors, for the period 2007-2014

	2007		2014		2014/2007 (%)	
	VAN/ha	VAN/AWU	VAN/ha	VAN/AWU	VAN/ha	VAN/AWU
Field crops	312.1	3193.4	467.7	16473.0	149.9	515.8
Horticulture	5262.8	3359.2	2426.9	2804.8	46.1	83.5
Wine	1678.2	3018.7	1381.4	6041.9	82.3	200.1
Other permanent crops	1290.0	3853.8	1434.3	5446.6	111.2	141.3
Milk	1023.9	2411.5	923.6	3944.1	90.2	163.6
Other grazing livestock	565.6	1917.6	855.5	4669.4	151.3	243.5
Other granivorous animals	7774.5	5289.1	4498.7	11777.8	57.9	222.7
Mixed	499.8	1156.5	833.9	2911.7	166.9	251.8

Source: FADN processing (RICA)

Major increases in economic performance compared to 2007 were recorded mainly in the livestock sector and in the wine sector. Although there is a slight downward trend in the number of farms (*table 5*), convergence towards a situation similar to that in the EU is slow (14.7% decrease in the number of farms in 2013 compared to 2005), the tendency reducing the number of agricultural holdings being more advanced at European level (decrease by more than 25% of the number of farms in the same period).

Table 5

Evolution of income rates, per sectors, for the period 2007-2014

	2007		2014		2014/2007 (+/-) Percentage points	
	Income rate (%)	Income rate without subsidies (%)	Income rate (%)	Income rate without subsidies (%)	Income rate	Income rate without subsidies
Field crops	19.0	-5.6	56.7	28.1	37.7	33.7
Horticulture	55.1	49.1	26.5	22.1	-28.6	-26.9
Wine	-9.2	-12.7	40.5	26.9	49.7	39.7
Other permanent crops	45.7	38.8	73.0	62.6	27.3	23.8
Milk	85.5	65.6	85.5	60.8	0.0	-4.8
Other grazing livestock	55.8	40.2	81.3	60.6	25.6	20.5
Other granivorous animals	7.8	-12.5	64.8	44.7	56.9	57.3
Mixed	42.9	30.8	69.1	52.1	26.1	21.3

Source: FADN processing (RICA)

The analysis of the subsidy structure in 2014 highlights that the most important subsidies were direct payments for the plant and livestock sector, followed by support for rural development and other subsidies, while in the livestock sector other subsidies were important, complementary national payments and support for rural development (El Benni N., Finger R., 2014).

CONCLUSIONS

The Community Agricultural Policy proved to be one of the most successful communitarian policies, having also a high degree of complexity. Exactly this success shall determine the difficulty of the reform, considering the changes in the initial

conditions that represented the fundament of its elaboration.

The analysis per types of production of the separation per sources of incomes, revealed us that the support through Pillar I – subventions for the vegetal and animal production – was more equally distributed among farms. The contribution of the income sources to forming the total income emphasized that the value of the agricultural production leads to around 67.1% of inequity, the remaining being under the influence of subventions. Among these, the most important contribution was determined by the free payments (21,3%), these being followed by subventions for intermediary consumption and other subventions. The assessment of the effect of the modification of the income sources on the total income:

Incomes from the agricultural production and other subventions lead to the increase of inequity among farms that obtain different products (grains, wine, horticultural products, etc.); increase with 1% of the incomes from the agricultural production leads to the inequity increase with 5.76%;

The subventions lead, generally, to the decrease of inequity between them, especially subventions for the animal production (decrease of 3,33%) and direct payments (with 2,17%);

The analysis per types of specialized farms concerning the discomposure on income sources showed us that the value of the agricultural production leads to 68.8% of inequity, the remaining ones being under the influence of subventions. Among these, the most important contribution was of the free payments (20,8%) and the subventions for the intermediary consumes. The assessment of the effect generated by the modification of the income sources on the total income:

- incomes from the agricultural production, other subventions and subventions for breeding, lead to the increase of the inequity between the specialized farms; the increase with 1% of the incomes from the agricultural production leads to the increase of inequity with 6,85%;

- the subventions generally lead to the decrease of the inequity between them, especially in regard to the subventions for breeding (decrease of 4,1%) and direct payments (with 3,04%).

In conclusion, the subventions granted based on Pillar I present the highest level of importance in obtaining the incomes and therefore influence more and directly the inequity between farms. The obtained results show us that a modification with 1% of the subventions granted through Pillar I: they have a negative effect leading to the increase of inequalities between different size farms; they have a positive effect leading to the reduction of disparities between the farms from different sectors or specialized on certain products.

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ASPECTS REGARDING THE MARKETING STRATEGIES FOR SMALL AGRI-FOOD PRODUCERS. A CASE STUDY ON ”LEGUMELE DE ACASĂ” TÂRGU FRUMOS

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Abstract

The agricultural sector is one of national importance, at present over 20% of the active population of Romania working in this economic branch. Although Romania has the largest number of agricultural holdings in the European Union, with 33.2% of their total number, only provides 3.4% of the standard production of the European Union. In Romania, only 1.5% of the total agricultural holdings are represented by large, industrialized and performing farms, being registered in total over 3.5 million subsistence and semi-subsistence farms. With 91.8% of the agricultural holdings with an area of less than 5 hectares, Romania faces a paradox: the smallest ratio between the number of agricultural holdings and production. Most agricultural holdings are facing problems in terms of capitalization of production, the lack of effective marketing strategies mirroring in the low income recorded. The purpose of this case study is to analyze how a small-scale agri-food local producer managed to implement effective marketing strategies that led to an increase in the income and profitability of the activity. The analyzed data highlighted a series of main marketing strategies that were implemented by ”Legumele de Acasă”, a small agri-food producer based in Târgu Frumos, Iași County, Romania. Leading to positive results, the main marketing strategies the unit implemented successfully are: Social Media Marketing, publicity through recommendations and *Word of Mouth*, differentiation from competition through products and distribution and the creation of a local community around its brand by participating at and organizing events aimed at attracting more customers and studying the habits of the target audience. Through these marketing strategies, the local agri-food producer ”Legumele de Acasă” has managed to attract and maintain a stable customer base that has gradually increased over time. A notable aspect that differentiated ”Legumele de Acasă” from other local producers, is that the budget required to implement these marketing strategies was low compared to big producers, most of the strategies being implemented by the producer itself, with minimal costs.

Key words: marketing, local agri-food products, marketing strategies, small farms, Social Media Marketing.

The high natural fertility of the soils and the diversity of the climate gives Romania a high potential in terms of field vegetables production, but the favorable pedoclimatic conditions are not sufficient to increase the productivity in this sector.

The production levels of domestic products have dropped dramatically in recent years, transforming Romania from a predominantly exporting country into an importer of vegetables. Romania imported vegetables and fruits worth 783.1 million euros in the first half of 2018, while the exports value was almost ten times lower, according to centralized data from the National Institute of Statistics. Under these conditions, Romania's deficit in international trade in vegetables and fruits amounts to 704.5 million euros (INS, 2018). Among the causes of this phenomenon with negative effects on the national economy are the large number of small-scale agricultural units, the low degree of endowment of farms with modern technical means of production and harvesting, the low yields per hectare, the increase of the frequency of extreme climatic phenomena with effects on production (MADR, 2017).

It can be observed that the factors which influence the productivity in the vegetable sector present a certain interdependence, the large number of small farms decreasing the possibility of agricultural farms to equip themselves with efficient technical means, irrigation systems or other methods to improve the effects of extreme climatic phenomena, which , in turn, lead to a low yield per hectare. Given the fact that over 20% of Romania's active population is active in the agricultural sector (INS, 2019), the efficiency of

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this sector is imperative, being necessary results able to positively influence both the national economy and daily living of the population involved.

The process of nationalization and collectivization of agricultural lands in the communist period and, subsequently, the return of the nationalized lands to the former owners through a defective system had repercussions on the infrastructure, the production and exploitation systems and on research in the agricultural field. Currently, the effects of these actions are felt and the main concretisation took the form of a high fragmentation of agricultural lands. Of the total number of agricultural holdings of the European Union, Romania occupies a large share compared to other Member States, accounting for 33.2% of their total number (Eurostat, 2013).

Although the share of agricultural holdings of Romania is high, in terms of productivity this country is not among the leading member countries, only 3.4% of the standard production of the European Union being provided by Romania. One reason for this is the lack of efficient industrialization and technology within subsistence and semi-subsistence agricultural units, which occupy the largest share with 3.5 million, while only 1.5% of total agricultural holdings are represented by large farms. The lack of funds needed for investments in this sector is felt among small-scale agricultural units, leading to the fact that most of the land remains unexploited, Romania presenting a low percentage of agricultural areas exploited in the EU. The statistical data gathered by INS show a decrease of the area cultivated with vegetables, from 253.4 thousand ha registered in 2007, to 226. 3 thousand ha registered in 2018 (*table 1*).

Table 1

The evolution of the area cultivated with vegetables in Romania between 2007 - 2018

Specification	UM	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Surface	thousand ha	253.4	268.6	267.1	262.7	263.4	258.9	259.0	239.4	239.4	228.1	224.6	226.3

Source: INS Statistical Yearbook of Romania, 2007-2018, Crop production at the main crops 2018 INS

Thus, it can be observed a gradual decrease of 27.1 thousand ha in 2018 compared to 2007, but the most drastic change is a predominant report starting with 2014, when the agricultural area cultivated with vegetables decreased with 19.6 thousand ha compared to 2013 (*table 1*).

With 91.8% of the agricultural holdings with an area of less than 5 hectares, Romania is facing the lowest ratio between the number of agricultural holdings and production. Most small farmers face problems in terms of productivity and production value, the lack of implementation of effective marketing strategies being felt in the recorded income. As regards the fragmentation of agricultural land, a number of factors are involved, with several parties with power of decision, the process is an arduous one and subject to delays of different natures. As concerns other factors that could improve the situation of capitalization of agricultural production the decision-making power belongs to the management of each agricultural holding. Thus, the agricultural units must find efficient methods of capitalizing on the production, which will be applied successfully and which will give the maximum efficiency. A series of marketing strategies targeting an effective promotion of the obtained agricultural products, their distribution and sale must be implemented by each unit, taking into account all the factors that intervene on the market in the capitalization process (Chiran A., Dima F. M., Gindu E., 2007).

In addition to the productivity related factors and the judicious use of resources, the increasingly fierce competition in the agri-food sector puts its mark on how small-scale agricultural units and producers manage to withstand the current market and develop successful businesses (Hoffman L., 2007).

MATERIAL AND METHOD

The necessary studies to elaborate the present paperwork were performed during 2019 using as sources of information secondary data, particularly analyzing a series of marketing activities and strategies implemented by the analyzed agricultural unit, together with its online communication channels: the website and official pages on social networks, online marketing campaigns that are implemented in the virtual space, its online store and articles published about the unit in local and national newspapers. Also, primary data sources, such as interviews with the owners of "Legumele de acasă" Târgu Frumos were gathered during the reasearch.

RESULTS AND DISCUSSIONS

In an increasingly abounding market of global companies implementing marketing strategies with large budgets, the success of small and medium-sized companies lies in how they

manage to find a suitable niche and apply effective marketing strategies in terms of involved resources vs. obtained results (Gîndu E., 2006).

Analyzing a series of marketing strategies implemented by the local producer of agri-food products "Legumele de acasă" Târgu Frumos and a series of interviews with the business owners, it has been noticed a tendency of stabilization on the local market and an increased notoriety of the brand in the last years.

With a production area of 2 ha, „Legumele de acasă" Târgu Frumos is one of the agricultural units based in Iasi County, Romania, which has as main activity the cultivation and capitalization of vegetables. The unit represents a relevant example of a small-scale domestic producer, which provides end-users with vegetables and greens as an alternative to imported ones. The unit was created through the initiative of two associates, after one of them accessed European funding, respectively a project through the European Agricultural Fund for Rural Development and the Agency for Financing Rural Investments under Sub-measure 6.1 - *Support for the installation of young farmers during the financial year 2014 – 2020.*

The unit carries out its activity in the field of production and capitalization of vegetables and greens in protected areas, respectively in greenhouses and solariums based on the radius of the city of Târgu Frumos, Iași County. Unlike other competing units in the area, the approach of the two associates is different in the way they promote their products and distribute them to the final consumer. Thus, the unit carries out campaigns to promote the products through online communication channels, via email and social networks and the distribution of the products is done personally at the customers' domicile or workplace, or at certain meeting points.

The analyzes carried out concluded that the manufacturer has daily interventions on the online channels where communicates directly with the potential or existing customers regarding the way of obtaining the products, the way of capitalization, the meeting points for the actual purchase and other important information. This type of direct communication, although requires significant time resources, brings a series of advantages over a classic strategy of product promotion and capitalization:

a. there is no intermediary between the producer and the final consumer. The two associates of the unit establish a daily contact through online communication channels and through direct meetings with the final client are able to receive a direct feedback and opinions regarding their products and marketing strategies;

b. the potential or existing customers can observe, through the producer's images and movies posted on Internet, how the cultures are evolving, how they are planted and harvested;

c. there can be a much greater degree of confidence regarding the quality of the products due to the direct meeting between the producer and the buyer;

d. the producer is able to develop a closer relationship with the target audience, by exchanging information, by direct feedback, by continuous pre- and post-sale communication.

Depending on the season and the market demands, the offer of "Legumele de Acasă" has been diversified, currently reaching over 20 types of products (*table 2*).

Table 2

The main crops capitalized by the agricultural unit "Legumele de acasă" Târgu Frumos, Iasi County, 2019

No. crt	Product category	Product name	
1	Fresh vegetables	Asparagus	Cauliflower
		Leek	Spinach
		Red lettuce	Pink radishes
		Green lettuce	Red radishes
		Celery	Green tomatoes
		Corn for popcorn	Cherry tomatoes
		Hot peppers	Tomatoes
		Cucumbers	Yellow tomatoes
		Pumpkins	Multicolored tomatoes
		Eggplants	Carrots
		Bell peppers	White onions
		Bulgarian peppers	Green onions
2	Greens	Parsley	Parsley root
		Grass parsley	Thyme
3	Processed Vegetables	Pickled cabbage	Vine leaves in brine
		Pickles	Yellow / red tomato juice

Source: The sale offer listed on the official Facebook page and website of"Legumele de Acasă" Târgu Frumos

The complete product variety, shown above (*table 2*) is produced throughout the year, by rotation. In addition to the production of fresh vegetables and greens, the unit aims at developing a supply of processed vegetables, which brings a greater profit and offers the possibility of sales for longer periods of time, the production being less affected by perishability and seasonality. In addition, lately it was registered a high demand for these kind of products among the targeted public in Iasi County, especially regarding the traditional products obtained from processed vegetables. Due to a constant increase of demanding observed among their clients, ”Legumele de Acasă” Târgu Frumos gradually diversified and increased its production according to the customer demand. Through customer loyalty strategies and by diversifying the range of products according to the season, a stabilization of the number of persons served has been achieved, the sales and deliveries being realized on the basis of prior programming, due to the high number of requests from the part of new and loyal customers.

Being involved in a production activity characterized by seasonality and perishability, the vegetable producers must implement efficient and prompt marketing strategies in order to capitalize the production on time. The marketing strategy of the local producer „Legumele de acasă” Târgu Frumos has as its central point the targeted promotion on niches of customers spread geographically in the area in which the unit operates. This limited strategy in space and time has as a reason the necessary resources as regards the product promotion and placement:

- through specific niche oriented communication campaigns with personalized message the sale can be done in a shorter time;
- the *door-to-door* distribution policy involves the coverage of a territorial area, restricted on the one hand, but presents competitive advantages on the other.

The main capitalization channel is represented by „Legumele de acasă” website, which is structured as an online store where each product is presented through photos, price, description. This channel offers the possibility of ordering online with home delivery option, providing the target audience an easy mean of purchasing.

The products are distributed only in Iasi county by producers or their employees, twice a week: on Wednesdays and Saturdays. During the week the orders are picked up and processed, one day before delivery the baskets of vegetables are prepared, and then the fresh vegetables are delivered at home / work place / meeting point established with the client.

The key messages which are pointed out in their advertising campaigns are focused on the idea of high quality products, natural and healthy, carefully grown vegetables, without the use of harmful chemicals. Due to the lack of financial resources necessary for the implementation of offline advertising campaigns, the only advertising channels utilized so far are online channels: through social media networks, website and online platforms belonging to a series of partners.

Facebook was the main channel that facilitated the promotion of the company on the local market. Through this social media platform, ”Legumele de Acasă” Târgu Frumos succeeded to inform a large number of people about the company's offer. Through a series of special groups created on Facebook the producers made their first sales in Iasi county, followed by the creation of a personal page for communicating weekly offers, distribution days, meeting points and news about production. The main Facebook groups in which the producer advertises its products are ”Iașul vrea produse locale” (”Iași wants local products”) with over 37.500 members and ”Iașiul vrea produse naturale” (”Iași wants natural products”) with over 40.000 members. The official Facebook Page of the producer has more than 3200 followers and likes who are constantly buying their products. Also through this communication network, the producer has been able to increase a loyal weekly customer base – with the help of positive reviews and *word of mouth* advertising which is one of the key factors that generate discussions and interaction in online.

In online medium control over the spread information about a brand is almost impossible. With a widespread negative impression rate and a low public attention retention in the absence of constant communication, the company has managed to attract attention in a positive way and to have the desired impact on the public in Iasi county area. A positive reputation in online has helped to attract the attention of the press, ”Legumele de Acasă” Târgu Frumos benefiting of unpaid and viral reports and articles in local and national press, which highlighted the novelty of the business approach and the innovative marketing strategies adopted by the company. Until present, well known media publications, such as ProTV, Antena 1, TVR1 have produced and published articles and TV shows in which the owners of ”Legumele de Acasă” Târgu Frumos presented their business and successfully promoted themselves without investing in advertising budgets, benefiting of publicity through mass media (*figure* 1, 2, 3).

Figure 1. **Free article about "Legumele de acasă" Târgu Frumos published in "Adevărul" – a national circulation newspaper**
Source: www.adevarul.ro

"Adevărul", a daily national circulation newspaper available also online, is one of the most popular mass-media publications in Romania, with more than 20 milions of visits per month according to Audience and Internet Traffic Study (SATI). "Adevărul" published an entire article about the development of "Legumele de Acasă" Târgu Frumos with the help of internet and how this mean of communication was integrated in their marketing strategy (*figure 1*).

Other local publications published articles about "Legumele de Acasă" Târgu Frumos, the unit being considered an example of positive communication, with an effective marketing approach (*figure 2*).

Figure 2. **Free article about "Legumele de acasă" Târgu Frumos published in a local newspaper**

Besides articles published in written press, "Legumele de Acasă" Târgu Frumos benefited of publicity on national scale during one of the most watched news bulletin in Romania – ȘtirileProTV (*figure 3*).

Figure 3. **News report about "Legumele de acasă" Târgu Frumos - Știrile ProTV**

In an economy characterized of fierce competition, where articles in newspapers and news reports exceed by far the advertising budget of small local agricultural units, obtaining a positive publicity in the program of national publications is a marketing efficiency attestation, an objective aimed by every company. Through a balanced combination of online and offline advertising actions, authentic and direct contact with customers, real-time adjustment of the offer and messages according to the received feedback from the market, high quality of the delivered products, ”Legumele de Acasă” Târgu Frumos managed to consolidate the image of authentic and domestic brand in the field of production and capitalization of vegetables and greens in Iasi County.

CONCLUSIONS

In an increasingly abounding market of global companies implementing marketing strategies with large budgets, the success of small and medium-sized companies lies in how they manage to find a suitable niche and apply effective marketing strategies in terms of involved resources vs. obtained results.

With the help of online communication channels, brands succeed to implement various marketing strategies in order to meet the consumers desires, through key messages oriented in positioning themselves as more active and locally oriented, involving low marketing budgets.

Positioned as local agri-food producer through efficient marketing strategies positively influenced ”Legumele de Acasă” Târgu Frumos reputation on the market and has increased its number of loyal customers. Regarding the grounds attesting to the company's growing awareness, we mention:

- implementing online marketing campaigns on Facebook and Google helped ”Legumele de Acasă” Târgu Frumos capitalizing its products and creating a strong and loyal customer base of more than 200 weekly customers, each with a medium shopping basket value of 100 lei; with the help of online channels, the unit succeeds in selling all its products online, distributing their products in stores and supermarkets being not necessary;
- ”Legumele de Acasă” Târgu Frumos has create a strong connection with the local target audience through its communication messages, reflected in the rise of reactions on its Social Media presence – more than 3200 likes and active followers on its official Facebook Page, constant orders through messages and comments;
- the unit gained visibility on local and national market through a series of articles and reports published in national newspapers and TV news bulletins well known in Romania, such as ProTV, Adevărul etc;
- creating strong community ties while meeting local needs or tastes through its range of locally tailored products ”Legumele de Acasă” Târgu Frumos managed to enter an already crowded market of local and imported agricultural products, difficult to access by small producers with low marketing budgets.

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COMPETENCES OF THE UNIVERSITY TEACHERS. EXAMPLES OF GOOD PRACTICES

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Abstract

According to Europe 2020 Strategy, in 2017, the Commission published „A renewed EU agenda for higher education", which made education and skills a priority of European cooperation. It focuses on four priority areas: tackling future skills mismatches and promoting excellence in skills development; building inclusive and connected higher education systems; ensuring higher education institutions contribute to innovation; supporting effective and efficient higher education systems. The communication seeks to emphasize the essential role of the university in achieving sustainable development at the global, European and national level. We mainly consider the strategic documents of the European Union. From this perspective, the paper will emphasize examples of good practices around the world regarding the training and development of competences for university teachers that are in line with these new requirements. Based on proposals made by Louvain Learning Lab (Louvain-la-Neuve University, 2005), the communication develops the content of 10 basic competences of the university teaching activity, in order to focus the educational steps on the formation of professional and transversal competences. We also argue the need for the involvement of universities in the process of initial and continuous training of university teachers.

Key words: university reformation; lasting development; the paradigm of centred competence; university teaching staff skills; training of university teachers.

According to Europe 2020 Strategy, the Commission published *New EU Agenda for Higher Education* (2017), which made education and skills a priority for European cooperation. It focuses on four priority areas: aligning the development of skills in the field of higher education with the needs of the labor market; ensuring that higher education is accessible widely and more favorably to inclusion and increasing its degree of interaction with society; stimulating the innovation capacity of higher education; increasing the effectiveness and efficiency of higher education.

All these objectives can only be achieved by competent university teachers (CUTs). The quoted document (EC, 2017) draws the attention to the psycho-pedagogical training of the CUT (initial and continuous).

The higher education system in Romania does not yet rise to the level of the demands of a postmodern society, in accordance with EU standards. *The Times Higher Education World University Rankings* (2019) does not include any Romanian universities in the top 200. Three universities in Romania are between 801st -1000th and four after the 1001st place. In an international ranking *The 2019 Change Readiness Index (CRI)*, Romania ranks 54th out of 140 countries. The EU countries that follow us are Bulgaria (60) and Greece (65), the statistics of 2019 being centered on the ability of countries to face the climate change.

MATERIAL AND METHOD

The communication seeks to point out the essential role of the university in achieving sustainable development at global, European and national level. We mainly consider the strategic documents of the European Union. We exemplify the creation of a hackathon by Louvain University in Neuve to design the university in 2035.

From this perspective, the paper will emphasize examples of good practices worldwide regarding the competencies of university teachers who are in line with these new requirements.

RESULTS AND DISCUSSIONS

The development of universities in the world was made following two models: the Napolenian one and the Humboldtian one, that were developed almost simultaneously (Reisz R.D., 2018). **The Humboldtian model** has the following

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characteristics (Reisz R.D., 2018): the unit of education and research; academic freedom in education and research; inclusion of sciences in the philosophical faculty; the national role of the university. The development of American and Japanese universities is also under the sign of the Humboldtian model. **The Napolenian model** also has several defining notes: separation of research education; higher schools should not be autonomous as organizations; his main product will be the engineer; typical faculties are technological ones (Reisz R.D., 2018). Polytechnic schools in Soviet Russia took over the French model, which spread to other socialist countries, including Romania. There are known attempts to rethink the development models of universities having in view the challenges of the contemporary world. Today's students will live in another world and universities must make a collective effort to project their development from this perspective.

The danger of turning education into a profitable commodity (Renaut A., 2007) is manifested by several indicators: the importance of the utilitarian discourse; fascination for international rankings (ranking); the evaluation practices will focus on the number of published articles and patents obtained; the emergence of a third mission of the university (besides the ones of education and research), to be in the service of the society (Valenduc Gé., 2016).

Higher education experts are looking for alternative models for the two classical models (Humboldtian and Napolenian). A significant example is **the entrepreneurial university**, which is based on a new type of management (*new public management*). "The role of the entrepreneurial university is increasingly being seen as important to find new ways to compete and succeed in uncertain and unpredictable environments and to find new solutions to the multiple challenges that need to be addressed for the public good, whether local or global" (Hannon P. D., 2013).

The search for alternatives should not lead to a reductionist approach to the universities' mission, but to think of building a university with several missions. University missions are multidimensional. "For example, it is very difficult to prioritize the importance of improving advanced knowledge, citizens' education, high-level professional training, support for social mobility, etc." (Paradeise C., 2007).

The conference of university presidents (CUP, 2018, 2019) in France made several recommendations on the development of European universities. "What we need is an approach [*Design Thinking*] to innovation that is powerful, effective, and broadly accessible, that can be integrated into all aspects of business and society, and that individuals and teams can use to generate breakthrough ideas that are implemented and that therefore have an impact." (Brown T., 2009). *Louvain Learning Lab* organized in 2016 an innovative formula to reflect on the future of the university on the horizon of 2035, entitled *Hack'apprendre*, that was attended by around 80 participants, which were organized into 8 groups. University features in the year 2035 were summarized as follows: modular; confident in the students' potential; catalytic (contributing to the emergence of new trades); circular and systemic; fluid (allowing different types of learning); open to human experiences; will advise people's projects; high heterogeneity of students (Lebrun M., 2016).

Marie-Anne Paveau (2019) proposed a benchmark of the competences of the university teacher:

The pedagogical dimension

1. To have a representation of the teaching-learning activity that is becoming more and more effective.
2. To plan and implement teaching-learning activities (choosing and articulating objectives, teaching strategies, scientific content, educational resources, etc.) relevant, effective and efficient.
3. To plan and put into practice activities to evaluate learning outcomes (choosing and articulating criteria, assessment methods, tools, correction techniques, etc.).
4. To master various forms of pedagogical communication (oral and written, nonverbal communication, multimedia use, etc.).
5. To animate and manage interactions in groups of students of different sizes (teacher-student, student-student relationships).
6. To support students in the learning process (tutoring, methodological support, formative evaluation, etc.).

The institutional dimension

7. To promote the success of as many students as possible and ensure the personal development of each one.
8. To work in a multidisciplinary or interdisciplinary team for projects or pedagogical programs.

The socio-professional dimension

9. To develop a reflective thinking on the pedagogical practice.
10. To overcome duties and ethical dilemmas involved by the profession of a university teacher.

Following a constant theoretical effort, Institute of University Pedagogy and Multimedia (which in the meantime became *Louvain Learning Lab*) published a strategic document (2005), which

identified 10 basic competences of the university teaching activity, in order to professionalize it:

Competence 1. *To adopt a representation of the teaching-learning activity that can make this activity as effective as possible;*

The document suggests 5 clues to promote effective learning:

a) **Motivation.** Are the content and teaching strategies tailored to the students' skills and do they carry meanings? Is the teaching situation close to real life to interest the students?

b) **Information.** Do students have the necessary resources to understand and overcome teachers' contribution?

c) **Activating the mental structures** (analysis, synthesis, critical thinking, resourcefulness);

d) **Interplay** (between teachers and students, between students);

e) **Product** to be evaluated.

Competence 2. *To plan and implement teaching activities (articulated with the objectives, contents, teaching-learning strategies) relevant, effective and efficient;*

The teacher must ensure an "active and constructive" learning process by which the student will understand the available cognitive resources in order to create new knowledge (Kozman R.B., 1991). "Each student has concepts and competences with which he will build the knowledge necessary to solve the problems that the environment poses. The role of the community - other students and teachers - is to provide a device, set the challenges, and provide the support that will encourage this construction. "(Anderson R.D. *et al*, 1994).

Competence 3. *To plan and implement the activities of assessing the learning activities (articulated by assessment criteria and methods, tools, correction techniques, etc.);*

From a systemic perspective (Stanciu M., 2018), evaluation is the component that gives the measure of the efficiency of the teaching-learning process. It must be articulated with the other components of the university curriculum (competences, scientific content, teaching-learning strategies, forms and modes of organization, learning place). The university teacher will harmoniously combine the types (forms) of evaluation, emphasizing on the training (continuous) evaluation. Also, the methods and assessment tools appropriate to the subject (oral or written examination, practical tests, etc.) will be chosen. Before the start of each discipline, the teacher has to communicate to the students the assessment methods.

Competence 4. *To master different forms of pedagogical communication (oral and written, non-verbal communication, use of multimedia resources).*

Competence 5. *To animate and manage interactions within students groups of different sizes.*

A pillar of the education in the 21st century is considered by UNESCO to teach that individual to live together with other people (Delors J., 2000). Man is a social being and, therefore, each individual is linked to the others through a multitude of invisible threads. This especially in this world of interdependence, which further accentuates the need for human solidarity beyond all ideological hues.

Competence 6. *To advise students in the learning process (tutoring, methodological support, formative evaluation).*

We consider the paradigm of focusing the didactic approach on students, on their needs and interests. The university teacher cannot learn instead of the student, but he / she can enable a pleasant and efficient learning process.

Competence 7. *Promoting success for a growing number of students and personal development*

USAMV Iași won two ROSE projects financed by World Bank: "Success chances for agronomist students in the 1st year of study" (2017-2020) and "USAMV Learning Center Iasi-*Learning for Life"*, mainly aiming at supporting the 1st year students from USAMV Iași, who are exposed to the risk of abandonment and who belong especially to the disadvantaged groups.

Competence 8. *Work in multi- or interdisciplinary team for projects*

The pedagogy project tries to place the pupil /student at the center of education and training. Interdisciplinarity is one of the major directions in the upgrading of the school curriculum (Văideanu Ge., 1988; Stanciu M., 2018).

Competence 9. *Developing a reflective thinking about its pedagogical practice*

The professional educator, "the reflective practitioner" is able to analyze his/her own practices, solve problems and invent strategies. The training relies on the input of practitioners and researchers and aims at articulating the theory with practice in order to build the "analysis capabilities" of its practices. According to Altet M. (1996), this is a metacompetence that allows other competences to be built.

Competence 10. *To deal with the ethical responsibilities and dilemmas specific to the profession of university teacher*

Academic freedom must be correlated with a great responsibility regarding the quality of the training programs, the manifestation of the university as a nucleus of the socio-economic partnership, of the progress and innovation from the perspective of the demands of the society, approached from the perspective of systemic paradigms, of the complexity (Morin E., 1990, 1992) and a prospective vision.

CONCLUSIONS

By its contribution to the meeting of European leaders in Gothenburg, the Commission set a vision for a European Education Area by 2025, "in which learning, studying and doing research would not be hampered by borders" (European Commission, 2019).

Creation *of European universities* - networks of excellence in research and training, to promote Europe's core values (results of the 1st call, 2019: 17 alliances, 114 Higher Education Institutions, 24 member states).

Rethinking the university curriculum specialized in the initial and continuous training of university teachers. It must have a predominantly innovative character (Wagner T., 2014; Lison Cr. *et al*, 2014).

The creation at the level of the Romanian universities of institutional structures that will deal with the initial and continuous training of the university teaching staff.

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TRENDS OF USING DIGITAL INSTRUMENTS IN EDUCATION

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Abstract

The introduction of digital tools takes place in all spheres of life, including the education. In this paper, I attempted to structure and characterize the existing digital educational tools in terms of functions and capabilities for users, characteristics of user interactions in tools. In the literary review in first part of this work, the current state of digitalization of various spheres of life was investigated, and the relation of society to perspective universal automation and digitalization of all on the basis of the published scientific works were studied. The purpose of the study was to structure and consolidate the data about the available digital learning tools and digital educational environments, to perform the role of the teacher in the use of each tool, and to highlight the ability of students and teachers in the framework of specific tools. This paper suggests the need for a closer transfer of knowledge and technology in the educational process, with the parallel formation of the concept of "digital competence" and the identification of the criterion of its evaluation in future and practicing teachers.

Key words: digital tools, digital competence, teacher formation, digital tutor

Digital technologies are entering the lives of 21st century citizens. Teachers are beginning to recognize the training potential of these technologies and are looking for ways to use them effectively in support of learning. In this regard, we want to contribute by summarizing some theoretical problems, offering implementation suggestions for the efficient integration of digital technologies in teaching and learning. The increased ubiquity and instructional benefits of digitalizing education have made teachers use them in the classroom to keep up with modern trends in education, without assessing, however, how beneficial digital technologies are to their students. Teaching has evolved over the centuries by adopting new approaches, methods, tools and technologies to reach a wider audience (Akbar, 2016). With the new technologies, this fact is very important not only to evaluate their influence on the students, but also to combine new trends with some traditional methods, known methods and which have been successful in education for a long time. Although teachers, understand that education should use all that science has to offer and follow it, they should be cautious in transferring all innovations and new technologies as appropriate to a particular group. In addition, new approaches in education create real challenges for both teachers and students. Education, understood as the capability to know what, how, where, when, why and for what would appear to be fundamental for any human being. Not only education is essential for finding or creating a job, but it is also a prerequisite for living as a democratic and global citizen. Today more than ever people need to have access to educational and learning processes that foster the best of oneself and life- long, life-wide and life-deep learning skills.

The modernization of the education system aims to train a person who has developed a high level of key competences. The use of digital in educational activities creates new opportunities, suitable methods for the transfer, dissemination and management of digital information, developing the skills needed on the basis of digital literacy, ensuring fair access for all. There is a view that in 5-7 years the paper textbooks will disappear (Makarova, 2018). How well will the programs be respected? Will the textbook be digitized and placed on student tablets? Or will different textbooks be created? There are already some notable experiences, in which the manual has been transformed into an interactive activity, benefiting from multiple audio-video functions. In this way, it ensures the respect of the scientific content but offers the student a dynamic experience, in which he can choose the right type of activity (accompanying the text text, music, videos, accessing links with additional information, searching for keywords, solving application).

We live in a multimedia rich world, so we must use these unique opportunities to "learn

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anytime, anywhere", but we should not forget that our human dynamics are becoming increasingly exposed to the risk of addiction to digital devices in life. students (Pedro, by Oliveira Barbosa, Santos, 2018). Appreciated by both students and teachers, digital technologies are often seen as a remedy in itself to many educational problems. But technologies can become a problem, it adds difficulties faced by students and teachers.

MATERIAL AND METHOD

Digitalization, as one of the characteristics of the openness and availability of the educational process, requires a revision of the approaches of the educational process and of the teachers training. For modern education, special training of staff is required, based on their competences, taking into account the flexible role of the teacher in the educational process. Under the current conditions, the teacher not only presents information, but also organizes the activity between the students to obtain this information. He not only explains and presents the material, but also answers questions. He should not only provide instructions for the task, but also help in discussing possible solutions with students. The information extracted in such a common activity becomes the personal knowledge of the learner and the teacher who works in this way, becomes a mentor or tutor (Makarova, 2018). Guidance support is a pedagogical activity in the individualization of education by identifying and developing the students' motives and interests, looking for resources to create a personalized educational program. Creating such a program is much easier with digital tools, the teacher having multiple functions for monitoring and recording the student's progress or regress.

Also, e-counseling experiences, using internet-mediated communications, between teachers to perfect their planning and training (Smith & Israel, 2010), have proven to be indirectly beneficial to their students or students. It is worth mentioning here, there are also teachers from some rural schools, who had limited access to resources due to geographical obstacles, engaged in online counseling using private messaging and Skype to support the refinement of teaching practices (Sawchuk, 2013). Overall, digital technologies create additional options for teachers by expanding resources and training to help address time constraints or geographical constraints. Among the digital tools, the most frequently researched seems to be the video function as a tool for examining teachers regarding their own practice and that of others. It was shown that the video recording was based on the teachers' abilities to critically and objectively evaluate their own practices and to consider possible refinements (for example, Rich & Hannafin, 2008; Tripp & Rich, 2012). The combination of video reflection with tutoring / mentoring has led to significant changes in student / student learning practices, and has been correlated with the improved quality of teacher language use during assignment cues. Moreover, video and web tools, combined with tutor feedback and implication, have led to significant changes in teacher training practices (Powell and Diamond, 2013) compared to using technology without tutorial support. Thus, in order to become a mentor or tutor of the students in the digital learning activity, it is necessary to exist for the teacher, another mentor to relate with. In this way, the confidence of the two partners is successful.

Many learners were also knowledgeable about a range of digital technologies which they used out of school and college. For example, the use of mobile telephones, mp3 players and iPods for digital recording were reported by learners to be commonly used out of school. Where schools acknowledged and built on the technological skills and confidence that learners brought with them, this was seen as a driving force and was associated with an increase in learners' access to digital technologies. However, these skills were rarely used to aid learning in school, and the strength of the restraining forces which actively discouraged the use of such technologies within institutions, often because of concerns about control and safety, was evident in many of the case study schools and colleges. Conole, de Laat, Dillon, and Darby (2008) found that learners select and appropriate technologies to suit their own needs, for example they use computers, the Internet and books simultaneously. They also found that students appropriate technologies to play to their strengths in terms of visual and auditory capabilities, for example those with a preference for auditory information would download and listen to Podcasts or create their own recordings. Although these findings relate to learners in post secondary education, there is a strong likelihood that, given the chance, learners within schools would appropriate technologies to suit their needs and thus personalise their learning in this way.

As shown in a previous paper (Sancho, 2010), today students are literally besieged by auditory, visual and sensory stimuli, which provide them with very different life and learning experiences, which are often neglected or rejected by schools. According to Twenge (2006), these people belong to Generation Me, the first generation capable of speaking the language of self: "Just be yourself." "Believe in yourself." "Express yourself." For these people, the so-called Web2.0 seems like a perfect set of tools for expressing "self" through digital social media that facilitates creativity, collaboration and sharing between users and efficient information management. Members of this generation were named Millennials (Howe and Strauss, 2000), Instant Messenger Generation (Lenhart *et al*,

2001), homo sappiens (Veen, 2003), Internet Generation (Oblinger and Oblinger, 2005), Gamer Generation (Carstens and Beck, 2005) and even the Einstein generation (Boschma and Groe, 2006), being considered smarter, faster and more social. Given what we know about how people learn (Sawyer, 2006; Carey, 2014) and the opportunities offered by digital media (Järvelä, 2006), researchers and teachers need to turn the idea of teaching the subject into teaching to the subjects. This means promoting and guiding the learning of students. Changing the idea of representing teachers as those who know and students as empty passive vessels, to the idea of partners in the learning process, becoming equal parts in the instructional-educational approach.

RESULTS AND DISCUSSIONS

The wide range of digital tools available now, through personal devices, allows teachers to think innovatively and creatively about how they meet, both with students, and how they actually work with their peers. However, although some web and video-based resources have gained recognition as guidance and support tools (e.g. Downer, Kraft- Sayre, and Pianta, 2009; Neuman and Wright, 2010), research on the use of other digital technologies for improvement of the pedagogical practice remains rare. In addition, some teacher teams may find that certain technologies are better suited to their goals than others, so the flexibility and willingness to experiment with new tools is important for success.

Taking into account the basic principles of the development of the digital educational process, the objective is the independent learning of the students, and the following provisions can be proposed:

• moving to a new qualitative level of the relationship between mentor and teacher, between teacher and student, based on changing personal positions, resulting in a partnership in education.

• the educational activity becomes a new one, starting as manager of the training process;

• The system of educational activities becomes one in which interactive digital educational technologies, productive and creative tasks play a major role.

The mentioned researches provides insight into how flexible use of multiple digital tools can support high-quality interactions between tutors and teachers, between teachers and students. This implementation allows the teacher and the student to assume the full ownership of the instruction, increasing its effectiveness. The flexibility offered by digital tools creates new options for mentoring / tutoring contexts that facilitate solving instructional problems and create space for teachers to reflect and innovate. By expanding the range of learning tools, teachers and students have the opportunity to choose their own unique learning path. Also, with the help of digital materials available to both in the classroom, student-teacher interactions focus more on problem solving, thus deepening the learning process. In short, teachers can revitalize the school syllabus if they are able to use the learning standards and understandings of digital literacy for formal education. This is a call for a change in what is meant by academic learning, where teachers can continue their education, but adapt the way knowledge is transferred. Therefore, many of the educational practices, suggestions and ideas are not new; rather, it offers a reform of the investigation of digital instruments and technologies as a means of production. Digital educational technologies are the most promising ways to improve the competency- oriented learning process, based on problem- solving principles, distinguishing it from the traditional methods of the education system. Research shows that combining digital educational tools and innovative teaching technologies is an intensive way to increase the independence of beginner teachers, not to the detriment of the volume of information processed, but due to the depth and speed of their processing.

CONCLUSIONS

In the last decade, there has been a change in learning. The ubiquitous nature of digital instruments in educational institutions has brought changes in the design of courses and pedagogical practices. We are witnessing a growing discrepancy between the learning styles that are cultivated in formal education and those that characterize students' experiences outside of school. The students / students are immersed in a consumerist culture that determines their autonomous and active sense, although much of their learning is passive and directed (Buckingham, 2007). This situation is a challenge for teachers and decision-making institutions called upon to modify the behaviors generated by his need to have as much as possible(s) of all offers in favor of the need to be his own selection criteria favorable to becoming. It is a task that we can fulfill including by using technology to find solutions capable of showing us the possible variants and their effects.

In general, combining digital educational tools with innovative teaching technologies helps teachers improve their skills and gain experience in the following areas: identifying, selecting and solving problems; working with information -

understanding the meaning of the results described in the situation; analysis and synthesis of information and arguments; work with assumptions and conclusions; evaluation of alternatives; decision making; discussing problems and understanding other people (teamwork skills); taking into consideration the problems associated with learning implementation, management decisions; correlating theories and concepts in the learning process and in real life activities; coordination of conflicting objectives; interactive learning; experience conceptualization skills; reflective skills; self- esteem and developing self-awareness. Since the teacher has expertise in these areas, the student or student can see in it the mentor who gives them confidence, support in meeting the objectives and understanding the possible limits.

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CORRELATION BETWEEN THE QUALITY OF THE BLONDE BEER ORIGINATING FROM A PROFIL UNIT IN THE NORTH-EAST OF ROMANIA AND FOOD SAFETY

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Abstract

Natural, traditional beer is an alcoholic beverage, naturally saturated with carbon dioxide, which is obtained from barley malt, water, hops and yeast for fermentation. This is the third most consumed drink in the world, after water and tea, and the oldest alcoholic beverage on the entire planet. In this context, the main purpose of the research was to analyze the quality of the different types of blonde beer within a profile unit in northeast of Romania. In order to identify the technological features of beer production, the technological flow within the study unit was followed. The researched material was represented by 20 blonde beer samples, which came from four different types of beer (Suceava clasic, Călimani, Bermas and Solca), produced in the study unit. The samples were analysed organoleptically and then subjected to physico-chemical analyzes, determining: apparent extract, real extract, pH, alcohol concentration, total acidity, bitter value and CO_2 concentration. Sensory analysis was performed by the scoring method, evaluating the appearance, colour, smell, taste, CO_2 impregnation and persistence of the foam, the four types of beer evaluated having a good or very good quality. pH is one of the most important parameters regarding the taste and beer stability, the values obtained falling within the range 4.35-4.8, imposed in the study unit by product standards. CO_2 concentration is another important parameter, all four types of blonde beer falling within the range of 0.3 - 0.5%. After analyzing all the results obtained, it is concluded that these products comply with the quality standards imposed by the legislation in force.

Key words: beer, hops, alcohol concentration

Beer is a non-distilled alcoholic beverage, obtained by the fermentation with yeast of a wort made of malt and water, boiled with hops (Muste S. et al., 2005; Masschelein C.A. et al., 2008; Ghimpețeanu, M., 2017). This can be: beer with alcohol (contains about 5% alcohol) and beer without alcohol (contains between 0 and 0.5% alcohol) (Branyik T., 2012). The ideal temperature for beer consumption is between 6°C and 8°C (Banu C., 2009; Hlatky M., 2013).

As a rink with a wide variety, the beer can be: blonde, brune, filtered, unfiltered, but also flavored with lemon, orange, grapefruit juice or different spices.

Beer contains the nutritional components of malt and new products resulting from alcoholic fermentation: organic acids (acetic, malic, lactic acid), aldehydes, higher alcohols, water-soluble vitamins from yeast (B_1, B_2, B_6, B_{12}, PP, H), growth factors such as biotin, inositol, pantothenic acid, but also mineral substances (potassium, magnesium, calcium, phosphorus, iodine) (Berzescu P., 1981; Banu C., 2001; Banu C., 2009).

Consumed in moderation, this beverage can be beneficial to health, due to the natural ingredients from which it is obtained. Beer cereals, especially barley, are an important source of protein, fiber and vitamins. Also called green gold, hop is a source of antioxidants, and beer yeast contains 17 vitamins, 14 minerals and 16 essential amino acids to the human body (Banu C., 2009).

The researchers recommend the consumption of unpasteurized beer, because pasteurization reduces the nutritional value by removing the "live" components, and the best type of beer is the unfiltered, because the filtration eliminates the yeast, rich in vitamin B.

MATERIAL AND METHOD

The study took place between March-December 2018 in a brewery located in northeast of Romania.

In order to identify the different

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particularities regarding the technology of brewing, the technological flows of their manufacture within the processing unit were followed. Initially, the organoleptic properties of the beer were analyzed in the units own laboratory, the samples being subjected to physico-chemical analyzes, determining: apparent extract, real extract, pH, alcohol concentration, total acidity, bitter value and CO_2 concentration. The Alcolyzer Beer Analyzing System was used to determine the physico-chemical parameters (*figure 1*).

Some determinations were made, both at the beginning and at the end of the fermentation period, but for the finished product, all the parameters were determined.

Figure 1 **Alcolyzer Beer Analyzing System**

Four types of blonde beer were analyzed in the study (Suceava classic, Călimani, Bermas and Solca), five samples from each assortment.

Suceava clasic is a blonde beer for consumption with a 4.4% alcohol concentration and a carbon dioxide content of at least 0.4g/100ml beer. This type of beer is obtained from water, malt, unmalted cereals (barley) and natural hops from two varieties grown in Transylvania. Suceava clasic is packaged in Mold ½ bottles and has a shelf life of 120 days.

Călimani is a blonde beer that bears the name of the mountainous massif from the Eastern Carpathian chain and is obtained from water, malt, unmalted cereals (barley) and natural hops from two varieties grown in Transylvania. This beer has a 4.6% alcohol concentration and a carbon dioxide content of at least 0.4 g/100 ml beer. Is packaged in NRW ½ bottles and has a shelf life of 180 days and at keg barrels of 50 liters with a shelf life of 30 days.

Bermas is a blonde beer and is made from water, malt and German hop. This beer has a 5.2% alcohol concentration and a carbon dioxide content of at least 0.4 g/100 ml beer. Is packaged in NRW ½ bottles and has a shelf life of 180 days.

Solca is a trademark with tradition that appeared in 1810. It is a superior blonde beer, obtained from water, malt and Romanian hop. Solca has a 4.8% alcohol concentration and a carbon dioxide content of at least 0.4 g/100 ml beer. This beer is packaged in NRW ½ bottles and has a shelf life of 180 days.

Sensory analysis of the four assortments of beer was performed by the scoring method, evaluating each organoleptic property (appearance, colour, smell, taste, CO_2 impregnation and persistence of the foam). The total score was calculated by summing the average scores for each organoleptic characteristic in part, after multiplying them by the specific weighting factor (*table 1*). The levels of appreciation of the sensory quality of the beer are established according to the total score obtained and based on it, the level of product quality is determined (*table 2*) (Mihaiu M., 2013; Ghimpețeanu M., 2017).

Table 1

Calculation of the score of organoleptic characteristics (Ghimpețeanu M., 2017)

Score	Appearance	Colour	Smell	Taste	CO_2 impregnation	Persistence of the foam
Individual score	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5	0 - 5
Weighting factor	0.6	0.8	0.2	1.4	0.6	0.4

Table 2

Beer evaluation based on score method (SR 13355-1:1997)

Total score	Appreciation step	Product characterization
18.1 – 20	Very good	Beer has positive, specific, well-defined organoleptic properties. There are no visible gaps or defects.
15.1 – 18	Good	Beer has positive, specific, defined organoleptic properties. It presents insignificant deficiencies/defects.
12.1 – 15	Satisfactory.	Beer has specific organoleptic properties, poorly shaped. It has small defects due to which the product is at the minimum level allowed by the product standard.
7.1 – 12	Unsatisfactory	The beer presents defects due to which it is of an inferior quality to the minimum limit of the product standard. It can be used for consumption only after admitted remediation by technology that do not contravene the rules of food hygiene.
0 - 7	Inappropriate	The beer has major defects, which makes it inappropriate for consumption.

RESULTS AND DISCUSSIONS

Results and discussions from the sensory analysis of the finished beer

Suceava clasic is a clear beer, without suspensions or sediment (5p). CO_2 impregnation is continuous, of short duration (4p), and the foam is white, dense, persistent which leaves a lacy imprint on the glass (4p). The colour is dark yellow (3p) and the smell is characteristic, pleasant with slight aroma of hops and malt (4p). The taste is specific, remnant pleasant, which harmoniously combines the taste of hops and malt with the fine bitter, specific to the assortment (5p). The total score, after applying the weighting factors is 17.2, which indicates that this beer is of good quality.

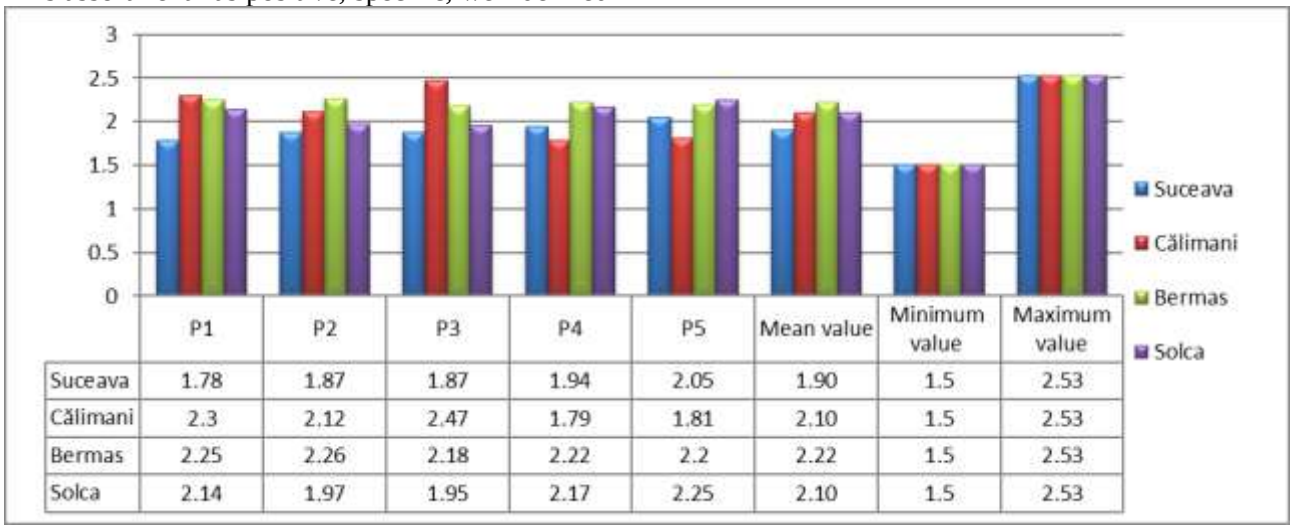
Călimani is a clear beer, without suspensions or sediment (5p). CO_2 impregnation is continuous, of short duration (5p), and the foam is white, dense, persistent which leaves a lacy imprint on the glass (4p). The colour is yellow (4p) and the smell is characteristic, pleasant with aroma of hops and malt (5p). The taste is a specific one, which harmoniously combines the taste of hops and malt with the fine bitter, specific to the assortment (5p). The Călimani assortment is a very good beer. It registered the value of 18.8 points after calculating the total score resulted from the sensory analysis.

Bermas is a clear beer, without suspensions or sediment (5p). CO_2 impregnation is continuous, of short duration (5p), and the foam is white, dense, persistent which leaves a lacy imprint on the glass (4p). The colour is yellow (4p) and the smell is characteristic, pleasant with slight aroma of hops and malt (4p). The taste is a specific one, which harmoniously combines the taste of hops and malt with the fine bitter, specific to the assortment (5p). This assortment has positive, specific, well-defined organoleptic properties and does not present any visible deficiencies or defects. The total score obtained is 18.6, which shows that this beer is of very good quality.

Solca is a clear beer, without suspensions or sediment (5p). CO_2 impregnation is continuous, of short duration (5p), and the foam is white, dense, persistent which leaves a lacy imprint on the glass (4p). The colour is straw yellow (5p) and the smell is characteristic, pleasant with aroma of hops and malt (5p). The taste is a specific one, which harmoniously combines the taste of hops and malt with the fine bitter, specific to the assortment (5p). The total score of 19.6 indicates that this beer is of very good quality.

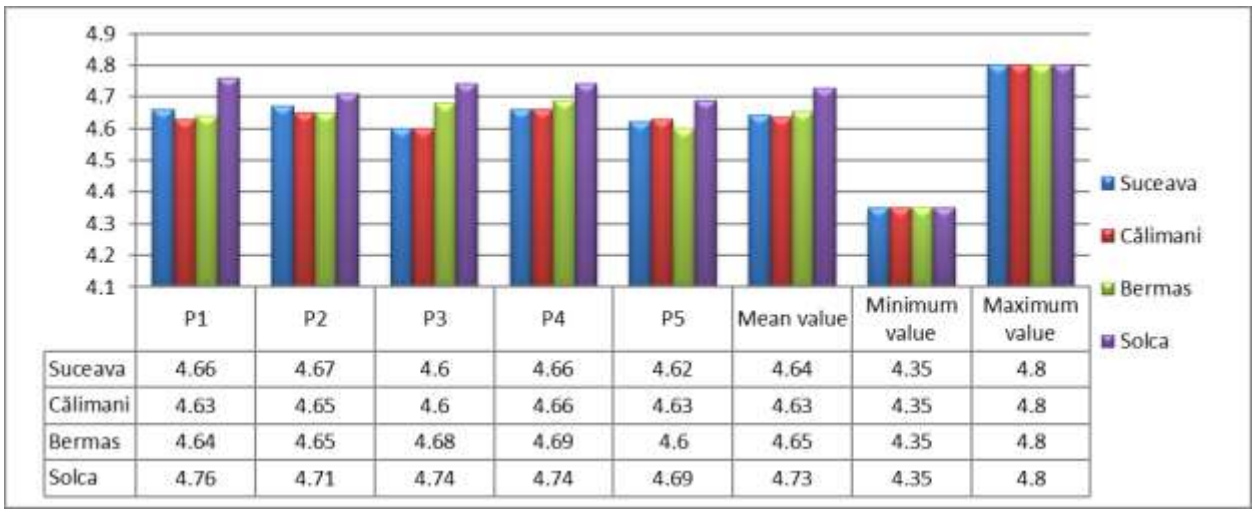
Results and discussions regarding the physico-chemical parameters of the beer during the fermentation period

The initial extraction takes place when the beer is directed into the fermentation tank, the first determinations of the initial extract, pH and acidity being made, for all four types of beer: Suceava clasic, Călimani, Bermas and Solca, at this stage. From the results of the analyzes obtained, it can be observed that the average values of the initial extract, pH and acidity fall within the values imposed at the unit, not exceeding the values established by the organization within the documentation of the food quality and safety management system (*figure 2*, *figure 3*, *figure 4*).



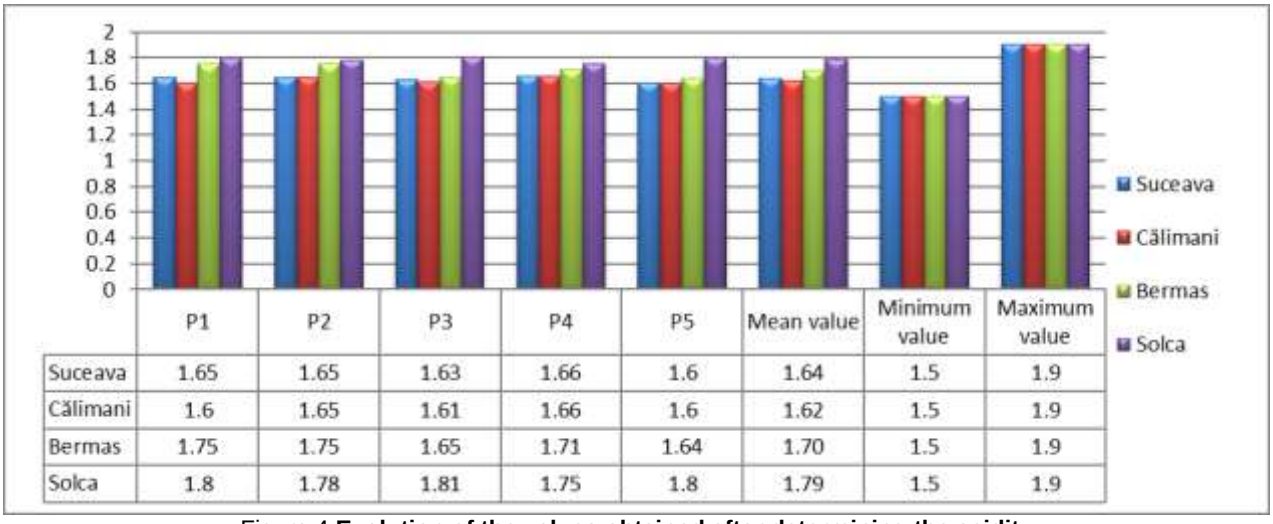
	P1	P2	P3	P4	P5	Mean value	Minimum value	Maximum value
Suceava	1.78	1.87	1.87	1.94	2.05	1.90	1.5	2.53
Călimani	2.3	2.12	2.47	1.79	1.81	2.10	1.5	2.53
Bermas	2.25	2.26	2.18	2.22	2.2	2.22	1.5	2.53
Solca	2.14	1.97	1.95	2.17	2.25	2.10	1.5	2.53

Figure 2 **Evolution of the values obtained after determining the initial extract**



	P1	P2	P3	P4	P5	Mean value	Minimum value	Maximum value
Suceava	4.66	4.67	4.6	4.66	4.62	4.64	4.35	4.8
Călimani	4.63	4.65	4.6	4.66	4.63	4.63	4.35	4.8
Bermas	4.64	4.65	4.68	4.69	4.6	4.65	4.35	4.8
Solca	4.76	4.71	4.74	4.74	4.69	4.73	4.35	4.8

Figure 3 **Evolution of the values obtained after determining the pH**



	P1	P2	P3	P4	P5	Mean value	Minimum value	Maximum value
Suceava	1.65	1.65	1.63	1.66	1.6	1.64	1.5	1.9
Călimani	1.6	1.65	1.61	1.66	1.6	1.62	1.5	1.9
Bermas	1.75	1.75	1.65	1.71	1.64	1.70	1.5	1.9
Solca	1.8	1.78	1.81	1.75	1.8	1.79	1.5	1.9

Figure 4 **Evolution of the values obtained after determining the acidity**

Results and discussions regarding the physico-chemical parameters of the beer at the end of the fermentation period

At the end of the fermentation period, the tasting is carried out and the last physico-chemical analyzes are performed for the four types of beer.

Analyzing the results obtained from the laboratory determinations, it was found that the parameters considered (apparent extract, real extract, pH, alcohol concentration, total acidity, bitter value and CO_2 concentration) fall within the allowed limits, according to the veterinary sanitary norms in force.

The results of the final analyzes of the apparent extract

From the analsis of the values obtained for the apparent extract, it can be observed that the average value for the Suceava clasic beer assortment is 1.59°P, for Călimani beer 1.87°P, for Bermas beer 2.12°P and for Solca beer 1.62°P, the values falling within the limits imposed by the profile unit product standard (*figure 5*).

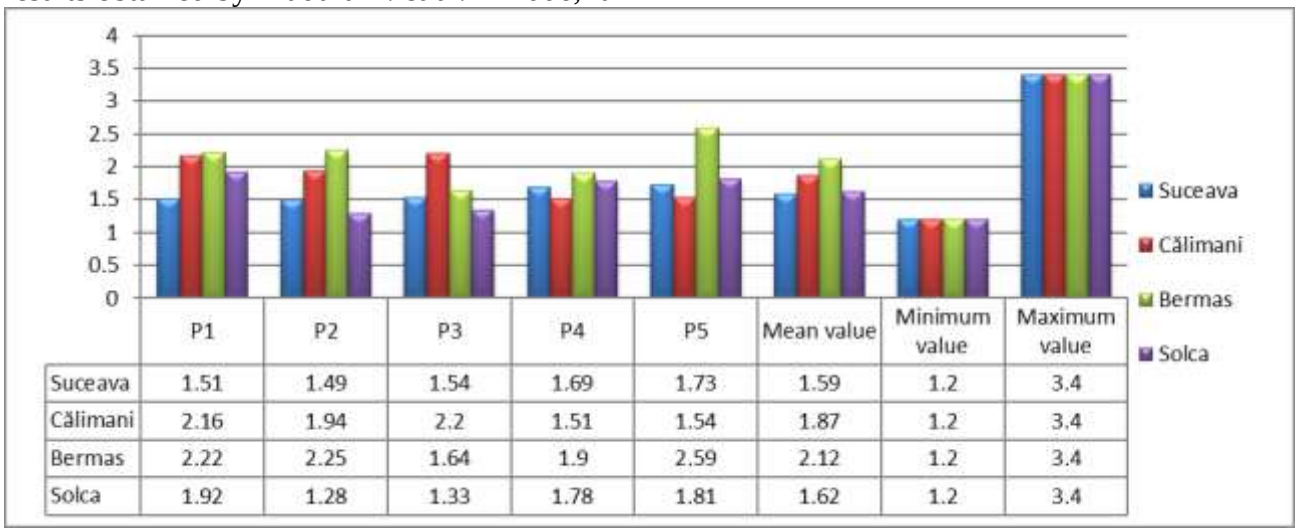
The results of the final analyzes of the real extract

Following the determination of the real extract of the beer in the unit's laboratory, an average value of this parameter of 3.18°P was obtained for the Suceava clasic beer, 3.70°P for the Calimani beer, 4.07°P for the Bermas beer and 3.66°P for Solca beer, all values falling within the limits imposed by the profile unit product standard (*figure 6*).

The results of the final analyzes of the pH

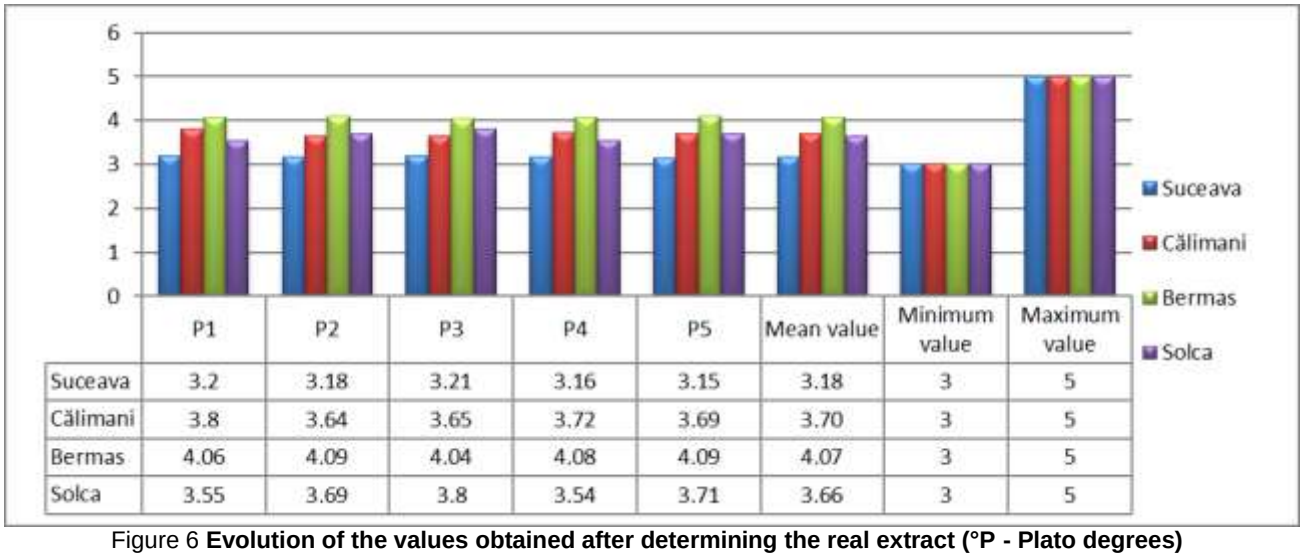
The average pH value recorded is 4.62 for Suceava clasic beer, 4.56 for Călimani beer, 4.58 for Bermas beer and 4.56 for Solca beer, the values falling in the range 4.35-4.8, imposed in the study unit. pH is one of the most important parameters in terms of taste and stability of beer (*figure 7*).

Comparing the results obtained in the present study, regarding the pH value, with the results obtained by Mudura E. et al. in 2006, it was found that similar results were obtained, which fall within the reference range 4.35-4.8.



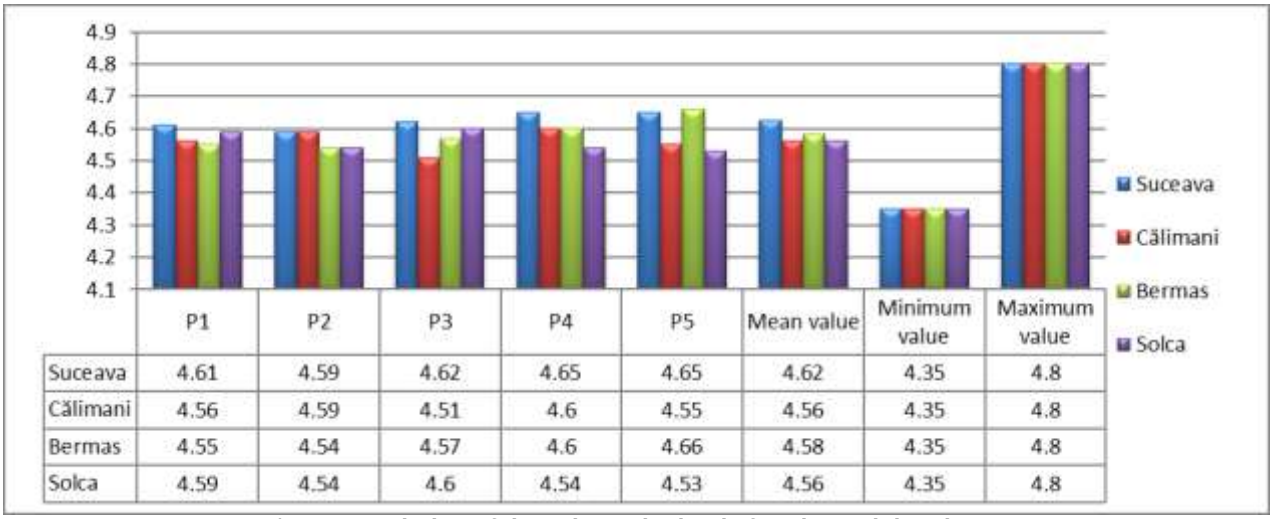
	P1	P2	P3	P4	P5	Mean value	Minimum value	Maximum value
Suceava	1.51	1.49	1.54	1.69	1.73	1.59	1.2	3.4
Călimani	2.16	1.94	2.2	1.51	1.54	1.87	1.2	3.4
Bermas	2.22	2.25	1.64	1.9	2.59	2.12	1.2	3.4
Solca	1.92	1.28	1.33	1.78	1.81	1.62	1.2	3.4

Figure 5 **Evolution of the values obtained after determining the apparent extract (°P - Plato degrees)**



	P1	P2	P3	P4	P5	Mean value	Minimum value	Maximum value
Suceava	3.2	3.18	3.21	3.16	3.15	3.18	3	5
Călimani	3.8	3.64	3.65	3.72	3.69	3.70	3	5
Bermas	4.06	4.09	4.04	4.08	4.09	4.07	3	5
Solca	3.55	3.69	3.8	3.54	3.71	3.66	3	5

Figure 6 **Evolution of the values obtained after determining the real extract (°P - Plato degrees)**



	P1	P2	P3	P4	P5	Mean value	Minimum value	Maximum value
Suceava	4.61	4.59	4.62	4.65	4.65	4.62	4.35	4.8
Călimani	4.56	4.59	4.51	4.6	4.55	4.56	4.35	4.8
Bermas	4.55	4.54	4.57	4.6	4.66	4.58	4.35	4.8
Solca	4.59	4.54	4.6	4.54	4.53	4.56	4.35	4.8

Figure 7 **Evolution of the values obtained after determining the pH**

The results of the final analyzes of the alcohol concentration

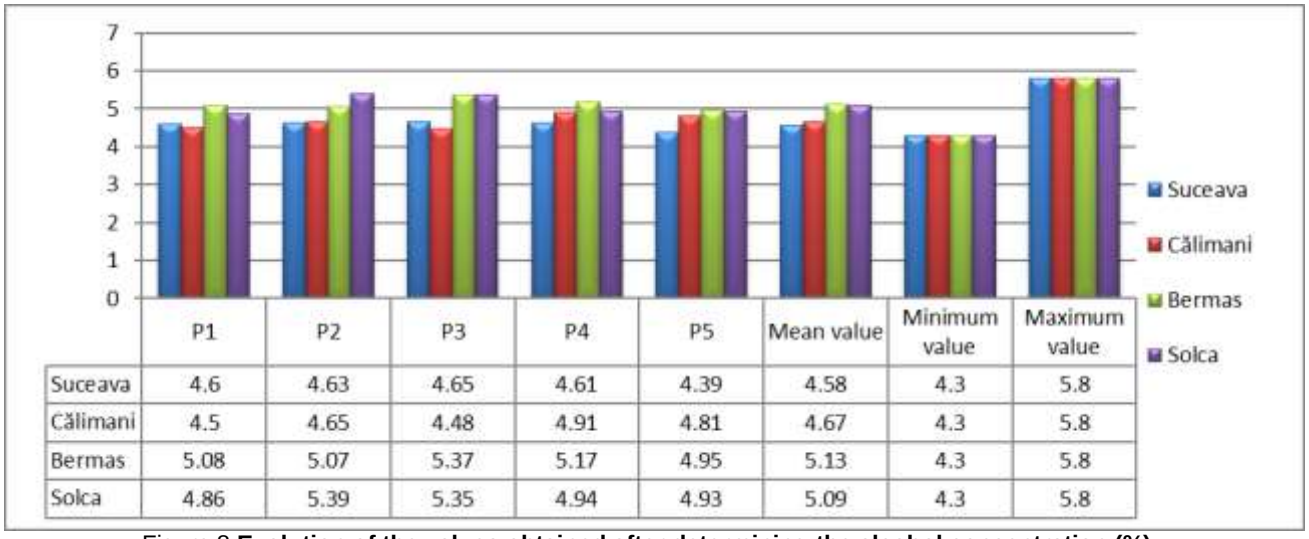
From the analysis of the obtained values, it can be observed that the average value of the alcoholic concentration of the Suceava clasic beer is 4.58%, of the Călimani beer 4.67%, of the Bermas beer 5.13% and of the Solca beer 5.09%, values that falls within the range imposed at the profile unit by the product standard (*figure 8*).

The results of the final analyzes of the total acidity

After determining the total acidity for the four varieties of beer, it can be observed an average value of 1.72 for Suceava clasic beer, 1.67 for Călimani beer, 1.99 for Bermas beer and 2.07 for Solca beer, the interval of reference imposed at the profile unit by the product standard being 1.6 - 4 ml solution NaOH/100 ml of beer (*figure 9*).

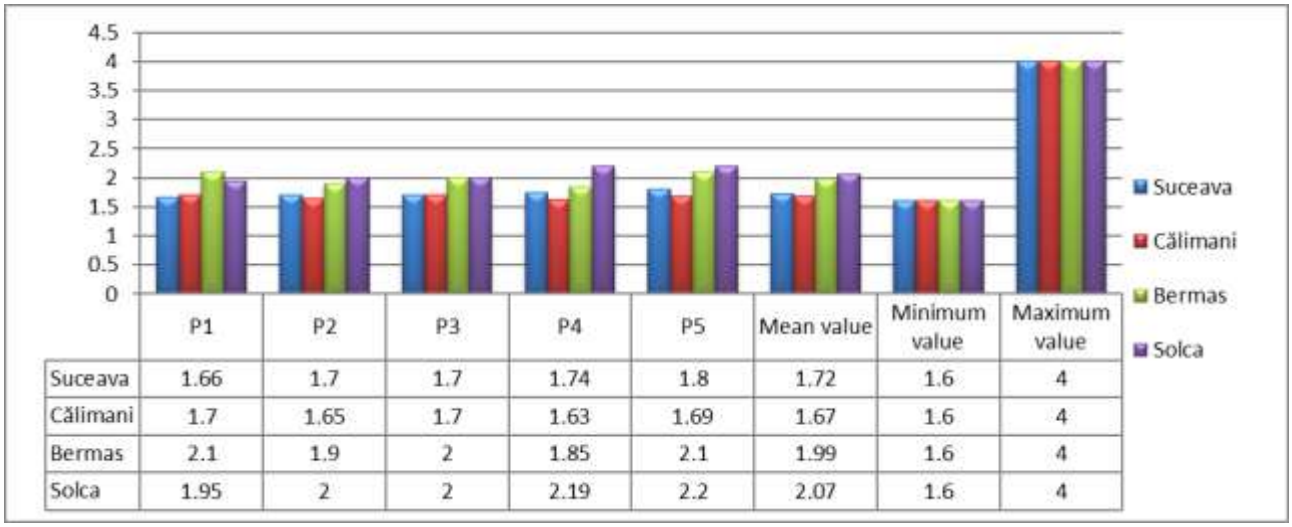
The results of the final analyzes of the bitter value

In the graph below, carried out after the determination of the bitter value for the beer assortments studied, it is noted that the average of this parameter is 23.04 bitter units for Suceava clasic beer, 20.72 bitter units for Călimani beer, 21.31 bitter units for Bermas beer and 21.14 bitter units for Solca beer, the values respecting the reference range required by the product standard (*figure 10*).



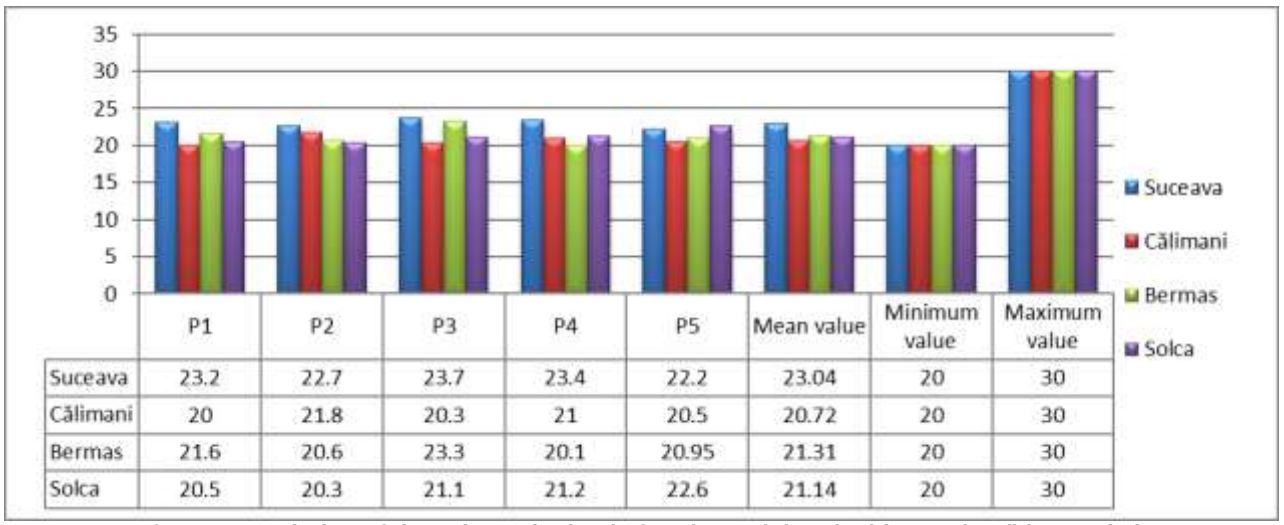
	P1	P2	P3	P4	P5	Mean value	Minimum value	Maximum value
Suceava	4.6	4.63	4.65	4.61	4.39	4.58	4.3	5.8
Călimani	4.5	4.65	4.48	4.91	4.81	4.67	4.3	5.8
Bermas	5.08	5.07	5.37	5.17	4.95	5.13	4.3	5.8
Solca	4.86	5.39	5.35	4.94	4.93	5.09	4.3	5.8

Figure 8 **Evolution of the values obtained after determining the alcohol concentration (%)**



	P1	P2	P3	P4	P5	Mean value	Minimum value	Maximum value
Suceava	1.66	1.7	1.7	1.74	1.8	1.72	1.6	4
Călimani	1.7	1.65	1.7	1.63	1.69	1.67	1.6	4
Bermas	2.1	1.9	2	1.85	2.1	1.99	1.6	4
Solca	1.95	2	2	2.19	2.2	2.07	1.6	4

Figure 9 **Evolution of the values obtained after determining the total acidity (ml solution NaOH 1 N/100 ml of beer)**

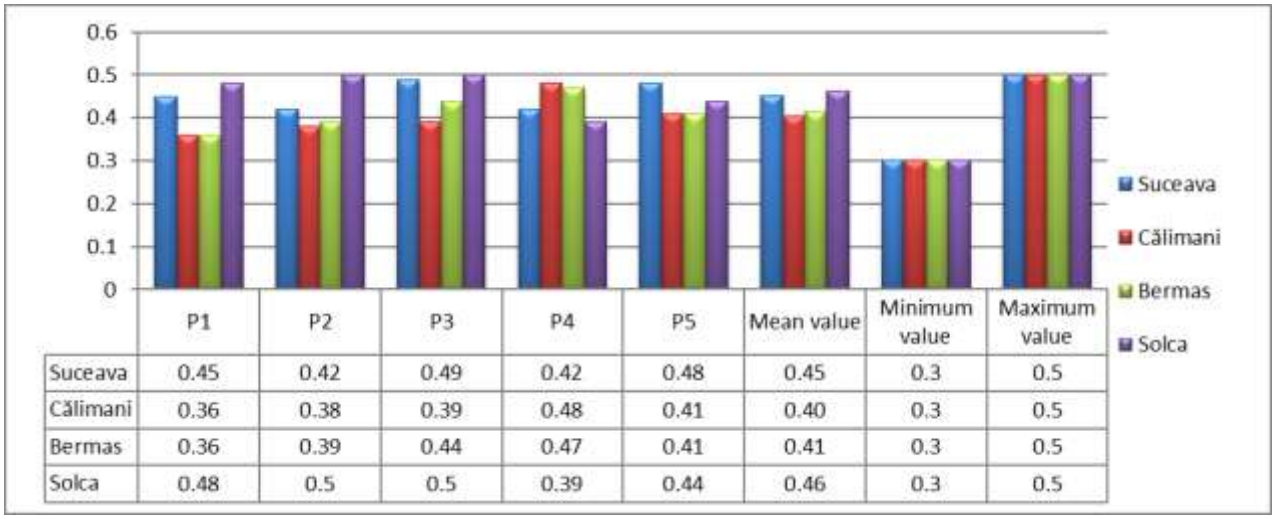


	P1	P2	P3	P4	P5	Mean value	Minimum value	Maximum value
Suceava	23.2	22.7	23.7	23.4	22.2	23.04	20	30
Călimani	20	21.8	20.3	21	20.5	20.72	20	30
Bermas	21.6	20.6	23.3	20.1	20.95	21.31	20	30
Solca	20.5	20.3	21.1	21.2	22.6	21.14	20	30

Figure 10 **Evolution of the values obtained after determining the bitter value (bitter units)**

The results of the final analyzes of the CO_2 concentration

The CO_2 concentrations fall within the range of values imposed at the profile unit for this parameter, namely 0.3-0.5%, registering an average value of 0.45% for Suceava clasic beer, 0.40% for Călimani beer, 0.41% for Bermas beer and 0.46% for Solca beer (*figure 11*).



	P1	P2	P3	P4	P5	Mean value	Minimum value	Maximum value
Suceava	0.45	0.42	0.49	0.42	0.48	0.45	0.3	0.5
Călimani	0.36	0.38	0.39	0.48	0.41	0.40	0.3	0.5
Bermas	0.36	0.39	0.44	0.47	0.41	0.41	0.3	0.5
Solca	0.48	0.5	0.5	0.39	0.44	0.46	0.3	0.5

Figure 11 **Evolution of the values obtained after determining the CO_2 concentration (%)**

CONCLUSIONS

Following the laboratory analyzes of the four types of beer (Suceava clasic, Călimani, Bermas and Solca) obtained in the study unit, resulted that for the analyzed parameters, the obtained values fall within the allowed limits, according to the veterinary sanitary norms in force, respectively the four types of blonde beer have a good or very good quality.

Following the determination of the apparent extract, the lowest value was registered in Solca beer, being 1.28°P and the highest value in Bermas beer of 2.59°P. These results fall within the limits imposed at the profile unit by the product standard.

pH is a very important indicator in the beer industry, the reference range being between 4.35 and 4.8, the highest value obtained being at Bermas beer, respectively pH=4.66.

The concentration in alcohol is another important parameter, all the four types of blonde beer falling in the range 4.3 - 5.8% alcohol, and limits between which the results of the determination of the CO_2 concentration were included, were between 0.3% and 0.5%.

The products obtained within the study unit correspond to the quality requirements imposed by the standards in force and the consumption of these products does not present any risk to the consumer.

It is recommended to maintain the frequency of the laboratory determinations, because this way, obtaining products with constant parameters is guaranteed.

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EFFECT OF WEATHER CONDITIONS ON GROWTH AND YIELD OF WINTER WHEAT

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Abstract

The reaction of winter wheat cultivars in four highly different climatical years, especially regarding the temperature and rainfall, suggested the necessity of stability analyses of their yield. For cultivar recommendation in north-east region if Romania, we evaluated the cultivar ecological plasticity. The paper presents the production results obtained from 44 Romanian varieties of winter wheat grown under pedoclimatic conditions at Ezareni Farm – Iasi Didactic Station, under non-irrigation regime.

The best yield stability had Glosa, Andrada and Bezostaia 1 cultivars. The highest yields have been achieved by Unitar[3], Ursita[4], Mirandal FDL[4], Voinic[3], Otilia[4], T.143-11[3] cultivars, with a [3]three/[4]four years average over 6 t/ha. They have a good yielding ability related to different climatic conditions.

Key words: *Triticum aestivum*, winter wheat, yields, wheather

The main objective of agricultural activity is the obtainment high and stable yields year after year, so that, the large and incalculable variations of environment factors does not strongly affect the yield level. Under optimum conditions, the yield stability is more important than higher yields especially in sustainable agriculture (Rosielle A.A. and Hamblin J., 1981).

The interactions between genotype and environment has an important role in the breeding programs to the releasing of cultivars with specific adaptation to both favourable and unfavourable climatic conditions. The interactions are complex because of very different environmental factors (site, soil, climate) as well as of cultivar traits and features.

In the last years, the tendency of main fluctuations from one year to another as regards the rainfall and temperatures has been emphasized.

During 2015–2019, in Romania, fluctuations from one extremely rainy year (2017) to a droughty one (2018), were registered, as rainfall recorded during the winter wheat vegetation period.

The present paper emphasizes the Romanian winter wheat cultivars with the best yield stability during the last four years, in the North-eastern part of Romania, contributing to a better understanding of their reaction to the stress factors.

MATERIAL AND METHOD

During the last four years (2015-2019), the behavior of 43 Romanian winter wheat cultivars besides the former Bezostaia 1, were studied. Twelve cultivars were studied for a period of four agricultural years: Bezostaia 1 (control variant.), Andrada, Codru, Glosa, Izvor, Miranda FDL, Otilia, Pajura, Pitar, Semnal, T.123-11, Ursita. Eight were studied for a period of four agricultural years: 11424 G1, Dumbrava, T.124-11, T.19-10, Unitar, T.109-12, T.143-11, Voinic. Four were studied for a period of two agricultural years: Zamfira, T.118-11, T.95-12, Litera, and twenty were studied just for an agricultural year: Zamolxe, Zina, Amurg, Armura, Abundent, L5X, T.25-14, T.51-14, T.57-14, T.59-14, T.7-15, Vestitor, Voevod, 11368 G1, 11838 G8, Boema, T.150-11, T.42-05, T.55-01, T.62-01.

The field experiment was carried out at the Didactic Station of Iasi – Ezareni Farm of "Ion Ionescu de la Brad" University of Agricultural Sciences and Veterinary Medicine, situated in the in north-eastern region of Romania at latitudes of $47^0$07'36" N, longitude $27^0$30'45"E and altitude 125 m above mean sea level.

The general climatic condition of Iasi area is classified as pronounced continental temperate climate with mean annual rainfall of about 550-600 mm out of which 68 percent rainfall is received during warm season. Maximum and minimum temperature ranges between 38^0C (August) -22^0C (January).

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RESULTS AND DISCUSSIONS

The effects of climate change represent a significant threat to global food security, not only by increasing global average temperatures, estimated at 1.5-2°C during the 20th and 21st centuries, but also through increasing the frequency and severity of extreme weather events. The increase of heat waves, drought, floods and the pressure exerted by pests create direct demands on crops, which leads to reduced yields (Ilangumaran G. *et al*, 2018).

The first decade of the 21st century has positioned the north-eastern area of Romania in an unprecedented position. The region of Moldova is forced, lately, to face very hot and drought and very humid and rainy periods. These climatic events in some cases exceed the relevant meteorological observations, some of them varying strongly from the multiannual average values recorded so far (Machidon O., 2017).

The characteristics of the climate of a region are very important for the geographical environment of the respective region, for the life of the people in that area, as well as for the economic activities, or of another's activities developed in that area. As a whole, the climate of the north-eastern part of Romania can be characterized by the presence of favourable features, but on this background are frequently observed climatic events which limited the high potential of this geographical area. Sometimes, the manifestations of climatic elements and phenomena are quite unusual, creating real difficulties for people and damaging the economy (Săulescu N. *et al*, 2006, Vasilescu L. *et al*, 2014).

Having in view that the experiments were performed under field conditions, the results were influenced by the climatic factors specific to the analyzed period. *Table 1* presents the air temperatures, rainfall and relative humidity registered at Ezareni Farm – Iasi Didactic Station during March-July, 2015-2019. The climatic data on the air temperature, rainfall recorded during the studied period were carefully analyzed for comparisons between the four studied agricultural years, as well as for observing the trends of evolution of air temperature over time.

Table 1

Climatic conditions at Ezareni Farm – Iasi Didactic Station, during 2016-2019

		March	April	May	June	July
Air Temperature (^{0}C)						
Multiannual average (^{0}C) (last century)		**3.1**	**10.2**	**16.0**	**19.5**	**21.2**
2016	Month average (^{0}C)	6.5	13.3	15.3	20.9	22.6
	Deviation (^{0}C)	+3.4	+3.1	-0.7	+1.4	+1.4
2017	Month average (^{0}C)	8.0	10.0	16.1	21.1	21.6
	Deviation (^{0}C)	+4.9	-0.2	+0.01	+1.6	+0.04
2018	Month average (^{0}C)	1.2	15.4	18.7	20.8	21.3
	Deviation (^{0}C)	-1.9	+5.2	+2.7	+1.3	+0.1
2019	Month average (^{0}C)	7.3	10.6	16.1	21.9	21.2
	Deviation (^{0}C)	+4.2	+0.4	+0.1	+2.4	0.0
Rainfall (mm)						
Multiannual sum (mm) (last century)		**28.4**	**43.9**	**55.9**	**82.6**	**69.3**
2016	Month sum (mm)	33.8	76.2	70.4	142.4	24.0
	Deviation (mm)	+5.4	+32.3	+14.5	+59.8	-45.3
2017	Month sum (mm)	107.0	140.4	72.8	71.6	84.4
	Deviation (mm)	+78.6	+96.5	+16.9	-11.0	+15.1
2018	Month sum (mm)	56.8	18.0	16.8	216.0	136.6
	Deviation (mm)	+28.4	-25.9	-39.1	+133.4	+67.3
2019	Month sum (mm)	40.4	62.6	125.2	113.8	24.2
	Deviation (mm)	+12.0	+18.7	+69.3	+31.2	-45.1

Between 2015-2019, in the experimental field of the Ezareni Farm, 44 winter wheat genotypes were tested, in terms of production stability (*figure 1*).

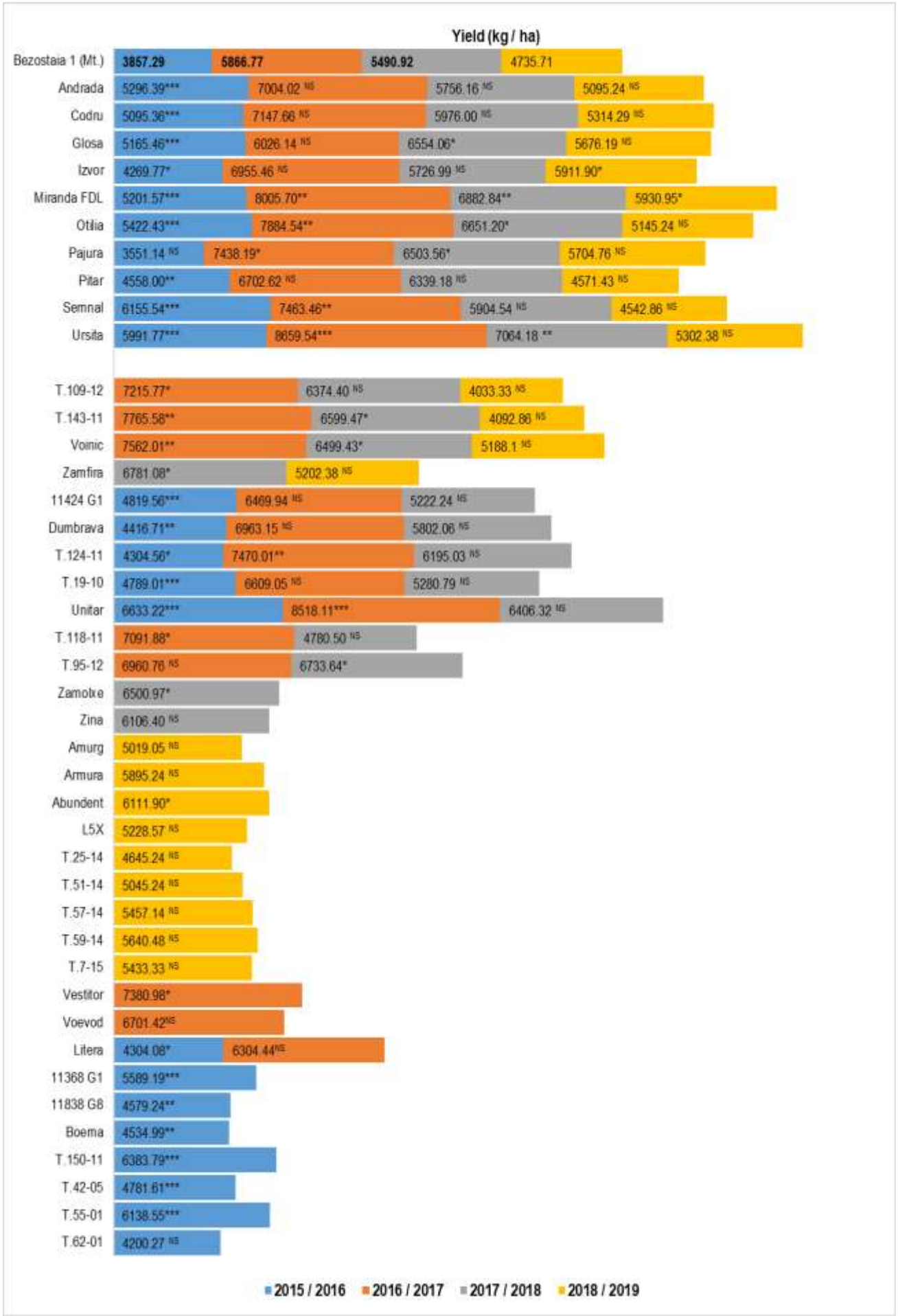

Figure 1 **Yields recorded between 2015-2019**

The average yields recorded at the surface unit was (per ha), in most cases, were above the control genotype, Bezostaia 1.

The highest yields were registered in 2017, and the lowest yields were registered in 2016. In the last two years of experiments were recorded medium yield values.

The highest yields were recorded in 2017, wen between March and June was recorded the highest rainfall.

The driest period, was recorded in 2018, but in this year before sowing was recorded a high level of precipitation which favored the good emergence and development of wheat plants in autumn.

CONCLUSIONS

The best yield stability had Glosa, Andrada and Bezostaia 1 cultivars. The highest yields have been achieved by Unitar[3], Ursita[4], Mirandal FDL[4], Voinic[3], Otilia[4], T.143-11[3] cultivars, with a [3]three/[4]four years average over 6 t/ha. They have a good yielding ability related to different climatic conditions.

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INNOVATIONS AND ADVANCED TECHNOLOGIES – SOURCES TO INCREASE THE COMPETITIVENESS OF AGRICULTURAL ENTERPRISES FROM THE HORTICULTURAL SECTOR OF THE REPUBLIC OF MOLDOVA

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Abstract

Achieving success in business depends indisputably by the notion of competitiveness, which is a very used term in the modern economy, characterizing the level of performance of an enterprise. We can speak about the notion competitiveness at different levels: product competitiveness, enterprise's competitiveness, competitiveness of a branch of economy and competitiveness of a country. Although competitiveness has many definitions al over the World, we can conclude that it doesn't exist an unique opinion regarding this notion and we can afirm that the competitiveness of a country depends on the competitiveness of the enterprises from this country. It is crucially for any long-term organizational development strategy to introduce innovations, advanced technologies in the adopted business models, in the processes of production, which will determine high level of productivity, thus contributing at the increasing of the competitiveness of the enterprises. The purpose of this scientific research is to: analyze the innovations and advanced technologies as a source of increasing the competitiveness of agricultural enterprises from the horticultural sector of the Republic of Moldova, to highlight the major problems faced by the agricultural enterprises in introducing innovations and new technologies in the production of horticultural production, to reveal the role of the state in application of innovations and advanced technologies to develop a high performance agriculture and to propose measures for enhancing the competitiveness of agricultural enterprises through innovations and new technologies.

Key words: innovatios, advanced technologies, competitiveness, agricultural enterprises, total factor productivity

Agricultural sector is the traditional branch of the economy of the Republic of Moldova which, contributed to GDP in 2018 by 10.2% and the gross added value increased by 1.9% compared to 2017.

The increase of the global agricultural production was determined by the increase of the vegetal production – by 3.8%, the animal production being in decrease by 1.1%.

Analyzing the structure of the agricultural production, we can reveal that an important share – more than 25% is represented by the horticultural production, which is high value added production, generating high incomes for the population from the rural areas.

Nowadays the production of the horticultural production is performed manually, without performant technologies, in this sense the enterprises loose from productivity and at the end influencing negatively on competitiveness.

Those enterprises who use the results of the scientifical research, new technologies, innovations and the work of high performant machines are more competitive on the market.

The necessity of innovations is essential for the development of an agricultural enterprise from the horticultural sector, because innovations represent a complex system, an integrated process to the general strategy of the company, which contributes to acheaving the objectives of the company, contributing to increasing the competitiveness of the enterprises.

According to the Oslo Manual 2018, „***an innovation*** is:

- ✓ a new or improved product or process (or combination thereof)
- ✓ that differs significantly from the unit's previous products or processes and
- ✓ that has been made available to potential users (product) or brought into use by the unit (process)".

There are different types of innovations, according to Oslo Manual 2018 (OECD/Eurostat, Oslo Manual, 2018):

- ❖ **Product innovation**: A good or service that is new or significantly improved. This includes significant improvements in technical specifications, components and materials,

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software in the product, user friendliness or other functional characteristics.

- **Process innovation**: A new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.
- **Marketing innovation**: A new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
- **Organisational innovation:** A new organisational method in business practices, workplace organisation or external relations.

Therefore, innovations are essential for the development of the agricultural enterprises from the horticultural sector of the Republic of Moldova, encouraging technical creativity, through taking risks and their minimization through an adequate change management.

The objectives of the scientific research are: to analyze the situation from the Republic of Moldova regarding the application of innovations, to analyze the role of the state in promoting the innovational activity in enterprises, to evidentiate the role of innovations and advanced technologies in increasing the competitiveness of the agricultural enterprises from the horticultural sector of the Republic of Moldova, using the global indicator of competitiveness: ***Total Factor Productivity***; to propose measures of increasing the innovational activity in the agricultural enterprises from the Republic of Moldova.

MATERIAL AND METHOD

In this scientific research were used data from the:

- ✓ ***National Bureau of Statistics of the Republic of Moldova;***
- ✓ ***National Bank of Moldova;***
- ✓ ***Ministry of Agriculture, Regional Development and Environment of Republic of Moldova; etc.***

In the same time in this scientific study was used the global indicator of competitiveness - ***Total Factor Productivity*** (TFP), being calculated on the basis of the Malmquist productivity index, which consists of two components: the index of technological change and the index of technical efficiency change (Chaudhary S., 2012; Fare R.,et. al, 1994; Knox Lovel C.A., 2003; Cimpoieş D., Racul A., 2006; Squires D., Reid C., 2004; Лисситса А, et al., 2003):

$$M_0(x^{t+1},y^{t+1},x^t,y^t) = \frac{D_0^{t+1}(x^{t+1},y^{t+1})}{D_0^t(x^t,y^t)}[(\frac{D_0^t(x^{t+1},y^{t+1})}{D_0^{t+1}(x^{t+1},y^{t+1})})(\frac{D_0^t(x^t,y^t)}{D_0^{t+1}(x^t,y^t)})]^{\frac{1}{2}}$$

Where,

Technical efficiency change:

$$\frac{D_0^{t+1}(x^{t+1},y^{t+1})}{D_0^t(x^t,y^t)}$$

Technological change:

$$(\frac{D_0^t(x^{t+1},y^{t+1})}{D_0^{t+1}(x^{t+1},y^{t+1})})(\frac{D_0^t(x^t,y^t)}{D_0^{t+1}(x^t,y^t)})^{\frac{1}{2}}$$

TFP may take the following values:

a) TFP>1, then in the period t (between the moment t and t+1) was registered an increase of productivity;

b) TFP=1, in this case wasn't registered changes at the productivity level;

c) TFP<1, then was registered a decrease of productivity.

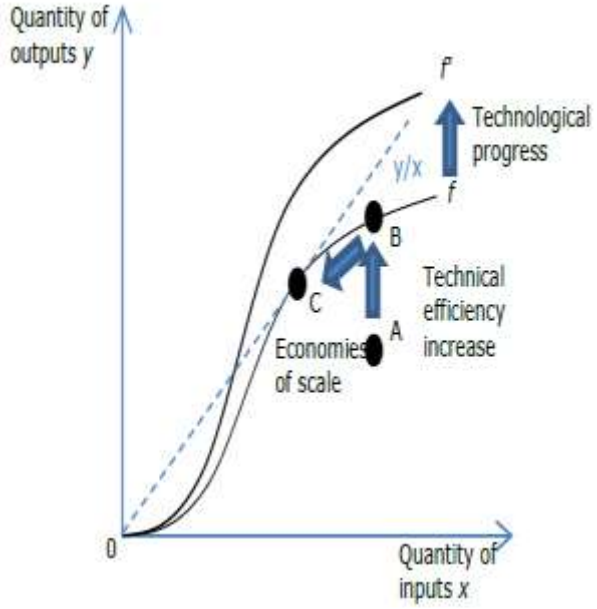

Figure 1. **Ways for increasing productivity of the agricultural enterprises**

Source: Latruffe (2010)

TFP reveals the joint effects of many factors including new technologies, innovations, efficiency gains, economies of scale, managerial skill, and changes in the organization of production (Latruffe L., 2010). Figure 1 shows possible pathways to improve productivity. One way is to shift the production frontier upwards by implementing new technologies (moving from f to f'). Another way is to increase the technical efficiency by better applying existing technologies (catching-up through better management, going from A to B). Economies of scale refer to optimizing the scale of operations to achieve a better output over input ratio (from B to C).

The data processing was performed using the DEAP version 2.1, elaborated by Tim Coelli, Centre for Efficiency and Productivity Analysis, Department of Econometrics, University of New England (Australia).

As research methods were used: analysis, synthesis, comparative method, logical analysis, graphical method.

RESULTS AND DISCUSSIONS

The agricultural production in 2018 constituted 102.5% compared to 2017 year. The increase of the agricultural production was determined by the increase of the vegetal production by 3.8%, the animal production being in decrease by 1.1% (NBS, 2018).

From the total agricultural production the horticultural production constitutes approximately one fourth (NBM, 2018; MARDE, 2018).

The horticultural sector is represented by two sub-sectors:

• Sub-sector of fresh horticultural products

• Sub-sector of processed horticultural products.

From these two sub-sectors, subsector of fresh horticultural products is generating highest incomes, being competitive on the local market.

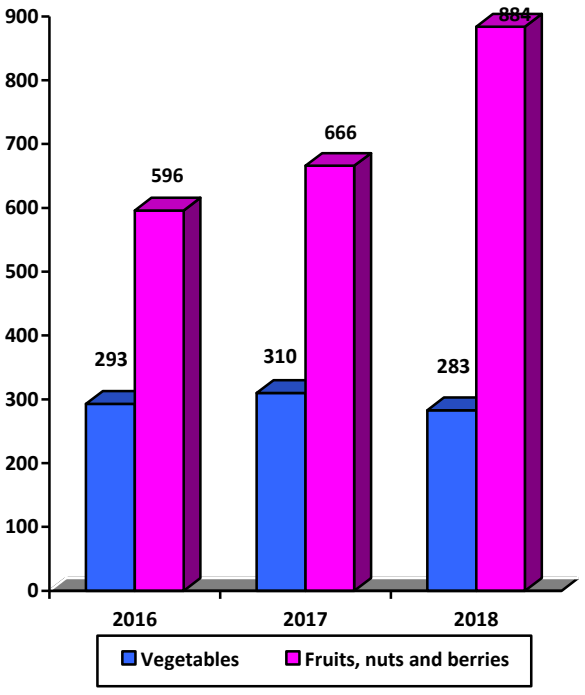

Figure 2 . **The dynamics of production of vegetables and fruits, nuts and berries during 2016-2018 (thousand tonnes)**

Analyzing the dynamics of production of vegetables and fruits, nuts and berries during 2016-2018, we can reveal an increasing trend of fruits from 596 thousand tonnes in 2016 to 884 thousand tonnes in 2018 and a decreasing trend of vegetables from 293 thousand tonnes in 2016 to 283 tonnes in 2018.

Analyzing the structure of the horticultural production in 2018 by categories of households, we can reveal that vegetables were mostly produced in population households – 75.2%, being followed by agricultural enterprises – 14% and peasant farms – 10.8%.

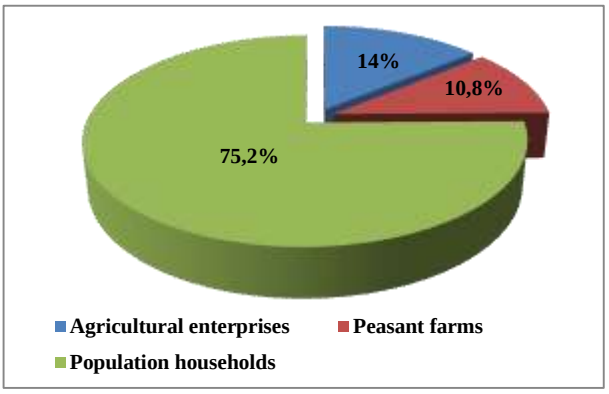

Figure 3. **Distribution of the vegetables production by categories of households, 2018 (%)**

Analyzing the distribution of fruits, nuts and berries production by categories of households we can reveal that the majority of production is produced in peasant farms – 50.1%, being followed by agricultural enterprises – 39.2% and population households – 10.7% (NBS, 2018).

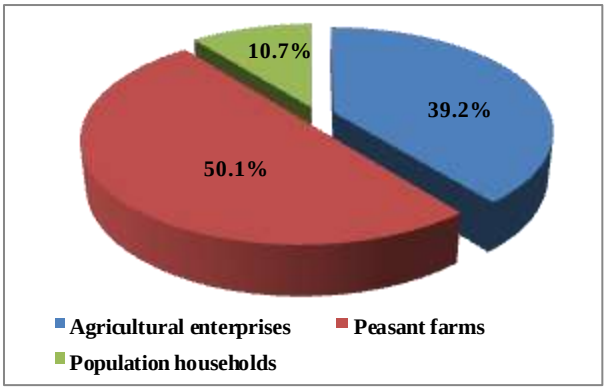

Figure 4. **Distribution of fruits, nuts and berries production by categories of households, 2018 (%)**

The competitiveness of agricultural enterprises from the horticultural sector of the Republic of Moldova was determined using Total Factor Productivity (TFP), which is considered "global index of competitiveness".

In the scientific investigation were used 303 agricultural enterprises, with horticultural frontier of function of production.

The data was processed using the Data Envelopment Analysis Program 2.1.

The function for determining the competitiveness of the agricultural enterprises from the horticultural sector had the following form:

$$\begin{cases} \min\limits_{\theta,\lambda} \theta \\ -y_i + Y\lambda \geq 0 \\ \theta x_i - X\lambda \geq 0 \\ N1' \lambda \leq 1 \\ \lambda \geq 0, \end{cases}$$

Where:

θ- efficiency parameter;

n – number of farmers

Y – output vector, represented by the income from selling the agricultural products

X – input vector, n^x 3 dimensional, given by:

a) Surface of the agricultural lands effectively seeded
b) Costs for labour remuneration, thousands lei
c) Other costs, which include: costs for seeds and planting material, thousands lei + costs for chemical and natural fertilizers, thousands lei + costs for auxiliary activities and indirect consumptions, thousands lei

N1–is vector n- dimensional with 1 component;

λ – variable of linear programming problem which would be solved.

Table 1

The command file hr303.ins of evaluation the competitiveness of the agricultural enterprises from the horticultural sector of the Republic of Moldova

```
hr303.dta   DATA FILE NAME
hr303.out   OUTPUT FILE NAME
303         NUMBER OF FIRMS
5           NUMBER OF TIME PERIODS
1           NUMBER OF OUTPUTS
3           NUMBER OF INPUTS
1           0=INPUT AND 1=OUTPUT ORIENTATED
0           0=CRS AND 1=VRS
2           0=DEA(MULTI-STAGE), 1=COST-
               DEA,2=MALMQUIST-DEA,3=DEA(1-
               STAGE), 4=DEA(2-STAGE)
```

Source: elaborated by the author using the DEAP 2.1

Analyzing the TFP of the agricultural enterprises from the horticultural sector of the Republic of Moldova during 2014-2017, we can reveal that the average of this indicator is equal to 1.048, which reflects an increase by 4.8%. The increase of the indicator mentioned above, was determined by the increase of the technical efficiency change (ΔTE) by 13.5%, which is the product between the scale efficiency change (ΔSE) and the pure efficiency change (ΔPE).

From the table 1 it is revealed that the average of technological efficiency change (ΔT) during 2014-2017, is equal to 0,923, which is a subunit value, which signifies that the application of the performant technologies, innovations, the results of the technological progress decreased by 7.7%.

The value of this indicator below 1, represents that in the modernization of the park of tractors, machinery, production equipments were not performed significant investments and the enterprises doesn't use the results of the technological progress, innovations in the process of production.

Table 2

The analyze of competitiveness of agricultural enterprises from horticultural sector during 2014-2017 year (extract of 10 registrations from the DEAP results)

Nr. of enterprise	ΔTE	ΔT	ΔPE	ΔSE	TFP
2	1.299	1.013	1.403	0.926	1.315
5	0.731	0.912	0.924	0.792	0.667
41	1.604	0.970	1.423	1.127	1.556
46	1.151	0.928	1.051	1.096	1.068
71	1.153	1.060	1.267	0.910	1.222
80	0.901	0.885	0.865	1.043	0.798
105	1.330	0.897	1.387	0.959	1.193
182	0.959	1.100	1.160	0.826	1.055
217	1.034	0.950	1.238	0.835	0.983
303	0.744	0.774	0.792	0.939	0.576
Average	**1.135**	**0.923**	**1.185**	**0.957**	**1.048**

From the analyze of competitiveness of the agricultural enterprises from the horticultural sector of the Republic of Moldova during 2014-2017, it is revealed that the enterprise number 2 has TFP equal to 1.315 and it is more competitive compared to the average of TFP for 2014-2017, which was equal to 1.048. The increasing of TFP was ensured by the technical efficiency change by 29.99% which also was determined by the increase of the pure efficiency change by 40.3%. The scale efficiency change registered a decrease by 7.4%. The technological change registered an increase by 1.3%, which means that the enterprises is using the results of the technological progress, innovations and new technologies.

Analyzing the enterprise with the number 303, we see that TFP is equal to 0.576, which

means that the enterprise is not competitive, and this indicator decreased by 42.4%. The decrease was determined by the decrease of the technical efficiency change by 25.6% and by the decrease of the technological change by 22.6%. In this company the subunit value of the technological change, reveals low investments in new technologies, new machinery, low degree of innovations, determining low level of competitiveness of the company.

Analyzing the table 2 we can conclude that more competitive are the enterprises with technological efficiency change more than 1, this means that these enterprises apply new technologies, inovations, invest in implementing the results of the technological progress and those enterprises where the technological efficiency change is less than 1, we can see that these enterprises are less competitive with lower value of TFP.

Innovations are the heart of the competitiveness of an enterprise. It is very important that the development strategy within the organization to be based on innovations.

Analyzing the Global Innovation Index for the period 2014-2018, we can reveal that it continuously decreased from 40.7 in 2014 to 37.6 in 2018

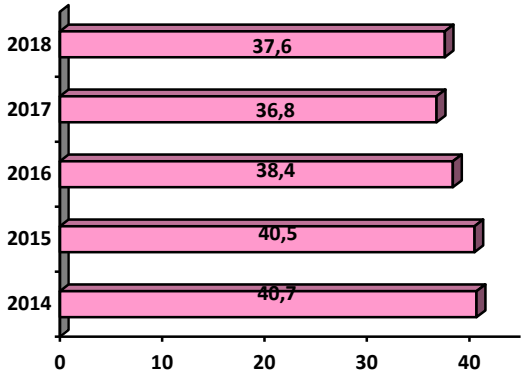

Figure 5 . **The Global Innovation Index of the Republic of Moldova during 2014-2018**

Among the factors determinng the decreasing of the Global Innovation Index is the research and development expenditure, percent of GDP. Analyzing this indicator for the period 2010-2017, we can reveal that it decreased significantly from 0.44 to 0.3 in 2017.

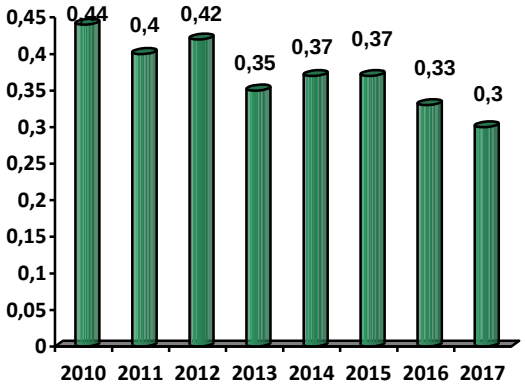

Figure 6 . **The research and development expenditure, percent of GDP of the Republic of Moldova during 2010-2017**

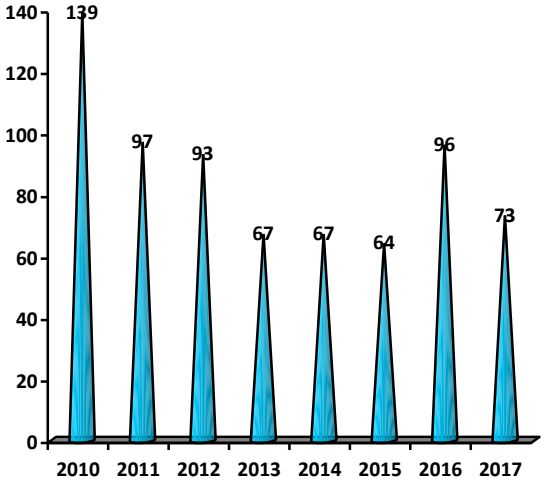

Figure 7 . **The patent application in Republic of Moldova during 2010-2017**

The figure 7 reveals a decreasing trend of the patent application in Moldova during 2010-2017 from 137 registered patents in 2010 to 73 registered patents in 2017.

Thus, we can reveal from the performed analysis that it is very important that the state to increase the research and development expenditures in Moldova, creating innovational parks where will be elaborated performant technologies which will be used in the agricultural production. It is very important, to strengthen the connections between business environment and the activities of research and innovation, which now are weak.

CONCLUSIONS

As a result of the performed scientific investigations we can reveal the following conclusions:

1. The horticultural production constitutes one fourth from the total agricultural production of the Republic of Moldova.

2. Vegetables production is produced mostly (75,2%) in population households, while fruits, nuts and berries are produced mostly in peasant farms (50,1%).

3. The enterprises from the horticultural sector which used innovations, advanced technologies registered values of TFP greater than 1, which was determined by the increase of technological efficiency, which also registered supraunitary values ($\Delta T>1$), being more competitive on the market, compared to those enterprises which did not use innovations, modern technologies in the process of production, registering subunit values of TFP and ΔT.

4. The innovation and research activity from Moldova is directly connected to the investments performed by the state, registering in the period of 2010-2017 a decrease of the research and development expenditure, percent of GDP from 0.44 in 2010 to 0.3 in 2017.

5. It is necessary to strengthen the connections between business environment and the research and innovations activites and to increase at the state level the research and development expenditures, percent of GDP of Moldova, in order to create innovational parks, create new technologies, apply innovations, which will be used in the process of production by the agricultural enterprises from the horticultural sector of the Republic of Moldova, contributing in this sense, at increasing the competitiveness of enterprises.

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INNOVATIVE AGRICULTURAL BUSINESSES – ELEMENTS OF AN EFFICIENT FARM MANAGEMENT

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Abstract

Innovation is one of the neo-factors with the greatest influence on building or enhancing a competitive advantage in all fields of activity, including the agricultural sector. Innovative agricultural businesses are the ones that ensure differentiation in relation to competition and are the main sources of added value in a dynamic economy. Innovation is one of the attributes of the entrepreneur. Business ideas that identify new products, new features or usage patterns as well as new market niches are tools that help ensuring successful management of the farms concerned. The paper aims to identify a series of innovative business ideas related to agricultural and agri-food activities, to provide examples of good practices associated with these businesses and to analyze the importance of innovation at European, national and local level. The study highlighted the direct correlation between innovation and performance, the Research and Development department of each enterprise gaining increasing importance related to the production department. Firms that did not adapt to the ever-changing environment and did not adopt differentiation strategies have involved or stagnated economically while companies that have come up with new products or presentation methods, new technologies and processing systems have considerably improved their economic results by becoming leaders in the segment targeted by them. Growing lavender, planting peanut, natural juice factories or cultivating and processing medicinal plants are some of the innovative businesses identified that have developed and brought to the entrepreneurs great results and to customers new products and services adapted to their needs.

Key words: innovation, agricultural business, farm management, agri-food sector, performance

Management is a science, respectively a systematized body of laws, principles, theories, instruments and requirements that must be respected in the process of effective management of the company's activities which have as a final objective the profit (Radu E. *et al*, 2003).

The agricultural farm represents the basic economic unit for the agricultural production consisting of agricultural land and/or the enclosure in which are the constructions, storage spaces, agricultural machinery and equipment, other annexes, animals and birds, as well as the related utilities that contribute to the agricultural activities. (Brezuleanu S. *et al*, 2017).

Farm management is fundamentally focused on how the farmer obtains and uses the essential means (land, labor, capital, time) that he has in order to achieve a certain number of objectives. (Manole V. *et al*, 2001) and today, throughout the world, management is recognized as the most important social sector of progress (Brezuleanu S., 2009).

Research and innovation are crucial tools to achieve a smarter and sustainable agriculture sector (Dovleac Lavinia, Bălăşescu, M., 2016) and the innovation is represented by the ability to continuously transform knowledge and ideas into new products, processes and systems, to the benefit of both the organization and the shareholders. (Popa I. *et al*, 2010).

Achieving the goal of an Innovative Europe requires a new paradigm of mobility, flexibility and adaptability to allow R&D and innovation to create the value that can then support our quality of life. (***, 2006, Creating an Innovative Europe)

Innovativeness is a key attitude in any management teams and any firms, thus coming out with new ideas for the competitive advantage and durability of their firms (Zawawi N.F.M., 2016).

Innovation represents the potential for creating wealth from already existing means. In other words, innovation can be defined as that ability whereby a means (in economic or social sense) is found to be used for something new.

Innovation is the specific function of the business initiative; it is the means by which the entrepreneur either creates new wealth-producing resources or endows the existing ones with an increased wealth creation potential.

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MATERIAL AND METHOD

Material used within this research is formed by European reports regarding innovations and enterprises, Eurostat Databases, data from National Institute of Statistics. The methods used in order to achieve the required results were: statistical data analysis and data interpretation, comparative analysis, case study etc.

RESULTS AND DISCUSSIONS

Developing a long-term view on agricultural research and innovation (R&I) needs, fosters the overall consistency, sequencing and impact of R&I activities. A strategic approach helps to ensure synergies between R&I activities and other EU policies and set a common direction with Member States and for international research cooperation regarding different strategic priorities and sectors *(figure 1).* The strategic coordination with Member States is crucial as the resources dedicated to agricultural research and innovation at EU level still represent only about 10% of Member States public investments in the same area.

Figure 1 **Strategic priorities and sectors Horizon 2020**
(Source: 2018 - Agriresearch factsheet)

Romania, next to Bulgaria, ranks last in terms of the performance of the innovation systems *(figure 2, 3).* In Romania the largest share regarding innovation expenses allocated to the purchases of machinery, equipment, software and buildings (48.3% in 2016) and only 44.7% on internal or external research-development activities *(figure 4).*

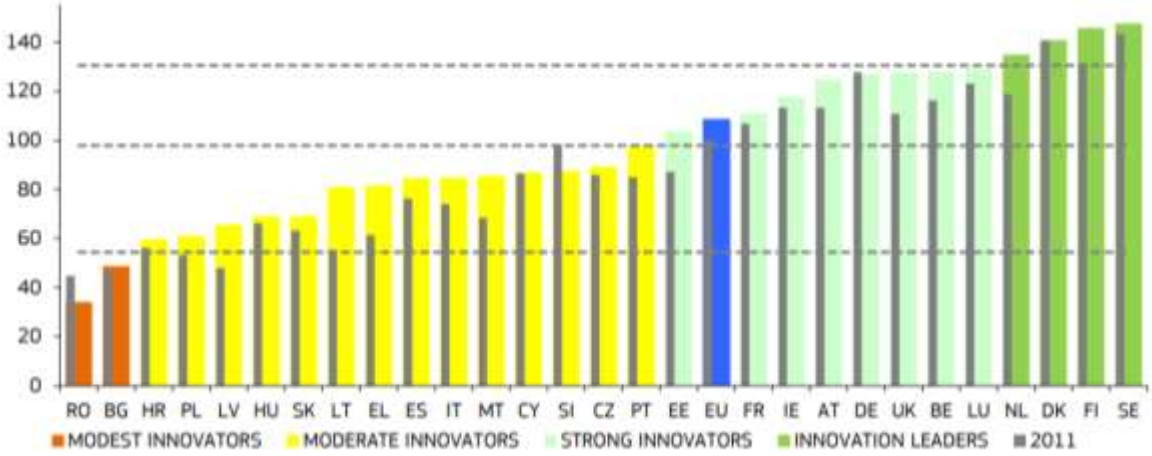

Figure 2 **The performance of the innovation systems of the EU Member States (% of EU average)**

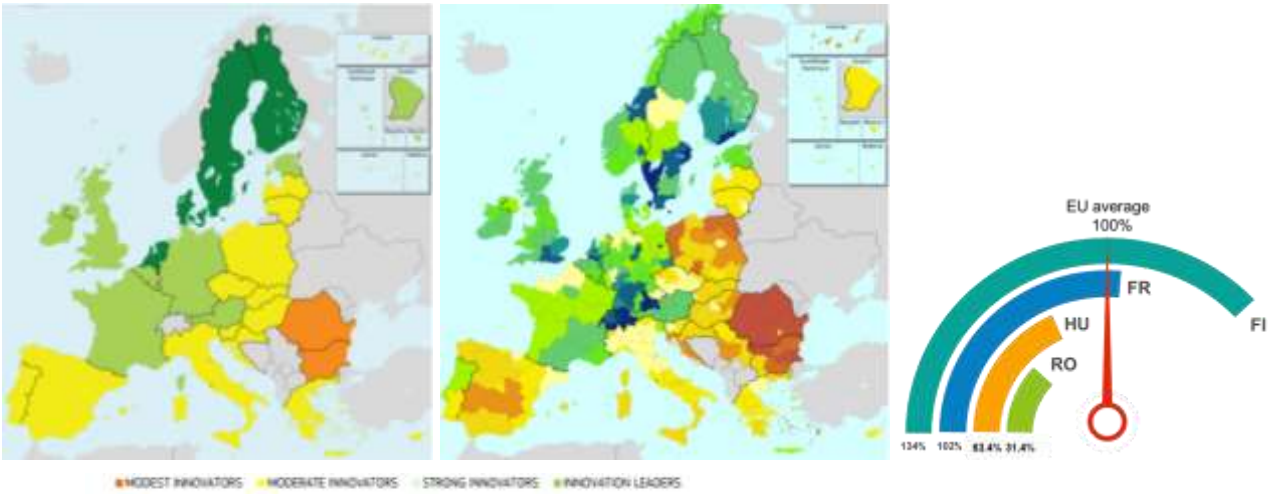

Figure 3 **Comparative analysis of the innovation systems within EU (% of EU average)**

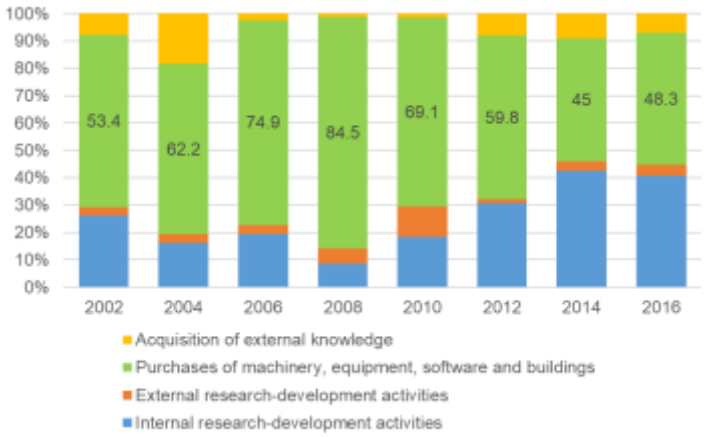

Figure 4 **Share of innovation costs of enterprises with product and/or process innovation in Romania**

The evolution of the number of innovative enterprises by innovation categories in Romania *(table 1)* indicates that enterprises only with product and / or process innovation and enterprises only with organizational and/or marketing innovation represent only 12.7% from the total of innovative businesses.

Table 1

Evolution of the number of innovative enterprises by innovation categories – Romania

	2008		2010		2012		2014		2016	
	Number	*Percent*	Number	*Percent*	Number	*Percent*	Number	*Percent*	Number	*Percent*
Total	29979	*100*	26330	*100*	28866	*100*	28380	*100*	28809	*100*
Innovative businesses	9986	*33.3*	8116	*30.8*	5968	*20.7*	3645	*12.8*	2925	*10.2*
Enterprises only with product and / or process innovation	1951	*6.5*	1137	*4.3*	541	*1.9*	988	*3.5*	721	*2.5*
Enterprises only with organizational and / or marketing innovation	4079	*13.6*	4353	*16.5*	4162	*14.4*	1805	*6.3*	1369	*4.8*
Companies with product and / or process innovation and organizational and / or marketing innovation	3956	*13.2*	2626	*10*	1265	*4.4*	852	*3*	835	*2.9*
Successful innovators	5748	*19.2*	3631	*13.8*	1691	*5.9*	1529	*5.4*	2795	*9.7*
Product-only innovators	710	*2.4*	635	*2.4*	351	*1.2*	313	*1.1*	430	*1.5*
Process-only innovators	1965	*6.6*	955	*3.6*	706	*2.4*	511	*1.8*	478	*1.7*
Product and process innovators	3073	*10.3*	2041	*7.8*	634	*2.2*	705	*2.5*	518	*1.8*
Innovators with unfinished and abandoned activities	159	*0.5*	132	*0.5*	115	*0,5*	311	*1.1*	130	*0.4*
Non-innovative businesses	19993	*66.7*	18214	*69.2*	22898	*79.3*	24735	*87.2*	25884	*89.8*

Source: own calculations using NIS data

The structure of innovative enterprises by size classes *(table 2)* indicates a constant decrease in all three types (small, mediums and large). The share for medium enterprises was 42.5 % in 2008 and only 12.2 % in 2016 (a difference of 30.3%).

Table 2

Innovative enterprises by size classes - Romania

Size class	2008		2010		2012		2014		2016	
	Number	%	Number	%	Number	%	Number	%	Number	%
Total	1250921	50.8	978724	50.2	722351	35.5	470656	23.2	338092	16.2
Small	171063	31	125532	28.5	89037	19.3	55655	12.4	42539	9.3
Mediums	291588	42.5	201053	40.5	147923	27.1	87185	16.2	68887	12.2
Large	788270	64.5	652139	64.5	485392	47.2	327816	31.5	226666	21.2

Source: own calculations using NIS data

One of the most common innovative business ideas met in the projects and still addressed by many successful managers was lavender which has an initial investment of approximately 5000 euros/ha and a yield of 5000 kg/ha. The profit obtained is about 8000 de euro/ha and the investment has a payback period of 2-3 years *(figure 5).*

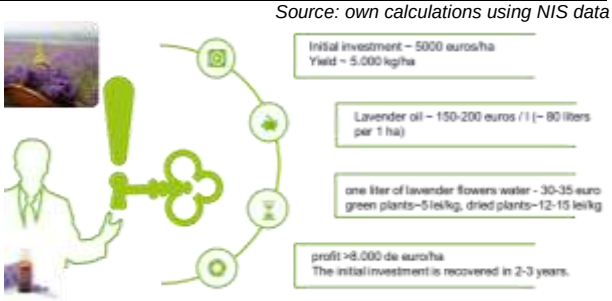

Figure 5 **Lavender**

Another innovative business but more rarely encountered in Romanian agriculture is hazelnut

tree plantation *(figure 6)* with an initial investment of approximately 3000 euros/hectare and a payback period of the investment between 3 and 5 years at a yield of 450 kg of peanuts/ha.

Figure 6 **Hazelnut tree plantation**

Natural apple juice factory is another innovative agricultural business indicating an efficient farm management. The investment is about 10000 € and the installation for a small factory 3000-4000 euros. The price of natural apple juice is 6-8 lei per l *(figure 7)*.

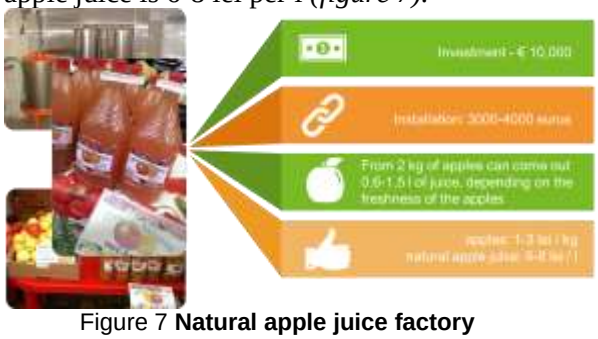

Figure 7 **Natural apple juice factory**

Sea buckthorn is widely distributed all over the world. It contains different kinds of nutrients and bioactive substances such as vitamins, carotenoids, flavonoids, free amino acids and elemental components etc. The clinical trials and scientific studies during the 20th century confirm medicinal and nutritional value of sea buckthorn. Initial investment for Sea buckthorn is estimated at 1500-3000 euros/ha. The yield is approximately15-20 t/ha (from year 3) and the price on the market is 10 -20 lei/kg *(figure 8)*.

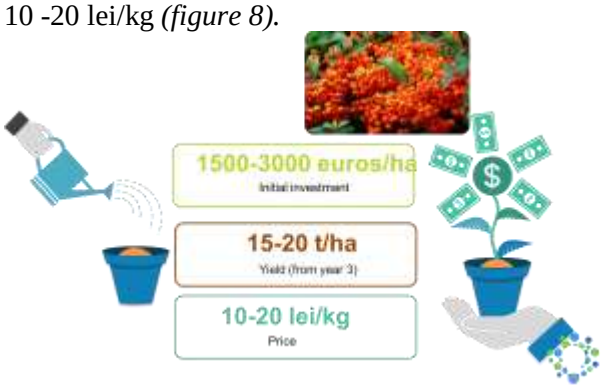

Figure 8 **Sea buckthorn plantation**

CONCLUSIONS

Innovation is one of the attributes of the entrepreneur. Business ideas that identify new products, new features or usage patterns as well as new market niches are tools that help ensuring successful management of the farms concerned. Firms that did not adapt to the ever-changing environment and did not adopt differentiation strategies have involved or stagnated economically while companies that have come up with new products or presentation methods, new technologies and processing systems have considerably improved their economic results by becoming leaders in the segment targeted by them. Growing lavender, planting peanut, natural juice factories or cultivating and processing medicinal plants are some of the innovative businesses identified that have developed and brought to the entrepreneurs great results and to customers new products and services adapted to their needs.

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STUDIES CONCERNING THE FINANCIAL POSITION OF A WINERY

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Abstract

In the knowledge based economy, the analysis of the financial position of a company, the whole of the assets and capital over which it exercises control, its places imprint on the strategy to being followed. The financial position may be influenced by the economic resources it controls, the financial structure, and its ability to adapt to the changes in the environment in which operated. In the study, the authors tried to carry out an analysis based on the data extracted from the annual financial statements using a system of indicators that are relevant and interpreting the conclusions can be drawn depending on which future evolution can be predicted. It was elaborated the diagnosis of the economic state which involved the analysis of the triad's diagnosis of technical resources, human resources, material resources continuing with, establishing the importance weights and the calculation of the aggregate score. the financial position implies the determination of the indices based on the chain calculated for the elements of assets / liabilities / equity. The diagnosis of the dynamics and structure of the assets, the dynamics and structure of the liabilities was made, thus making the diagnosis of the evolution and structure of the financial position. Studying the ability of the company with the payments due in accordance with IFRS, the diagnosis of liquidity and solvency was made. Based on the analysis of the working capital that gives the strengths and weaknesses of the financing and investment policy of the company. Finally, the SWOT analysis of the financial position of the studied entity was elaborated, enumerating the measures to be taken to strengthen the financial position

Key words: financial statements, financial diagnosis, financial management, financial stability, financial autonomy, global indebtedness

One of the objectives of any economic entity is to ensure the increase of the financial performance while minimizing the risk. In a constantly changing world, any manager must be able to control the change and predict the effects of the change in order to make the best decisions and especially at the right time.

The financial position of a company tells investors about its general well-being. A financial analysis of a company's financial statements - along with the footnotes in the annual report - is essential for any serious investor who wants to understand and appreciate a company correctly.(Gabriela Ignat, 2019)

The financial position, defined as the status of a company's financial well-being, is important for every business. (Covlea, M., C.S. Crăciun, 2008). The financial position of a company is measured by the performance it has in the financial statements of the company: a positive and increasing cash flow statement; increasing the profit in the profit, and loss account; and a balance sheet of assets, liabilities and equity in the balance sheet. **(**Gabriela Ignat, Andreea Alexandra Timofte, 2017)

In order to understand and value a company, investors need to look at its financial position.(Carmen Costuleanu, 2012)

Fortunately, it is not as difficult as it seems to conduct a financial analysis of a company by examining its financial statements. The financial position, explained as the effect of debt, solvency and liquidity of a company, which ultimately leads to the ability of the business to survive, is an important factor in large and small businesses alike. In general, the summary of the financial position is the most important aspect of accounting: assets, liabilities and equity. These three factors are the essence of the financial position of any business. This is so important that a statement of financial position has become one of the most important reports in a business. When it comes to assets, companies have a lot to balance. They must maintain the appropriate amount of money, equipment and more. Assets, in a very general explanation, are the resources that a business owns. Without resources, a business, like anything else, cannot survive.

A business must keep only enough debt to be able to increase the wealth it holds, making sure

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it doesn't have too many debts. This, officially called the condition of being "overcome", is a common path to failure.

MATERIAL AND METHOD

In order to achieve the proposed objectives, the present research used a series of scientific research methods, indispensable in the elaboration of the case studies, such as: the documentation method, the analytical method or the economic analysis, the dynamic analysis, the synthesis method, the induction method, the deduction method, the method descriptive, method of comparison, and method of quantitative analysis. The analysis based on the study of financial statements combines the retrospective and the predictive analysis with the static analysis and the dynamic analysis.

Both financial analysis methodology and financial diagnosis methodology were used in the processing of accounting financial information.

The case study was conducted at an economic entity with a wine profile in Iasi county

RESULTS AND DISCUSSIONS

The structure of the asset characterizes the composition of the economic patrimony of the company, in accordance with its more or less "capitalistic" character as well as its vulnerability to inflationary developments, highlighting the degree of stability of the financing and the financial autonomy it provides to the company, the combination of resources having various maturities and origins (equity, long-term, medium-term, or short-term debt).

The structure rates of the asset are influenced by the technical, economic and legal characteristics of the activity, being expressed as follows: the rate of fixed assets, the rate of tangible fixed assets, the rate of current assets, the stock rate, the debt ratio, the availability rate

The value of the rate of fixed assets over the last two years can be considered normal, this is below the maximum allowed level, decreasing by 10.49% compared to 2015 as a result of the change in a still greater proportion of the value of fixed assets in relation to the value total assets.

The value of the rate of tangible fixed assets for the whole period analyzed is about 100%, which is above the minimum accepted value (85%). The rate of tangible fixed assets has a constant trend, a situation considered favorable.

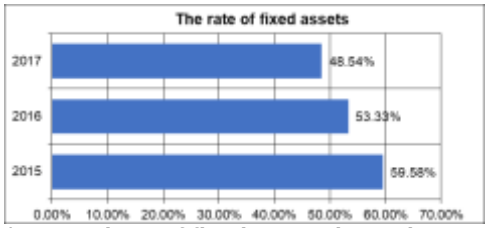

Figure 1 **Share of fixed assets in total assets**

The company does not present financial assets and as such, the rate of financial assets has not been calculated.

The value of the indicator of the current assets rate during the analysis period is above the minimum level allowed only in 2015, having an upward evolution over the analyzed period. This fact is due to the modification of the current assets in a smaller proportion than the total assets.

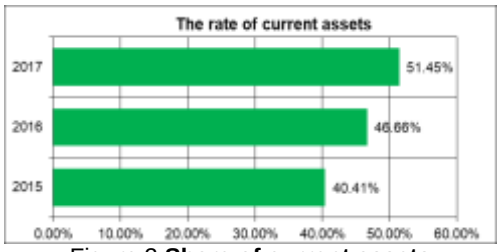

Figure 2 **Share of current assets**

The stock rate (*figure 2*) shows an oscillating, relatively constant evolution over the entire analysis period, but it is above the maximum allowed level. This means an increase in the share of stocks as a result of changing their value to a greater extent than that of current assets.

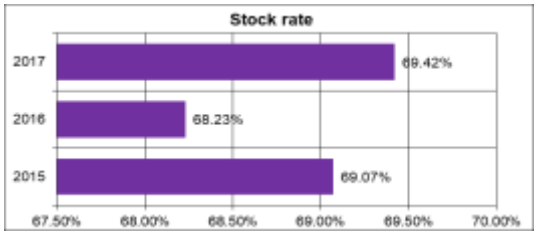

Figure 3 **The level of stocks in total current assets**

The debt ratio indicator shows a downward trend over the analyzed period. This means that the share of receivables decreases as a result of changing their value to a smaller extent than that of current assets.

The share of liquidity increases in the second year, reaching 0.10% of the total current assets, in the first and last year of

analysis the share of liquidities increases up to the admitted value of 6.49%.

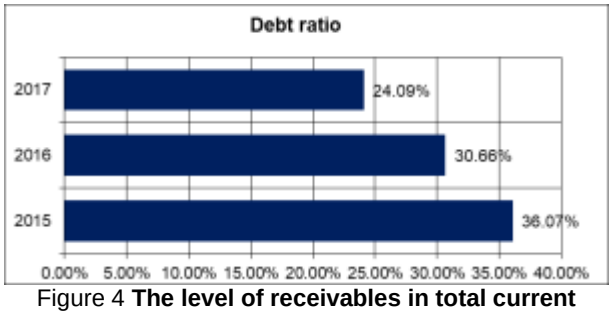

Figure 4 **The level of receivables in total current assets**

The situation is favorable in terms of financial balance.

Throughout the period of analysis the agricultural company has a relatively good degree of autonomy, located above the minimum acceptable value.

However, the indicator has shown an oscillating evolution, due to the slower growth of the permanent resources compared to the current ones.

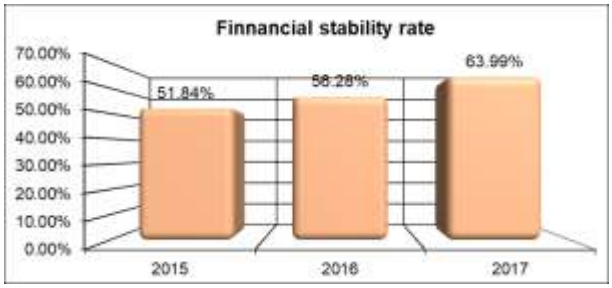

Figure 5 **Rate of financial return**

The increase of the share of the indicator in 2016 by 5% compared to 2015 reflects an increase in the share of resources with a cyclical character in the financing of the company.In the last year of analysis, the agricultural company finances over 63% of its activity from permanent capital, registering an increase of 28.65% over the previous year.

The rate of current resources, the degree of current funding, reflects the extent to which current resources participate in the formation of total resources and activities

Throughout the analyzed period the degree of financing of the activity from current resources was quite oscillating (but not exceeding the maximum level allowed), but it registered a reduction in the level of the first and last year of analysis, due in general to the faster decrease as the rhythm of current versus permanent resources

During the analyzed period, the working capital register positive values only in 2015, the other years of the analysis present a negative working fund, finding a shortage of potential short-term liquidity as compared to the potential short-term eligibility, the agricultural company failing to - and fully fund the permanent allocations and a shortage for financing the cyclical needs. This fact was due to the permanent decrease at a higher rate, during the analysis period, of the permanent resources compared to the decrease of the stable allocations

The negative working capital reflects an uncertain evolution of the security margin of the agricultural company. This situation can be perceived as an unfavorable result in terms of solvency, and as such the agricultural company is not able to meet the payment deadlines and must resort to a stock of liquidity.The activity of the company can be considered favorable, increasing the liquidity being one of the assets of the company to carry out a profitable activity that can make possible the repayment of the financial debts, as well as the efficient placement of the financial resources to consolidate the market position.

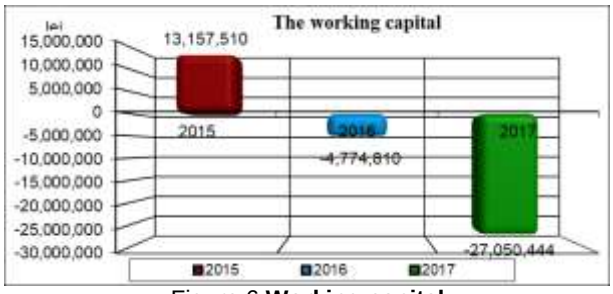

Figure 6 **Working capital**

The company has a very good overall financial autonomy over the whole period analyzed, as it shows a decreasing tendency due to the lack of borrowed and attracted resources.

From this point of view the analyzed agricultural company was safe, being below the maximum allowed value of the indicator showing an increase due to the faster increase of the share capital compared to the total debts.

During the analyzed period the exploitation result registers a decreasing tendency, thus in 2016 the exploitation result decreases from the value of 29,352,903 lei to

the value of 6,888,110 lei, that is a decrease of 76.50%, and in 2017 the result of the exploitation increases from the value of 6,888,110 lei in 2016 to the value of 26,749,781 lei, an increase in relative quantities of 91.13%.

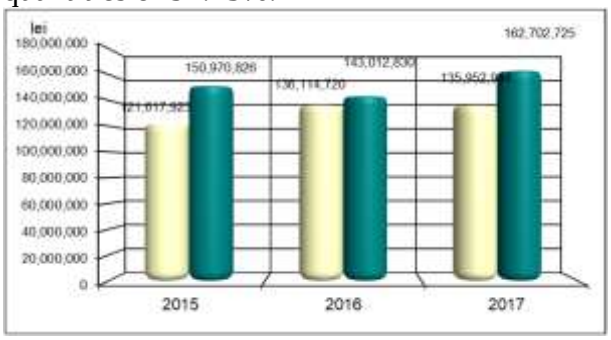

Figure 7 **Company expenditure and revenue**

During the 3 years subjected to the analysis, the company recorded an economic rate of return below the interest rate. In this situation, the company does not register financial leverage, respectively it will decrease its financial profitability, and the decision to be taken by the company is the cessation of loans. The increase of the economic profitability can be realized on account of the acceleration of the rotation of the assets. The rate of economic return of the asset characterizes the efficiency of the material elements employed in the activity of the company. Economic profitability measures the degree of profitability of using the total asset.

During the analyzed period, the rate of economic profitability registered in 2017 an increase of 359.29% compared to 2016, reflecting a decrease of the capacity of the total assets to generate gross profit. The increase of the level of the rate of economic profitability in 2017 is due to the increase of the net result of the financial year from the value of RON 5,585,241 in 2016 to the value of RON 22,937,305, an increase of 403.45%. In this situation when the rate of economic profitability is determined as the ratio between EBID and AT, the company registers financial leverage, respectively, it will increase its financial profitability. If the company receives financial leverage, it will be inclined to borrow from the market, respectively, to increase its production capacity, to the extent that the debt levels make it insolvent.

CONCLUSIONS

The determination of the financial position of the company can be realized by its book value: if we subtract the total debt from assets, we remain with the share capital of the shareholders. Essentially, this is the book value or book value of the shareholders' participation in the company. It is mainly made up of the capital contributed by the shareholders over time and from the profits obtained and retained by the company, including that part of any profit not paid to the shareholders as a dividend.

In 2017, the rate of return on equity registered a growth trend with 301% compared to 2016, an increase due to the increase of the net profit from the value of 5,685,241 lei in 2016 to the value of 22,937,305 lei, that is an increase of 403, 45%. In the period 2015–2017 the rate of return on permanent capital registered a growth trend with 315.61% in 2017 compared to 2016. In this situation, the company does not register financial leverage, respectively it will decrease its financial profitability, and the decision to be taken by the company is the cessation of loans. The increase of the economic profitability can be realized on account of the acceleration of the rotation of the assets.

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CONCRETE ASPECTS OF IMPROVING THE LANGUAGE LEARNING PROCESS USING NEW TEACHING METHODS

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Abstract

The topic of this paper concerns the following question: what aspects improve in the activity of the students of the German language, if after the exercises of *Partnerarbe*it (PA) type (working by two or in binomial), instead of the evaluation in ordinary plenary session, I will call *Gruppenarbeit (GA)* (working in groups) to evaluate the results? The starting point of this research was the following situation I encountered in the classroom: after the students conducted dialogues, interviews or telephone conversations with a colleague on a particular topic, not all the results could be presented and evaluated in plenary, because this didactic sequence would take too long and the learners' attention would be lost quickly. The impulse for improving this situation came from chapter 2.2: "Using work forms and social form" in the volume Deutsch Lehren Lernen 4 (Aufgaben, Übungen, Interaktion by Hermann Funk, Christina Kuhn et al.): Changing the social form. From chapter 2.2 it is clear why it makes sense to change the social form to evaluate the results after working in binomial or by two.

Key words: teaching, method, language, teaching, education

The starting point for our action research was the following situation we encountered in the classroom: after our learners conducted dialogues, interviews, and phone conversations in partner work, not all the results could be presented and evaluated in plenary session because this sequence took too long and the attention of the learner sank quickly.

The impetus for the improvement of this situation came from the chapter 2.2: "Use of labor and social form" of the Deutsch Lehren Lernen, volume 4: the change of the social form. (Funk H., 2014, p. 57-76). In this chapter we found very good reflections on how we could increase the involvement of the learners and their awareness of taking a more active part in the learning process. I am often confronted with a similar situation (described by Demmig, 2007, p.132): most of my course is frontal teaching, I am in the middle and I still do many things alone, but I have observed this and I would like to change it, but this is by no means too easy to do. The statement of the respective teacher shows that it is not at all easy to change habits and that we are often confronted with uncertainty, when and what forms of work or social forms should we introduce and what aspects we should pay attention to.

The advantages of the frontal teaching can be quickly enumerated by many teachers:

1. Fast dissemination of the teaching material;
2. Simultaneous information transfer to all the students;
3. Less effort for the teaching organization;
4. Recognition of the professional authority of the teacher;
5. Simple and direct correction of the student's option.

However, we often forget that a teaching style that assigns the learner's passive role to learners requires rhetorical skills on the speaker side and the effective use of appropriate presentation techniques. Only in this way will the learners be encouraged to think along and remain attentive. As you probably know from your own experiences with courses that you have visited yourself, the ability to concentrate while listening decreases rapidly. Especially by with younger learners the attention and the concentration decreases after a few minutes (Büttner-Schmidt-Atzert 2004). Otherwise not all students can process the same information at the same time. The teacher can hardly do justice to these differences in the frontal class.

Switching from one social form to another is often very sensible. There are several advantages to moving from individual work to group work. Furthermore, it was found that the individual work

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often offers the change in cooperative social forms. Mostly other language acts are practiced than in the often short speeches in the evaluation in plenary. It is systematized, justified, questioned, demanded and discussed. The students gain confidence in their exchange of views on their work outcomes, and are more motivated to present them after in plenary, if necessary.

In chapter 2.2 it becomes clear to us why it makes sense to change the social form for the evaluation of the results after the partner work. Especially since we were able to determine from the lesson that it is both time-wise and in terms of content makes sense to present the results of the partner work not in plenary, but for the time being in groups and evaluate.

Therefore, after partner dialogues, partner interviews, phone calls and similar exercises, we decided to use group work to evaluate the results. With the change from partner work to group work, we intended to observe the following aspects:

1. Time management (increasing the participation of the individual learners in the total teaching time);
2. Cooperative learning (willingness to cooperate, fault tolerance, mutual help);
3. Practice other language actions (report, ask, explain, summarize).

MATERIAL AND METHOD

This is how I did the practical research project: I did the research in a student group at my university, where I teach German as a Foreign Language. The group consists of 18 participants, but only 11-12 come regularly. The course takes place once a week, with 2 hours of lessons. There are not language differences between the students, we don't have foreigners in this group and a quarter have a satisfactory level, as the continuous evaluation has shown.

We plan to follow this scheme in the lesson sequence:

practice - evaluate - produce

Depending on the teaching situation, we propose the following activities: partner dialogues, partner interviews, telephone conversations, etc. The dialogues should first be practiced in partner work, and then the students should present their work results in group work or improve them. Finally, they should find a common variant, which will be presented at the end.

We intend to form matching pairs. For lower performing couples, the work materials could receive more linguistic help: redelivery boxes, vocabulary explanations. For the presentation and evaluation of the work results, we intend to form performance-heterogeneous groups, because here the mutual learning with mutual error correction / assistance stands in the center.

Time:

Activities in partner work (approx. 7-10 minutes);

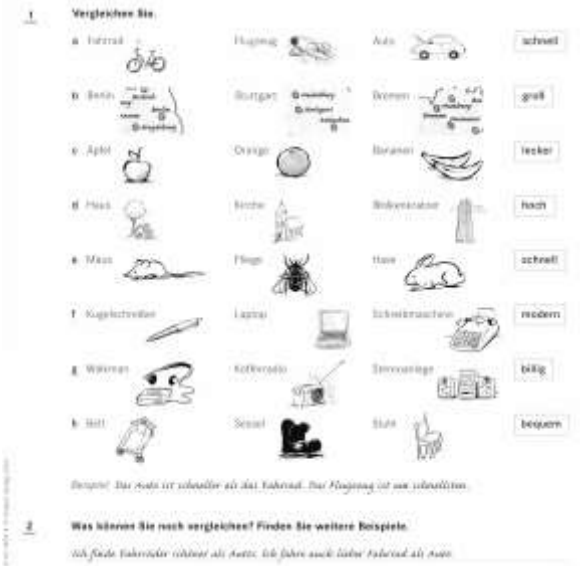
Group activities (approx. 5-7 minutes);

Presentation of the group results (approx. 3-5 minutes);

The exercise for the comparison of adjectives.

Part 1:

The learners will get a copy template in PA (for two) (the example below) and they will first practice the adjective forms in the comparative and superlative in the sentences. Afterwards, the results will be evaluated with another two-membered group and in the end they will be corrected with the help of a solution key.



Part 2:

You will present the other examples in plenary.

Exercise about traveling:

Part 1:

Learners are determined by the teacher to share their language level in PA. Each binomial gets a few questions about travel (about a balloon ride), which they should then ask each other: Examples: Would you make a balloon trip? If so, where would you go? What would you like to see from the air? How much money would you spend on it? etc. If not, why not? □

The PAs who need more vocabulary or grammar support will get expressions, beginnings of sentences, speech, etc.

Part 2:

The learners check their results in group work (up to five). The students have to imagine that they cannot travel in a balloon for two. Each person has a different occupation (computer scientist, artist, teacher, hairdresser, IT specialist, writer, architect, etc.). You have to explain to your partner's partner why they have to stay in the

balloon. They then exchange their opinions with another partner group (binom). You will decide in the GA who has the best arguments and may stay.

I would like to make the exchange between my students in PA and the evaluation in GA much livelier, than asking questions in plenary and not being able to hear all opinions because of the time constraints. This form of work will also support the less experienced learners and be more active. I want to make it possible for all learners in the classroom to speak and use the time in the classroom highly effectively.

The practical research project lasted for three weeks, with a total of 6 lessons. This research was conducted beginning with the fourth of a total of ten course weeks.

RESULTS AND DISCUSSIONS

This is how I collected data and these are the instruments that I thought:

• Structured observation (time management / time use, cooperation of the learners)

• Qualitative interview with learners (learner attitudes to co-operative learning)

• Video recording (speech actions / sample output).

I conducted the interview with a part of the learners. (Random selection) In the essence, the interview questions are based on the following basic elements of cooperative learning:

1. Willingness to cooperate;
2. Personal responsibility;
3. Time use;
4. Helping each other;
5. Fault tolerance;
6. Mutual encouragement;

The interview:

„In the last few weeks, we have conducted group work activities in German lessons after the partner work. I want to know what your attitude towards these activities is.

1. Do you enjoy working in the group?

2. What do you find most important in group work?

3. How do you handle time during group work?

4. How do you help the other group members when they need assistance?

5. How do you deal with the erroneous utterances of other group members?

6. How do you treat the group members if they make good suggestions?"

The data allow the following conclusions. The use of the GA instead of the plenum for the evaluation of the exercises solved in PA has the following advantages:

 time saving;

 increased efficiency in training the speech acts;

 increased motivation to speak the learners;

 lower fear of errors and inhibitions;

 fun to work with changing partners;

 better group feeling;

increased willingness to learn from others;

 lively exchange in the classroom.

CONCLUSIONS

I have personally learned from the evaluation of this practical research project in the team and from the reactions of the colleagues during the presentation:

- ✓ It stimulates communication and exchange.
- ✓ It allows the good exchange of information.
- ✓ It's time-economical.
- ✓ Through mutual suggestions we work tasks more motivated and more creative.
- ✓ It promotes the development of social skills.
- ✓ It uses a lot in reflection and correction phases about the subject matter.

The presentations from the other colleagues sparked the desire to make further experiments and to use other methods, because the change from partner work to group work enables a cooperative atmosphere and increases the participation of the individual learners in the total teaching time. Through the exchange with the colleagues I got a better idea of the evaluation of the interview.

The research has given me a different perspective on how to orient the learners and how to solve the difficult handling of heterogeneity: the learners' emotional attachment to their work is a very important aspect - the motivation and their own needs, the development of the learner to see language competence as a strengthening of self-confidence and the teacher not only as a correctional authority, but as a learning companion. The students have learned to help each other and to listen to each other.

Through this research, I realized that the responsibility for control shifts from the teacher to the group.

This practical research project gives me the opportunity to write this contribution and I found the results of this project very positive and motivating to create further perspectives.

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CONSIDERATIONS REGARDING THE "VOCABULARY" AND THE "GRAMMAR" OF A SPATIAL SEMIOLOGICAL STRUCTURE

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Abstract

For linguists, the investigation of gardens from a semiotical point of view, involves a very complex and challenging research material. The research may be conducted in many directions, incorporating numerous topics related to gardens. Gardens may be regarded as "spatial entities" organized by man, endowed with a high semiotic potential. Gardens may be considered "alive cultural phenomena" undergoing a continuous transformation and organization due to the fact that gardens' identity is represented by nature and art. Gardens may be investigated and treated as "texts" allowing us to analyze the production of significance/meaning, pointing out the communicative effects within any spatial semiological entity. Our research aimed to examine the garden as a "text", defining its "vocabulary" - its constitutive natural and artificial elements, and the "grammar" - the rules of composition and the manner the constitutive elements are put together or joined, corresponding to the aesthetic or utilitarian function typical of any spatial semiological structure.

Key words: cultural text, spatial semiological entitity

Specialized literature has demonstrated that in the area of Semiotics of Culture we witness a transfer of conventional methods which have been developed and applied to a certain cultural phenomenon to other domains, totally different and/or more extensive. Expressing itself by "texts", Culture has the capacity of conversion or transfer of discourse from one language into another. Given these conditions, the "text" has become a methodological tool for Semiotics of Culture. The "texts" are not only literary. From a semiotic perspective, any physical structure meant to embody ideas may become a "text" and any "text" has/ or is characterized by a special internal organization. Based on the fact that both the "text" and the "space" are defined by a certain construction, made up of different elements arranged in an orderly manner, sharing specific traits, our research aimed to examine the garden - this alive cultural phenomenon, as a "text", exhibiting a specific "vocabulary" and "grammar"

MATERIAL AND METHOD

In the humanities, different fields of study concern themselves with different forms of *texts*. Literary theorists, for example, focus primarily on literary texts—novels, essays, stories, and poems. Legal scholars focus on legal texts such as laws, contracts and regulations. The idea of what constitutes a text has evolved over time. In recent years, the dynamics of technology - especially social media - have expanded the notion of the text to include symbols such as emoticons. The concept of the *text* is not a stable one. It is always changing as the technologies for publishing and disseminating texts evolve. In the past, texts were usually presented as printed matter in bound volumes such as pamphlets or books. Today, however, people are more likely to encounter texts in digital space. Specialised literature has shown that the study of Semiotics has originated in a literary or linguistic context and has been expanding in a number of directions since the beginning of the 20th century.

The essential breakthrough of Semiotics was to take linguistics as a model and apply linguistic concepts to other non-linguistic fields or "phenomena-texts" (for example a visual image) and not to language itself. The language, the text, the structure, the model, the system of modelling have represented the major notions and concepts in the studies of the Tartu semioticians till 1973, when the Semiotics of Culture was born.

In the first half of the 90's, it was noticed a change of the linguistic concerns in the semiotical publications of the time, followed by a more and more marked attraction towards a semiotical approach of some new non-linguistic disciplines including biology among many others. The School of Semiotics from Tartu hasn't got an unique methodological approach, but concrete and different methodological patterns focused on a way of thinking directed, on the one hand on the

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understanding of the character of *structure* and system of the object under study, and, on the other hand, on the search of several methods for the semiotical description of different languages from non-linguistic fields.

No treatment of Culture can, nowadays, escape the propositions of the Tartu-Moscow school of Semiotics about the *textual nature* of cultural phenomena. According to this school, textual features can be recognised in almost all *spatial representations* (gardens included) both in terms of artefacts and mentifacts.

Within Cultural Semiotics the concept of *text* has been defined and redefined many times. The diverse semiotic and communicative functions of text in culture and in cultural tradition – for example, as a container, a generator or a transmitter of information have made the position of the text relatively fluid on the semiotic metalevel. The text possesses a beginning, an end and a definite inner organisation and this allows, along with other features, the creation of a typology necessary for an adequate deciphering of texts (Lotman I.M.,1974). The three main features or aspects of the text, which have been described by Lotman using the terms ”expressed”, ”bordered”, and ”structured” come together by virtue of a general property of the different dimensions of the text: their confined or circumscribed nature.

Any garden viewed as a semiotic spatial representation, exhibits *textual* and *cultural* characteristics and may be considered “a cumulative deposit of knowledge, experience, beliefs, values, attitudes, meanings, hierarchies, religion, notions of time, roles, spatial relations, concepts of the universe, and material objects and possessions acquired by a group of people in the course of generations through individual and group striving”. There is no doubt that all these aspects are to be found in one of the numerous definitions given for Culture (definition available on line at: https://www.tamu.edu/faculty/choudhury/culture.)

Seeing gardens as *text* is a way of revealing the meaning-making principles that have shaped garden construction the world over, and thus provides a way to understand the relationship of garden design to the social, philosophical and cultural discourses and traditions which give it meaning. All *sign systems* operate in physical and *semiotic space*, at the same time all space, be it physical or conceptual, is *semiotised* via *sign systems* at several levels of modelling. Culture is located in a certain physical environment, and artefacts are embedded in environment, shaping the later in unique ways that have given reason for the description of the planet in terms of culture areas (Pânzaru O.,2010)

Gardens have been named by Sebeok Thomas A., (2002) as ”major semiosic non-verbal constructions” They are endowed with a special ”vocabulary” and ”grammar” - the heterogenous elements connected to each other through various relationships to create a significant whole with a complex semiotic potential. In most gardens and parks, the “alive part” represented by plants, and the “inanimate part” made up of ornamental elements and arrangements are harmoniously combined in such a way as to suit utilitarian and aesthetic functions.

RESULTS AND DISCUSSIONS

For many people, the word *vocabulary* is primarily associated with the number of words that a person knows. But the word has many shades of meaning.

As it is shown in Merriam-Webster on line Dictionary, vocabulary may indeed refer to the collection of words known by an individual or by a large group of people. It may also signify the body of specialized terms in a field of study or activity (“the vocabulary of science”). It may designate a physical object, such as a book, in which a collection of words is defined or explained. And it may name things other than words, such as “a list or collection of terms or codes available for use,” “a set or list of nonverbal symbols” and “a set of expressive forms used in an art” (as in “the vocabulary of dance).

This last part of the ”vocabulary”definition may be applied to the constitutive elements of any garden – be they natural or artificial, as a “set of expressive forms”, created by people, which are selected, arranged, combined and ordered according to some rules to form a coherent whole, producing a unity in diversity – the attribute or the defining characteristic of any semiotic spatial entity (Pânzaru O., 2018)

When speaking about the “vocabulary” of most gardens, we have in view a combination of natural and constructed elements, although even very “natural” gardens are always an inherently artificial creation. Natural elements present in a garden principally comprise flora, fauna, soil, water, air and light.

Constructed elements include paths, patios, decking, sculptures, systems for drainage, lights and buildings, but also living constructions such as flower beds, ponds and lawn.

This “vocabulary” or collection of elements is involved in different levels of communication, starting from biological communication up to cultural symbolism, from personal cognition up to social identities, enabling a better understanding of the garden’s status as a *text*, related to the multitude of social, religious, philosophical, and cultural discourses (Pânzaru O., 2010).

Specialised literature shows that any *text* may be divided into meaningful units such as words, sentences, or topics. As regards the “grammar” of the garden we have in view the

system of rules or principles that define its *structure*: the classes of words – the constitutive elements, their inflections - the arrangements or special combinations and their functions – utilitarian and aesthetic. Usually every active sentence starts with the subject, or the "doer", the verb (what's being done) and an object (the receiver of the action). In the case of the garden the "doer" is represented by the gardener, "the verb" by gardener's continuous non-interrupted activity, as he projects and designs the garden, but also of the nature's involvement in that design. The "object", that is the receiver of the action, is represented by the viewer, the person who visits or admires that garden.

Kalevi Kull in his scientific work, *Semiotic ecology: different natures in the semiosphere*, (1998) has stated that when people apply certain models, or certain general linguistic patterns upon nature "we have in view the building of second nature". This can be easily demonstrated when considering the notions used to describe gardens. The rules of "order" can be seen as belonging to and coming from certain traditions of gardening schools. However, these are probably something much deeper, since regardless of the particular school, the rules always apply idealised forms to nature. They originate from the discretized descriptions of nature, from the linguistic nature, as limited by the general mechanisms of perception and operation.

Each element from a garden usually holds an individual symbolic content. This is why it is not enough to understand the garden itself as simply a combination of parts. The aesthetic principles are embedded in the spiritual and intellectual experience of the people who have designed them. Gardens are spatial entities where culture and nature combine to form a single entity, a place where different cultures can co-exist.

The garden may be considered a spatial structure or a "stage" which facilitates a dialogue between nature and culture, in other words a place of communication between people and nature, or humanity and universe, where art, science, and nature become most intimately interlocked.

The specific organization of the garden space within its natural environment contributes to a different aura for each garden. In this way, the particular implementation of the elements contributes to a unique experience for each visitor. The design of the physical setting of the garden is a continuous process, a non-interrupted human intentional *semiosis*, a permanent search of the best expression, of that function or complex of functions which are best adapted to the natural and artificial elements of the environment.

According to the semiotical theory, *semiosis* is any form of activity, conduct, or process that involves signs, including the production of *meaning*. In other words, *semiosis* is a sign process. Thus, the space of the garden with its "vocabulary" and "grammar" becomes a *sign*, which assumes the form of the *text*, producing meaning, expressing ideas, experiences, concepts, traditions, philosophical and religious ideals which bring about an interpretative approach in the mind of that or those persons watching or admiring it.

CONCLUSIONS

The purpose of our research was to analyse the gardens as *cultural* and *textual* phenomena, endowed with a specific "vocabulary" and "grammar".

The particular elements of any garden, that is its "vocabulary" and its "grammar", namely the arrangements or parts of the garden that have been assembled and connected to form a coherent, meaningful whole, provide that unity in diversity which is present in almost any major semiosic non-verbal construction.

Generally speaking, gardens have been created by people transforming principally unmodified environmental objects into *signs* and organizing these into *texts*, which by means of their "vocabulary" and "grammar" have represented social meanings materially encoded. The art of gardening is strongly multidimensional in its *semiotic organizing principles* and *communicative* purposes. The garden communicates using natural materials which are selected for their unique semiotic potentialities and allow the realization of particular *textual meanings*. It utilizes a restricted set of *semiotic materials* and modes to achieve precise *communicative* effects. Through their combination and collaboration, these "semiotic" materials and meaning making principles effectively convey an array of different meanings concurrently.

While communication has generally been considered mainly a linguistic phenomenon, in practice communication involves *meanings*, that is 'inscriptions" carried through different material forms that are brought together and organized in various combinations.

Gardens represent a place of communication between people and nature, or humanity and universe, where art, science, and nature become most intimately interlocked. Many mechanisms and signs are involved in these processes of communication, frequently reflecting the result of the interaction between biological and cultural communication.

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MICROOGRANISMS ASSOCIATED WITH BLACK POINT DISEASE

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Abstract

Black point disease is characterized by a brown to black discoloration of wheat kernels. The disease can be a problem in regions where are registered heavy rainfall during de early stage of kernels development. Black point disease is associated with many microorganisms, both fungi or bacteria, but those most usually responsible for these symptoms are species of the fungus *Alternaria alternate*, *Cochliobolus sativus*, *Fusarium graminearum*, *Aspergillus* spp., *Penicillium* spp. The aims of this study were to identify microorganisms associated with black point disease of wheat. The kernels of twenty-eight winter wheat varieties were analyzed for the purpose of determining the microorganisms associated with the black point.

Key words: wheat diseases, Black point, *Alternaria* spp., *Cladosporium* spp.

Numerous diseases affect the grain yield and quality of wheat. Such a disease is the black point of wheat. Black point occurs in all wheat-growing regions and is an economically serious disease in cereals that affects crop yield and value.

Black point is found in all regions where this plant is grown and is characterized by the change of color of wheat kernels, being observed especially in the area of the embryo (*figure 1*). The disease can be a problem when in the early phenophases of kernels formation are recorded high amounts of precipitations. (Gafencu A.M. *et al*, 2019; Özer N., 2005).

Black point hampers the seed germination, seedling growth, tillering, and grain yield. Therefore, many regions imposed regulations on the incidence of black point in wheat seeds. For example, a level of 2%-4% of black point-affected kernels is permitted in wheat samples for the food industry in the USA. In Australia, the upper limit was 5% for seeds storage in silos. In Romania, up to this moment, there is no official regulation regarding the incidence of the black point (Fernandez M.R. *et al*, 2011, 2000; Kaur J. *et al*, 2018; Khani M. *et al*, 2018; Gafencu A.M. *et al* 2019).

Incidences of black point are accelerated in the presence of environmental condition of heavy rain, high humidity, or extreme temperature during the early grain filling-stage (Conner R.L. *et al*, 1988; Gafencu A.M. *et al*, 2018).

Figure 1 **Black point symtomps in wheat kernels (Original)**

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MATERIAL AND METHOD

Twenty-eight winter wheat varieties were used as research material for this study, which was conducted under field conditions from de Iasi Didactic Station - Ezareni Farm, during the vegetation seasons 2016-2017 and 2017-2018.

The fields were not treated with any fungicide controlling black point, or other diseases, whereas standard cultural practices were normally applied.

For the determination of the microorgranism associated with the black point, 100 kernels from each wheat cultivar were analyzed (75 kernels with black point symptoms and 25 healthy kernels). The kernels were disinfected by immersion in sodium hypochloride (1%) for 3 minutes and then rinsed with sterilized distilled water. The kernels were placed in Petri dishes (9 cm in diameter) containing 20 ml PDA (Potato Dextrose Agar). Petri dishes were incubated at a temperature of 20^0C for 10 days. The arising colonies were counted and for identification, the fungi were morphologically and microscopically examined for features of mycelia, conidiophores and spores (El-Gremi S.M. *et al*, 2017; Toklu F. *et al*, 2008;, Li Q.Y. *et al*, 2019, Özer N., 2005;). Referring to Ellis M.B. and Ellis J.P. (1985) the fungi were identified.

RESULTS AND DISCUSSIONS

Following the study of the diseased karyops, five genera of fungi were identified: *Alternaria* spp., *Cladosporium* spp., *Fusarium* spp., *Chaetomium* spp., and *Cochliobolus* spp. Of these microorganisms, *Alternaria* spp. was the predominant genus, being found in all cultivars analyzed. *Cladosporium* spp., *Fusarium* spp., *Chaetomium* spp., and *Cochliobolus* spp. were observed at a low frequency.

The data contained in *table 1* show the microorganism associated with the black point of wheat kernels harvested in 2017.

Alternaria spp. was observed in all cultivars, the number of isolated colonies varying according to the cultivar studied. Most colonies, 14.3 were isolated from wheat kernels from Bezostaya 1 variety. In the case of this wheat variety, 2 colonies of *Cladosporium* spp. were observed.

Table 1

The average number of fungal colonies identified from wheat kernels, harvested in 2017, with black point symptoms

No.	Winter wheat variety	Black point incidence (%)	*Alternaria* spp.	*Cladosporium* spp.	*Fusarium* spp.	*Chaetomium* spp.	*Cochliobolus* spp.
1	Bezostaya 1	4.57±0.27	**14.3**	**2.0**	0.0	0.0	0.0
2	11424G1	8.73±0.35	**10.6**	0.0	0.0	0.0	0.0
3	Andrada	12.13±0.69	**8.6**	**0.6**	0.0	0.0	0.0
4	Codru	7.93±0.59	**7.6**	**2.3**	0.0	0.0	0.0
5	Dumbrava	10.13±0.61	**11.6**	**0.6**	0.0	0.0	0.0
6	Glosa	12.27±0.49	**12.6**	0.0	0.0	0.0	0.0
7	Izvor	29.27±0.98	**8.3**	0.0	0.0	0.0	0.0
8	Litera	21.37±1.37	**6.3**	**0.6**	**0.6**	0.0	0.0
9	Miranda FDL	20.20±1.27	**7.6**	**0.6**	0.0	0.0	0.0
10	Otilia	12.53±0.65	**7.3**	0.0	0.0	0.0	**0.3**
11	Pajura	25.83±1.53	**10.3**	**0.3**	**0.3**	**1.0**	0.0
12	Pitar	9.73±0.61	**5.3**	0.0	0.0	0.0	0.0
13	Semnal	26.50±0.97	**3.6**	**0.6**	**0.6**	0.0	0.0
14	T.109-12	7.53±0.34	**6.6**	**0.6**	0.0	0.0	0.0
15	T.118-11	9.03±1.56	**4.6**	**0.3**	0.0	0.0	0.0
16	T.123-11	3.30±0.32	**9.3**	0.0	0.0	0.0	0.0
17	T.124-11	7.67±0.20	**8.6**	**0.3**	0.0	0.0	**0.3**
18	T.143-11	13.27±0.35	**7.3**	0.0	**0.3**	0.0	0.0
19	T.19-10	5.40±0.25	**4.6**	**0.3**	0.0	0.0	0.0
20	T.95-12	5.93±0.03	**8.3**	**1.3**	**1.3**	**0.3**	0.0
21	Unitar	23.10±0.21	**5.6**	**0.3**	**0.3**	0.0	0.0
22	Ursita	11.17±0.24	**7.3**	**0.6**	0.0	0.0	0.0
23	Vestitor	5.97±0.30	**6.3**	**0.3**	0.0	0.0	0.0
24	Voevod	8.13±0.68	**12.6**	0.0	**0.3**	0.0	0.0
25	Voinic	24.03±0.85	**8.3**	**1.6**	0.0	0.0	0.0

Cladosporium spp. has also been identified from wheat kernels from the Andrada, Codru, Dumbrava, Glosa, Litera, Miranda FDL, Pajura, Semnal, T.109-12, T.118-11, T.124-11, T.19-10, T.95-12, Unitar, Ursita, Vestitor, Voinic varienties.

The third microorganism identified from wheat kernels with black point symptoms, harvested in 2017, was represented by *Fusarium* spp., whose presence was observed in seven cultivars: Litera, Pajura, Semnal, T.143-11, T.95-12, Unitar and Vestitor.

Chaetomium spp. was identified from the kernels with black point symptoms that came from the Pajura and T.95-12 varieties. Also, in the case of two varieties, Otilia and T.124-11, from the kernels with typically symptoms was isolated and *Cochliobolus* spp.

Of the cultivars analyzed, in neither case were not all the five fungi have identified, in the case of the Pajura variety and the wheat line T.95-12 four microorganisms were identified.

Following the analysis of wheat kernels from the wheat cultivars harvested in 2018, it was observed that the incidence of the black point attack was lower than the previous year, and of the five microorganisms identified after analyzing the kernels from 2017, in this year were observed only four of them: *Alternaria* spp., *Cladosporium* spp., *Fusarium* spp. and *Chaetomium* spp. *Aternaria* spp. was identified in all the kernels analyzed. The number of wheat cultivars were *Cladosporium* spp. was identified was reduced this year compared to the previous year. The cultivars for which the fungus was identified were represented by 11424G1, Codru, Dumbrava, Otilia, Pajura, Semnal, T.109-12, T.118-11, T.124-11, T.143-11, T.19-10, T.95-12, Unitar, Ursita, Voinic, Zamolxe. *Fusarium* spp. was identified in case of the following varieties Andrada, Miranda FDL, T.19-10, T.95-12, and Unitar.

Of the fungi identified after analyzing wheat kernels with black point symptoms harvested in 2018, *Chaetomium* spp. was identified just in two cases, represented by T.123-11 and T.143-11 wheat lines (*table 2*).

Table 2

The average number of fungal colonies identified from wheat kernels, harvested in 2018, with black point symptoms

No.	Winter wheat variety	Black point incidence (%)	*Alternaria* spp.	*Cladosporium* spp.	*Fusarium* spp.	*Chaetomium* spp.	*Cochliobolus* spp.
1	Bezostaya 1	3.20±0.30	**4.6**	0.0	0.0	0.0	0.0
2	11424G1	2.70±0.44	**6.3**	**0.6**	0.0	0.0	0.0
3	Andrada	2.70±0.46	**12.6**	0.0	**0.6**	0.0	0.0
4	Codru	2.83±0.41	**5.0**	**0.6**	0.0	0.0	0.0
5	Dumbrava	4.87±0.67	**9.3**	**2.3**	0.0	0.0	0.0
6	Glosa	3.30±0.25	**14.0**	0.0	0.0	0.0	0.0
7	Izvor	9.67±0.32	**11.3**	0.0	0.0	0.0	0.0
8	Miranda FDL	3.40±0.38	**11.3**	0.0	**0.6**	0.0	0.0
9	Otilia	5.60±0.55	**5.6**	**1.0**	0.0	0.0	0.0
10	Pajura	7.70±0.25	**7.3**	**1.6**	0.0	0.0	0.0
11	Pitar	3.70±0.29	**2.6**	0.0	**0.3**	0.0	0.0
12	Semnal	2.57±0.22	**3.3**	**0.3**	0.0	0.0	0.0
13	T.109-12	2.17±0.20	**3.0**	**1.6**	0.0	0.0	0.0
14	T.118-11	3.73±0.62	**4.3**	**0.3**	0.0	0.0	0.0
15	T.123-11	3.27±0.15	**4.6**	0.0	0.0	**0.3**	0.0
16	T.124-11	2.47±0.17	**2.6**	**0.3**	0.0	0.0	0.0
17	T.143-11	5.33±0.64	**5.6**	**1.3**	0.0	**0.3**	0.0
18	T.19-10	11.63±0.18	**4.6**	**0.6**	**0.3**	0.0	0.0
19	T.95-12	1.20±0.15	**2.3**	**1.0**	**0.3**	0.0	0.0
20	Unitar	2.90±0.10	**3.3**	**1.0**	**0.6**	0.0	0.0
21	Ursita	2.87±0.46	**2.6**	**1.0**	0.0	0.0	0.0
22	Voinic	4.77±0.38	**5.0**	**1.6**	0.0	0.0	0.0
23	Zamfira	2.07±0.41	**3.0**	0.0	0.0	0.0	0.0
24	Zamolxe	4.20±0.32	**3.0**	**1.3**	0.0	0.0	0.0
25	Zina	2.93±0.17	**3.3**	0.0	0.0	0.0	0.0

CONCLUSIONS

As a result of the study on microorganisms associated with the black point attack, five fungi were identified as responsible for this disease : *Alternaria* spp., *Cladosporium* spp., *Fusarium* spp., *Chaetomium* spp., and *Cochliobolus* spp.

Alternaria spp. was isolated for all wheat cultivars studied.

Cladosporium spp. was isolated in case of 17 wheat varieties harvested in 2017 and in the case of 16 wheat varieties harvested in 2018.

Fusarium spp. Was isolated in case of 6 varieties, in 2017 and also in 2018.

Chaetomium spp. was isolated from the wheat kerneles from 2 wheat varieties in both years.

Cochliobolus spp. it was isolated only in the case of wheat kernels harvested in 2017, being observed just in the case of two varieties.

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ELYMUS L. GENUS – SPECIES DIVERSITY, CONSERVATION AND IMPLICATIONS FOR AGRICULTURAL ECOSYSTEMS

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Abstract

In recent years, botanical collections are being used extensively as primary resources for numerous research studies. "Alexandru Beldie" Herbarium is part of the patrimony of the National Institute for Research and Development in Forestry "Marin Drăcea" and is registered in Index Herbariorum under the acronym BUCF. Created nine decades ago, the collection currently comprises approximately 40000 mounted specimens, with emphasis on the Romanian flora. The purpose of this work study was to create an updated electronic database of *Elymus* L. genus stored in the BUCF Herbarium and to provide a short description of the most relevant weeds with notes on their distribution, ecology and implications for agricultural ecosystems.

The *Elymus* genus comprises 120 vouchers and is represented by eleven species and one subspecies. Among them were found three rare taxa for the vascular flora of Romania: *Elymus farctus* subsp. *bessarabicus* (Savul. & Rayss) Melderis, *E. panormitanus* (Parl.) Tzvelev and *E. pycnanthus* (Godr.) Melderis. The Herbarium also stores a historical record, an *E. hispidus* (Opiz) Melderis specimen dated over two hundred years. Almost all plants are very well preserved being kept in their entirety and correctly attached to the voucher. *Elymus* representatives are widespread across the country and are found primarily in open woodlands, meadows and agricultural fields where are problematic weeds of cultivated crops. Specimens of *Elymus* genus stored in the herbarium were mainly collected from forest areas, but they can also be used as reference material in agricultural studies.

Key words: *Elymus*, herbarium, specimen, voucher, weed

Elymus L. (*Triticaceae*, *Poaceae*) is a genus with a cosmopolite distribution (from artic regions up to tropical ones), comprising approximately 150 species (Dubcovsky J. *et al*, 1997; Okito P. *et al* 2009; Sun G., Salomon B., 2009; Zhou Q. *et al*, 2016). Its taxonomy is considered as extremely complex and controversial as it was revised numerous times (Salomon B., 1994; Assadi M., 1996; Banfi E., 2018). As such, numerous taxa considered as a member of the *Elymus* genus were relocated based on morphologic, anatomic or cytological studies to related genus such as *Agropyron*, *Anthosachne*, *Elytrigia*, *Leymus*, *Thinopyrum*, *Triticum*, etc. (Banfi E., 2018). As a consequence, the *Elymys* nomenclature is difficult due to its numerous synonyms (Mizianty M., Szczepaniak M., 1997).

In recent years, data from herbarium collections have been employed extensively as primary resources for a wide range of investigation (Meineke E.K. *et al*, 2018), from biogeographical patterns to environmental changes (Lavoie C., 2013).

"Alexandru Beldie" Herbarium is one of the most important botanical collections from Romania. It was created nine decades ago by the renowned botanist Alexandru Beldie and comprises around 40000 mounted specimens, with emphasis on the Romanian flora.

The herbarium is currently part of "Marin Drăcea" National Institute for Research and Development in Forestry and is also included in the international scientific circuit (registered in Index Herbariorum under the acronym BUCF) (Chisăliță I. *et al*, 2017; Dincă L. *et al*, 2018).

According to the last update of its inventory, the Herbarium contains: 19 species of *Androsace* genus (Dincă L. *et al*, 2017), 15 species of *Ornithogalum* genus (Enescu, R., Dincă L., 2017), 69 species of Potentilla genus (Crișan, V. *et al*, 2017), 15 species of *Veronica* genus (Dincă L. *et al*, 2017), 7 species of *Lycopodium* genus (Vechiu E. *et al*, 2018), 21 species of *Agrostis* genus (Cântar I.C., Dincă L., 2018), 80 species of *Trifolium* genus (Cântar I.C., Dincă L., 2018), 41 species of *Polygonum* genus (Vechiu E. *et al*, 2018), the 6 species of *Vaccinium* genus (*Scărlătescu* et al., 2017) and the 19 species of *Scorzonera* genus (Dincă L., Cântar I.C., 2017).

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MATERIALS AND METHOD

In order to establish the number of taxa belonging to the *Elymus* genus from "Al. Beldie" Herbarium, the entire material available was analyzed, including the related *Agropyron* and *Triticum* genera, as a part of its members are presently considered as belonging to *Elymus*. The species scientific nomenclature follows The Plant List international database (http://www.theplantlist.org).

The data about each specimen was recorded in a table: scientific name, collection name, exact place of harvesting (country, county, locality, mountains, forest, etc.), collection time (year, month, day), the name of the person who has collected or identified the plant and the conservation degree.

A numerical scale designed into four levels was used to assess the conservation of each specimen: 1(well conserved plant, entire and correctly attached to the voucher), 2 (plant detached from the voucher with striped but present parts), 3 (detached plant with missing parts), 4 (detached and fragmented plant with over 50% of its parts missing) (Vasile D. et al., 2017). An excerpt of the inventory is rendered in *Table 1*.

Subsequently, the species were described based on the bibliographic study analysis. For the most relevant species, their chorologyc, morphologic and ecologic particularities have been emphasized, as well as their implications in agricultural ecosystems.

Table 1

***Elymus* genus inventory (excerpt from the data base**

Drawer no.	Plate No.	Herbarium/ Botanic Collection/ Institution	Specie's name	Harvest date	Harvest place	Collected/ Determined by:	Conservation degree (1..4)
14	39	Flora Exsiccata Austro-Hungarica	*Elymus hispidus* (Opiz) Melderis	1812.01.01.	Hungary	J. Wagner	1
14	70	Museum Botanicum Universitatis Cluj	*Elymus farctus* (Viv.) Runemark ex Melderis	1924.06.10.	Dobrogea, Caliacra	I. Prodan, E.I. Nyarady	1
14	2	Al. Beldie Herbarium, Bucharest	*Elymus caninus* (L.) L.	1947.09.22.	Bucegi	Al. Beldie	1
14	23	"Regele Carol II" Polytechnic School, Botanic Laboratory, Bucharest	*Elymus trachycaulus* (Link) Gould ex Shinners	1983.07.22.	Suecia, Monte Suljatten Jemtlandiae	Conrad Indebetou	1
15	66	Herbier A. Autheman	*Elymus elongates* (Host) Runemark	1888.07.01	Martigues, Etang de Caronte	Autheman	1
15	70	J. Dorfler, Wiener botanischer Tauschverein	*Elymus pycnanthus* (Godr.) Melderis	1894.07.12.	Flora Anglica: Bristol	J.W. White, F.L.S.Clifton	1
15	65	J. Vetter Herbarium	*Elymus tauri* (Boiss. & Bal.) Melderis	1890.08.01	Piohlero, Elmalu	J.Vetter	1
15	62	ICS Herbarium	*Elymus repens* (L.) Gould	1937.09.13.	Maxim – Buzau Forest	C.C.Georgescu	2
15	60	Hortus Botanicus Universitatis Craiovensis	*Elymus repens* (L.) Gould	1966.06.29.	Distr. Craiova, Radovan	D. Cirtu	1
15	32	Herbarul Scoalei Politehnice Bucuresti	*Elymus repens* (L.) Gould	1893..07.06.	Torda	Wollf	1
14	19	Flora Bulgarica Exsiccata	*Elymus caninus* (L.) L.	1932.08.08.	Macedonia	B. Stefanaff et T. Georgieff	1

RESULTS AND DISCUSSIONS

"Al. Beldie" Herbarium contains 120 *Elymus* L. vouchers and is represented by the following species: *Elymus caninus* (L.) L., *E. elongates* (Host) Runemark, *E. fractus* (Viv.) Runemark ex Melderis, E. *fractus* subsp. *bessarabicus* (Savul. & Rayss) Melderis, *E. hispidus* (Opiz) Melderis, *E. panoramitanus* (Parl.) Tzvelev., *E. pungens* (Pers.) Melderis, *E. pycnanthus* (Godr.) Melderis, *E. repens* (L.) Gould, *E. mutabilis* (Drobow) Tzvelev, *E. tauri* (Boiss. & Bal.) Melderis and *E. trachycaulus* (Link) Gould ex Shinners.

The most numerous recordings were signaled for *E. repens* (49 vouchers), *E. hispidus* (32 vouchers), *E. caninus* (15 vouchers) and *E. fractus* (10 vouchers). Furthermore, three taxa included in the National Red List of rare species are also present, namely: *E. farctus* subsp. *bessarabicus*, *E. pycnanthus* and *E. panormitanus* (Olteanu M. *et. al*, 1994).

***Elymus repens* (L.) Gould** (syn. *Agropyron repens*) commonly known as quack grass or couch grass has a very wide spreading area, covering Europe, Asia, America and Africa (Szczepaniak M., 2009).

In Romania, it occupies a varied array of habitats (meadows, fields, dry shores, roadsides, shrubberies and forests), from the plain area up to the inferior mountain one (Anghel G., Morariu I., 1972). It is considered to be one of the most problematic weeds worldwide when associated with agricultural crops (Holm L.G. *et al*., 1977). It is a perennial plant, with a long and very ramified rhizome with aerial sprouts that can reach 80-100 cm in height. Its spike is compound, with multiflora bristles, laterally compressed, located with the broad part towards the rachis.

The species is characterized by a very high morphologic variability, with the floral literature describing a considerable number of intraspecific units (Palmer J.H., 1963).

Extremely important is the fact that its rhizome is used for preparing a medicinal tea with diuretic properties (Al-Snafi A. E., 2015).

Elymus hispidus (syn. *Agropyron intermedium*) grows in central and southern parts from Europe from where it extends towards Central Asia (Mizianty M., Szczepaniak M., 1997). It is morphologically similar to *E. repens* in that it develops long and creeping rhizomes, but unlike it, its lemma is entirely glabrous (*figure 1*).

Figure 1. ***Elymus hispidus***

Elymus caninus (syn. *Agropyron caninus*) has a native Euro-Asiatic areal, but narrower than the previous species. On the West side, its areal starts from Iceland and Great Britain from where it rapidly advances towards East countries up to South Siberia. The South limit ends in the North of the Mediterranean Sea from where it grows up to subarctic regions (Yan C., Sun G., 2012). In Romania it habituates on forests, forest clearings, shrubberies, debris, grass cliffs and more frequently in the mountain level. It is a plant without long stools and with aristate glumes that can reach 10 mm in length (*figure 2*).

Figure 2. ***Elymus caninus***

It shows also great morphological variability, the varieties and forms that are distinguished mainly by the number of floras in a spikelet, the length of lemma awn, leaf and sheaths pubescence (Mizianty M., 2005).

Elymus fractus (syn. *Agropyron junceum*) is present in coastal areas from Europe, Asia Minor and Africa. In our country, it can be found in Constanța County where it prefers sandy stations from the sea litoral. A vigorous plant, its rhizome is long, repent, with long spikes bonded to the axes that can reach 17-30 mm. It adapts well on sandy soils with salt excess (Gorham J. *et al*, 1986), being used for obtaining hybrids from the wheat that manifests the highest resistance to large salt concentrations (Forster B.P. *et al*, 1988).

Elymus farctus* subsp. *bessarabicus is reported only on the Black Sea coasts (Dewey D.R., 1970). In Romania, it appears sporadically together with a typical species from which it is hard to differentiate. This subspecies is characterized by spikelets shorter than the rachis internodes.

Elymus panormitanus (syn. *Agropyron panormitanus*) can be found in the Mediterranean region, Crimea, Syria and Algeria. It was signaled in our country in Caraș-Severin and Mehedinți, where it prefers shaded forests. From a morphologic point of view, it is similar to *E. caninus*, with the difference that it has an inferior, arista and longer glumes.

Elymus pycnanthus has dense spikes and large spikelets. The leaves have pronounced nerves, while overlapping sheaths margins lack cilia. The rachis is rigid, with short internodes.

The plant's harvesting period. The specimens were gathered over 180 years. The oldest voucher from the herbarium dates back to 1812 and belongs to an *E. hispidus* sample originating from Flora Exsiccata Austro-Hungarica.

Most of the vouchers dating before 1900 were donated or bought through exchanges from over 15 similar foreign institutions such as Flora Britannica, Flora der Mark, Flora Norvegica, Societas Helvetica, Flora Hispanica Exsiccata, Flora von West-Ungarn, Flora Exsiccata Austro-Hungarica, etc.

After the year 1900, most of the herbarium materials were harvested within 1930-1939 and 1940-1949 (*figure 3*). Their number amounts to almost half of the entire collection.

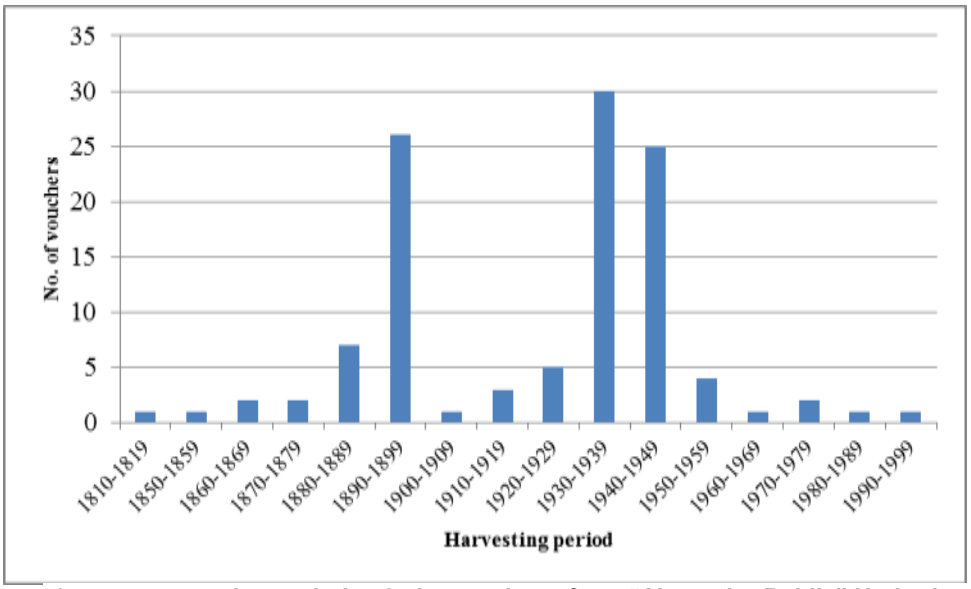

Figure 3. **Harvesting periods of *Elymus* plants from "Alexandru Beldie" Herbarium**

Species gathered from our country predominate in the collection (namely from Alba, Argeș, Brașov, Caraș Severin, Cluj, Constanța, Dâmbovița, Dolj, Ilfov, Prahova, Mehedinți, Mureș, Timiș, and Tulcea counties). The plants were harvested from renowned specialists among which we mention C.C. Georgescu (16 vouchers), Al. Beldie (13 vouchers) and Wollf (10 vouchers).

Amongst the 120 vouchers analyzed, 99,2% have obtained the first grade in regard to their conservation state. This is a favorable statistic, given the advanced age of many of the vouchers.

CONCLUSIONS

The geographic distribution of *Elymus* species in Romania shows very diverse patterns, from wide (eg. *E. repens*, *E. caninus*) to narrow ranges (eg. *E. fractus*, *E. panormitanus*). In addition, some species occupy a wide altitudinal range, while others are restricted to coastal areas.

Apart from the great variation in geographic distribution patterns, *Elymus* species present a large variability in morphological traits. As such, they occupy very diverse habitats, primarily open woodlands, meadows or agricultural fields where they have a negative impact on cultivated crops. On the other hand, some members possess useful genes for wheat breeding programs.

Among the main representatives, we have also detected three 'rare species for the Romanian flora (*E. farctus subsp. bessarabicus, E. pycnanthus* and *E. panormitanus*).

The storage conditions of the *Elymus* genus in the "Al. Beldie" Herbarium is remarkable, considering the age of specimens. Because of their historical relevance, vouchers can offer numerous research opportunities. Additionally, the agricultural sector can also benefit from stored and preserved vouchers, as they can help reconstruct the spread of invasive weeds or other species.

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INFLUENCE OF PLANTS DENSITY ON PRODUCTIVITY OF CORN FOR SILAGE IN THE CONDITIONS OF DEPRESSION JIJIA - BAHLUI

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Abstract

Corn silage is the most efficient way of feeding the animals during the grazing period, with a very high degree of consumability. The success of corn silage cultivation depends largely on the proper choice of hybrid, but also on the pedoclimatic conditions of the crop area. The characteristics and the suitability of the hybrid have an important role in the maize culture for silage, but in order to obtain superior productions from a qualitative and quantitative point of view, the technological elements and their application must be respected. The density of corn crop for silage is considered the most important technological element. All the improvements of the maize crop, the introduction of the most productive maize hybrids, the fertilization, the irrigation, etc., have led to new levels of production, changing each time the optimum plants density. The research was conducted in 2018 in the pedoclimatic conditions corresponding to the Depression Jijia – Bahlui. Three experimental factors were studied, as followed: the influence of plants density, the distance between the rows and the hybrid on the production of dry matter (DM). The obtained results showed that the technological factors (the density of plants and the distance between rows) caused changes in the biomass production, the quantity of dry matter being influenced by the hybrid, as well as the plants density and the distance between rows. As the density of plants per hectare increases, the amount of dry matter decreases thus registering at all three densities, reduced production differences.

Key words: maize hybrids, corn silage, dry matter production, row spacing

Corn is one of the most important cultivated plants that has a special role in the food of humans and animals. The success of a corn crop for silage involves some requirements that refer to establishing the optimum plants of density, choosing the hybrids, as well as the correct choice of the technological elements (Roth G.W. and Heinrichs A.J., 2017).

Corn silage provides high palatability with relatively constant quality and higher energy content than other forages (Oliveira I.L. *et al*, 2017). Chaudhary D.P. *et al*, 2013, argue that corn silage has a rapid growth, producing a very high quantity of biomass and of high quality. It contains sufficient amounts of protein and minerals and has a high digestibility compared to other forages.

The density of plants as a factor of production is important and influences the production of dry matter in the silage maize crop (Vîntu V. *et al*, 2010). The susceptibility to corn silage depends on several factors, among which: the choice of cultivated hybrid, climatic conditions, plants densities, relations between cultural, quantitative and generative factors (Ceclan O.A., 2010). Numerous studies showed that maize crop density is considered the most important technological element in maize crop for silage (Çarpici Budakli E. *et al*, 2010; Ramezani M. *et al*, 2011; Ferreira G. *et al*, 2014; Mandić V. *et al*, 2015; Sharifi R.S. and Namvar A., 2016).

Cañadas Á. *et al*, 2016, show that increasing the density of plants in corn cultivation for silage resulted in thinner and longer stems. According to the results, the highest production of dry matter was recorded at the plants density, of 125.000 plants·ha^{-1} with a production increase of 20.11% higher than the density of 65.500 plants·ha^{-1}. Ferreira G. and Teets C.L., 2017, show that increasing the density of plants increases the production of fodder by affecting the nutritional quality minimally. All the improvements of the corn crop, had led to new levels of production, changing each time the optimum plants density.

The study followed the production of dry matter on the surface unit and its modification depending on the density of plants, hybrid and the distance between rows.

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MATERIAL AND METHOD

The studies were conducted in 2018 in Moldavian Forest Steppe. From the administrative point of view, the area under study is located in the Iasi county, on the coordinates (47°02' North latitude and 27°22' East longitude).

From the climatic point of view, the territory belongs to the temperate-continental climate zone under the influence of Atlantic and Euro-Asian anti-cyclones. The year of experience was characterized by normal weather conditions, no extreme weather phenomenes were recorded during the whole vegetation period of the experience. The soil corresponds to the forest steppe zone types and is a cambic chernozem, formed on clay deposits. The research has followed the influence of plants density, distance between rows and three maize hybrids on the production of dry matter in the maize for silage. In order to attain the proposed objectives, a polyfactorial experience was set up. The experiment was established, with a design type 2x3x3, arranged in subdivided plots in three replications, which have a 22,4 m^2. The factors were as follows: A - distance between rows, with two graduations (a_1 - 70 cm between rows and a_2 - 50 cm between rows), B - cultivated maize hybrid, with three graduations (b_1 - H_1, b_2 - H_2 and b_3 - H_3) and C - plants density, with three graduations (c_1 – 70,000 plants·ha^{-1}, c_2 – 83,000 plants·ha^{-1} and c_3 – 100,000 plants·ha^{-1}).

The precursor culture was rape, the experience being in the second year of research in the same location. In the autumn, a basic fertilization of 200 kg·ha^{-1} ($N_{18}P_{46}$) was carried out and in the pre-sowing seedbed was fertilized throughout the experiment with 200 kg·ha^{-1} of urea (N_{46}).

Production was expressed in dry matter (DM); the results were statisticaly analyzed by the analyses of variance and limit differences.

RESULTS AND DISCUSSIONS

From the analysis of the influence of the distance between rows on the production of dry matter (*table 1*), it appears that the distance between rows had influenced insignificantly the production of dry matter. Thus, reducing the interval between plants to 50 cm resulted in the highest production of 15.71 Mg·ha^{-1} DM, the increase being 9.9% compared to the control variant. The lowest production, of 14.29 Mg·ha^{-1} DM was recorded in the control variant, respectively at the distance between rows of 70 cm. From the analysis of the influence of the hybrid on the production of dry matter (*table 2*), it appears that the genotypes analyzed behaved differently, the differences from the control (b_1-H_1) being very insignificant and distinctly significant.
Within the experience, in 2018, the H_3 hybrid adapted best to the pedoclimatic conditions in the studied area, achieving the highest production of dry matter, of 18.49 Mg·ha^{-1} DM, with a production increase of 33.7% compared to the control variant (b_1 -H_1), the difference being a distinctly significant one. The lowest production, of 12.68 Mg·ha^{-1} DM was recorded in the H_2 hybrid, recording a lower output than the control variant (*table 2*).

As a result of the improvement brought to the corn crop, the introduction of more productive hybrids, fertilization, irrigation, the density of the crop is considered the most valuable technological element.

Considering the separate influence of the plants density on the dry matter production in the studied maize hybrids, average dry matter productions with values between 13.94 Mg·ha^{-1} DM at the density of 83000 plants·ha^{-1} and 16.23 Mg·ha^{-1} DM at the density of 70000 plants·ha^{-1} (*table 3*).

Table 1

Influence of distance between maize plants rows on dry matter production

Experimental plot	DM production (Mg·ha^{-1})	Diferences		Statistical significance
		Mg·ha^{-1}	%	
a_1 - 70 cm between rows (c)	14.29	Control	100	Control
a_2 - 50 cm between rows	15.71	1.42	109.9	ns
	LSD 5%	*2.14*		
	LSD 1%	*3.56*		
	LSD 0.1%	*6.65*		

Table 2

Influence of maize hybrid on dry matter production

Experimental plot	DM production (Mg·ha^{-1})	Diferences		Statistical significance
		Mg·ha^{-1}	%	
b_1 - H_1 (control)	13.83	Control	100	Control
b_2 - H_2	12.68	-1.15	91.7	ns
b_3 - H_3	18.49	4.66	133.7	**
	LSD 5%	*2.51*		
	LSD 1%	*4.17*		
	LSD 0.1%	*7.79*		

The increase of the density from 70000 plants·ha^{-1} to 100000 plants·ha^{-1} has caused a significant increase in the production of dry matter. Of the studied variants, the density of 70000 plants·ha^{-1} determined to obtain the highest production of dry matter, respectively of 16.23 Mg·ha^{-1} DM.

Analyzing the influence of the studied factors (the distance between rows, the density of plants and the cultivated hybrid) on the production of dry matter (*table 4*), it is found that the values of production of maize for silage, are different depending on the hybrid, and on the same hybrid, depending on the density of plants and the distance between the rows. Thus, at the distance of 70 cm between rows, at all three density plants studied, the hybrids recorded different values of the production of dry matter in relation to the control variant (*table 4*), the highest production of dry matter, of 19.26 Mg·ha^{-1} DM being recorded at the interaction between a_1 - 70 cm x b_3 - H_3 x c_3 – 70000 plants·ha^{-1}, with a very significant difference compared to the control.

As can be seen (*table 4*), at the distance between rows of 70 cm, the values of the dry matter production registered a slight decrease with the increase of the density in all the three hybrids, with positive and negative differences compared to the control (*table 4*).

Table 3

Influence of plants density on dry matter production

Experimental plot	DM production (Mg·ha^{-1})	Diferences		Statistical significance
		Mg·ha^{-1}	%	
c_1- 70000 plants·ha^{-1} (c)	16.23	Control	100	Control
c_2- 83000 plants·ha^{-1}	14.83	-1.40	91.4	ns
c_3- 100000 plants·ha^{-1}	13.94	-2.29	85.9	ns
	LSD 5%	*2.48*		
	LSD 1%	*4.10*		
	LSD 0.1%	*7.67*		

Table 4

Influence of interaction between experimental factors on dry matter production

Experimental plot			Dry matter production (Mg·ha^{-1})	Diferences		Statistical significance
				Mg·ha^{-1}	%	
a_1 - 70 cm between rows (c)	b_1 - H_1 (c)	c_1 - 70000 plants·ha^{-1}(c)	14.97	Control	100	Control
		c_2 - 83000 plants·ha^{-1}	12.59	-2.38	84.1	o
		c_3 - 100000 plants·ha^{-1}	11.98	-2.99	80.0	oo
	b_2-H_2	c_1 - 70000 plants·ha^{-1}	12.37	-2.60	82.6	oo
		c_2 - 83000 plants·ha^{-1}	12.21	-2.76	81.6	oo
		c_3 - 100000 plants·ha^{-1}	11.65	-3.32	77.8	ooo
	b_3 - H_3	c_1 - 70000 plants·ha^{-1}	19.26	4.29	128.7	***
		c_2 - 83000 plants·ha^{-1}	17.58	2.61	117.4	**
		c_3 - 100000 plants·ha^{-1}	16.01	1.04	106.9	ns
a_2 - 50 cm between rows	b_1 - H_1	c_1 - 70000 plants·ha^{-1}	16.32	1.35	109.0	ns
		c_2 - 83000 plants·ha^{-1}	13.85	-1.12	92.5	ns
		c_3 - 100000 plants·ha^{-1}	13.30	-1.67	88.8	ns
	b_2-H_2	c_1 - 70000 plants·ha^{-1}	13.48	-1.49	90.1	ns
		c_2 - 83000 plants·ha^{-1}	13.43	-1.54	89.7	ns
		c_3 - 100000 plants·ha^{-1}	12.93	-2.04	86.4	o
	b_3 - H_3	c_1 - 70000 plants·ha^{-1}	20.99	6.02	140.2	***
		c_2 - 83000 plants·ha^{-1}	19.34	4.37	129.2	***
		c_3 - 100000 plants·ha^{-1}	17.77	2.80	118.7	**
			LSD 5%	*1.88*		
			LSD 1%	*2.52*		
			LSD 0.1%	*3.32*		

The distance between rows of 50 cm, caused a slight increase in the production of dry matter in most variants compared to the distance between rows of 70 cm, the values obtained being different depending on the plants density, with insignificant differences, distinctly significant and very significant compared to the control variant (*table 4*). Thus, at the distance of 50 cm between rows, the studied hybrids recorded higher values of dry matter production, the highest production, of 20.99 Mg·ha^{-1} DM being recorded at the interaction between a_2 - 50 cm x b_1 - H_3 x c_1-70000 plants·ha^{-1}, with a very significant difference compared to the control. Also, high values of the

dry matter production, of 19.34 Mg·ha^{-1} DM and 17.77 Mg·ha^{-1} DM respectively were recorded in the same H_3 hybrid at the density of 83000 plants·ha^{-1}, as well as in the interaction between a_2 - 50 cm x b_3 - H_3 x c_3 – 100000 plants·ha^{-1}, the differences being distinct and very significant compared to the control. According to the data obtained, it can be seen that the plants of density and the distance between the rows significantly influenced the production of dry matter (*table 4*).

CONCLUSIONS

The success of maize for silage crop implies some requirements that refer to establishing the optimum plants of density, choosing the hybrids, choosing the technological works and establishing the optimal harvest time.

The density of corn crop for silage is considered the most important technological element.

The obtained results showed that the technological factors (the density of plants and the distance between rows) caused changes in the biomass production, the quantity of dry matter being influenced by the hybrid, as well as the plants density and the distance between rows. Sowing corn for silage at a distance of 50 cm between rows, compared to 70 cm, increased the production of dry matter.

As the density of plants per hectare increases, the amount of dry matter decreases thus registering at all three densities, reduced production differences.

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QUALITY OF THE *Dichanthium ischaemum* (L.) Roberty SPECIES ON HARVESTING PHENOPHASES

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Abstract

The forage value of the species is strongly influenced by their growth stage when they are harvested or grazed. The forage value is the highest during the vegetative growth and the lowest during the seed formation stage. Therefore, when forage species are cultivated for the purpose of feeding cattle, they must be harvested or grazed in the early stages of maturity. As the forage plants reach maturity crude protein content decreases, ADF, NDF content increases and feed digestibility is reduced. The objectives of this study were to determine the influence of harvesting phenophases and of the organo-mineral fertilization on the quality of the *Dichanthium ischaemum* (L.) Roberty species. The experimental factors were represented by the harvesting phenophase, with three graduations: a_1 - harvesting at plants height of 15-18 cm, a_2 - harvesting at the ear formation (control), a_3 - harvesting to full flowering and fertilization with seven graduations: b_1 - unfertilized (control), b_2 - $N_{50}P_{50}$ kg·ha^{-1} annually, b_3 - $N_{75}P_{75}$ kg·ha^{-1} annually, b_4 - $N_{100}P_{100}$ kg·ha^{-1} annually, b_5 - 10 Mg·ha^{-1} sheep manure annually, b_6 - 20 Mg·ha^{-1} annually and b_7 - 30 Mg·ha^{-1} annually sheep manure applied at two years. The obtained results showed that the developmental stage is an essential factor that determines important changes in the quality of the analyzed species, the chemical composition of the species obtained being influenced by the harvesting phenophase, as well as the type of fertilizer and the applied doses. The relative qualitative value of the forage was found to be highest during the vegetative growth, so as the species advances the vegetation the crude protein content decreases, the content in ADF, NDF increases and its digestibility decreases.

Key words: old world bluestem (OWB), organic and mineral fertilization, CP, NDF, ADF, RFQ

Ionel A. *et al*., 2003; Vîntu V. *et al*, 2004, mention that the species *Dichanthium ischaemum* L. is common on eroded, dry steppe and forest steppe grasslands, with low feed value (1), while in Asia it is considered an alternative to *Eragrostis curvula* and *Cynodon dactylon* species (Coleman SW and Forbes TDA, 1998). The percentage of crude protein is between 7 - 10% in the leaves and around 5% in the stems, and the phosphorus is only 0.08% (Coleman S.W. *et al*., 2004).

Berg W.A., 1993, mentions that in terms of economic importance, the *Dichanthium ischaemum* L., species is considered to be a forage species consumed only in the early stages of vegetation. Allen V.G. and Brown P., 2005, show that the quality of *Dichanthium ischaemum* L. is high in the first half of the growing season (May-July), with crude protein concentrations averaging 9-12% during the growing period active (May-July). Redfearn D.D., 2003, shows that the highest crude protein content of *Dichanthium ischaemum* species is in the active growth period (May-July), when the vegetative mass is in full formation. After mid-July, the quality of the forage had a rapid decline. As the species progresses in vegetation, there is a decrease in the crude protein content and an increase of the cell wall components (NDF, ADF, hemicellulose and cellulose) (Carvallo T.D., 2008; Mahyuddin P. şi Purwantari N.D., 2009**;** Burns J.C. and Fisher D.S., 2010; Burns J.C. and Fisher D.S., 2012). The quality of the forage is influenced by many factors, including the harvesting stage, growing conditions, as well as soil fertility (Dabo S.M. *et al*., 1988; Bumb I. *et al*., 2016). The composition and nutritional value of the feed changes during the growing period, with a decreasing tendency during the vegetation period (Basurto R. *et al*., 2000). The stage of plant maturity or developmental phenophase at harvest time is the main factor responsible for decreasing the nutritional value of the forage (Bumb I. et al., 2016). Thus, the present study aims to recommend optimal harvesting phenophase of the dominant species *Dichanthium ischaemum* L., from a permanent grassland of *Dichanthium ischaemum* (L.) Roberty from Moldavian Forest Steppe with

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different variants of organic and mineral fertilization on the quality of the species.

MATERIAL AND METHOD

The experience was organized on a permanent grassland of *Dichanthium ischaemum* L. Roberty, situated in Moldavian Forest Steppe, on the territory of Andrieşeni locality, Iaşi county, between the geographical coordinates 47°02' N latitude and 27°22' -Eastern longitude, on a slightly inclined ground, with SE exposition.

The experience is bifactorial, arranged in randomized plots in three replicates. The aim of the study was to analyze the influence of the harvesting phenophase and of the organic and mineral fertilization at different doses on the quality of the species *Dichanthium ischaemum* (L.) Roberty, and the objectives were the determination quality indicators: plant crude protein (CP), NDF (neutral detergent fiber), ADF (acid detergent fiber) and calculate forage quality relative (RFQ).

The experimental factors were represented by the harvesting phenophase, with three graduations: a_1 - harvesting at plants height of 15-18 cm, a_2 -harvesting at the ear formation (control) and a_3 - harvesting to full flowering and fertilization with seven graduations: b_1 - unfertilized (control), b_2 - $N_{50}P_{50}$ kg·ha^{-1} annually, b_3 - $N_{75}P_{75}$ kg·ha^{-1} annually, b_4 - $N_{100}P_{100}$ kg·ha^{-1} annually, b_5 - 10 Mg·ha^{-1} sheep manure applied annually, b_6 - 20 Mg·ha^{-1} sheep manure applied annually and b_7 - 30 Mg·ha^{-1} sheep manure applied at two years.

Fertilization was done with two types of fertilizer: organic represented by well fermented sheep manure (older than two years) and mineral represented by complex fertilizer with nitrogen and phosphorus ($N_{20}P_{20}$). The manure and mineral fertilizers were manually applied every year in the spring, at the beginning of plant growth.

Nitrogen content was determined by Kjeldahl method, and NDF and ADF content were determined by Van Soest method (Van Soest P., 1963). RFQ (Relative Forage Quality) was calculated using the Equation 1 (Ward R, Ondarza M.B., 2008; Linn J.G.,Martin N.P., 2012).

The results were statisticaly analyzed by the analyses of variance and limit differences. We also determined the correlation equations and the significance of the square regression between the type of fertilization, harvesting pheophase and the species analyzed content in CP and RFQ.

$$RFQ = \frac{(4{,}898 + 89{,}796 \cdot (1{,}085 + 0.0124 \cdot ADF)) \cdot \frac{120}{NDF}}{1.23}$$

Equation 1. Relative Forage Quality

RESULTS AND DISCUSSIONS

The strategy of harvesting on a certain meadow in different phenophases represents a good alternative for optimizing green mass production, choosing the optimal harvesting time having a favorable impact on the quantity and nutritional value of the forage.

The chemical composition of *Dichanthium ischaemum* varies throughout the vegetation period. Protein values are high at the beginning of the vegetation period to a grazing height of 35-40 cm, having a decreasing tendency towards the end of the vegetation period (Teague W.R. *et al*., 1998; Allen V.G. and Brown P., 2005).

Analyzing the influence of the studied factors on the crude protein content of the *Dichanhium ischaemum* species (*table 1*), it is found that the values of the content of the species in CP, are different, depending on the fertilization variants used, and at the same doses, depending on the harvesting phenophase. Harvesting at plants height of 15-18 cm had the effect of distinct and very significant increases of the crude protein content in relation to the unfertilized variant, the highest values of the crude protein content, of 11.37 g·100 g^{-1} DM and 10.24 g·100 g^{-1} DM respectively were registered in mineral fertilized variants with $N_{100}P_{100}$ kg·ha-^{1} annually and $N_{75}P_{75}$ kg·ha^{-1} annually, with increases of 54.7% and 39.35% respectively (*table 1*). The data obtained (*table 1*), show that in this early phenophase the species has a high content of crude protein in all experimental variants compared to the unfertilized variant, with distinct and very significant differences compared to the control variant, the high values obtained being due to the level to intensify the meadow, but especially the young stage of the plants.

As can be seen in *table 1*, mineral as well as organic fertilization significantly influenced the crude protein content, causing substantial increases compared to the unfertilized variant taken as a control.

At the ear formation (control) phenophase of the species *Dichanhium ischaemum* taken as a control, the crude protein content of the analyzed species registered a slight decrease, with 45.3% for the fertilized variant with $N_{100}P_{100}$ kg·ha-^{1} annually and 31.7% for the fertilized variant with $N_{75}P_{75}$ kg·ha-^{1} annually compared to the first phenophase, the obtained values being 8.04 g·100 g^{-1} DM and 7.91 g·100 g^{-1} DM respectively, with insignificant differences compared to the control (*table 1*).

In the unfertilized variant in this phenophase, was registered a crude protein content of 7.35 g·100 g^{-1} DM.

When harvesting in full flowering phenophase, in contrast to the other two harvesting phenophases, in all the fertilized variants there were insignificant decreases in the crude protein content compared to the unfertilized variant, the

highest protein content, of 7.61 g·100 g^{-1} DM being registered in the variant fertilized with 30 Mg·ha^{-1} sheep manure applied at two years. In this phenophase in the variant fertilized with $N_{100}P_{100}$ kg·ha-^{1} annually, the crude protein content decreased by 53.8% compared to the first phenophase and by 8.5% compared to the ear formation phenophase taken as a control. Also, the same aspect can be observed in the case of the fertilized variant with $N_{75}P_{75}$ kg·ha-^{1} annually where the decrease of the crude protein content was 38.6% compared to the first phenophase and 6.8% compared to the ear formation phenophase taken as a control (*table 1*).

The values of the regression coefficient (R^2), in the case of the crude protein content of *Dichanthium ischaemum* species, were positively insignificant and significant in the case of mineral fertilization with NP (*figure 1*) and positively insignificant in the case of fertilization with sheep manure (*figure 2*), which shows that the value of the analyzed indicator correlated with the type and doses of fertilizer applied.

Table 1

The influence of the interaction between harvesting phenophase and fertilization on the quality of the species *Dichanthium ischaemum*

Variant		Quality parameters			
		CP (g·100 g^{-1} DM)	NDF (g·100 g^{-1} DM)	ADF (g·100 g^{-1} DM)	RFQ
a_1 - harvesting at plants height of 15-18 cm	b_1-unfertilized	8.55**	70.74	41.11^{ooo}	78.00*
	b_2- $N_{50}P_{50}$	8.95***	69.83	41.04^{ooo}	79.11*
	b_3- $N_{75}P_{75}$	10.24***	69.08^{o}	40.27^{ooo}	81.18*
	b_4- $N_{100}P_{100}$	11.37***	68.04^{oo}	39.11^{ooo}	84.29***
	b_5-10 Mg·ha^{-1} sheep manure applied annually	8.61**	71.15	41.19^{ooo}	77.42
	b_6-20 Mg·ha^{-1} sheep manure applied annually	8.84***	70.02	40.37^{ooo}	79.95**
	b_7-30 Mg·ha^{-1} sheep manure applied at 2 years	8.99***	69.07^{o}	38.94^{ooo}	83.29***
a_2 - harvesting at the ear formation (C)	b_1-unfertilized (C)	7.35$^{(C)}$	71.11$^{(C)}$	44.89$^{(C)}$	71.82$^{(C)}$
	b_2- $N_{50}P_{50}$	7.58	70.38	44.47	73.21
	b_3- $N_{75}P_{75}$	7.91	69.48	43.66	75.42
	b_4- $N_{100}P_{100}$	8.04	68.29^{oo}	42.38^{ooo}	78.77*
	b_5-10 Mg·ha^{-1} sheep manure applied annually	7.69	70.96	44.46	72.62
	b_6-20 Mg·ha^{-1} sheep manure applied annually	7.91	69.26	43.50	75.91
	b_7-30 Mg·ha^{-1} sheep manure applied at 2 years	8.14	68.33^{oo}	42.33^{ooo}	78.80*
a_3 - harvesting to full flowering	b_1-unfertilized	7.07	74.89***	49.33***	61.75^{ooo}
	b_2- $N_{50}P_{50}$	7.12	73.77*	48.16***	64.41^{o}
	b_3- $N_{75}P_{75}$	7.41	71.99	47.06**	67.67
	b_4- $N_{100}P_{100}$	7.42	71.02	45.73	70.62
	b_5-10 Mg·ha^{-1} sheep manure applied annually	7.17	74.55**	48.50***	63.24^{oo}
	b_6-20 Mg·ha^{-1} sheep manure applied annually	7.52	73.55*	47.49***	65.58^{o}
	b_7-30 Mg·ha^{-1} sheep manure applied at 2 years	7.61	72.42	46.77**	67.69
	LSD 0.01	1.41	3.56	2.49	9.99
	LSD 0.1	1.07	2.70	1.88	7.57
	LSD 0.5	0.80	2.02	1.41	5.65

Harvesting in different phenophases, as well as the administration of organic and mineral fertilizers, produced significant changes in the content of cell walls (ADF and NDF) in the species *Dichanhium ischaemum* (*table 1*). Analyzing the influence of the studied factors on the content of NDF in the species *Dichanhium ischaemum* (*table 1*), we observe that harvesting at plants height of 15-18 cm caused a decrease of the NDF values in most experimental variants, the negative differences between the unfertilized variant and the fertilized variants being insignificant and distinctly significant.

This decrease is mainly due to the phenophase in which the plants contain less cellulose and lignin, results confirmed by other similar studies. In this phenophase we observe a decrease of the species content in the NDF with the increase of the doses of NP, but also a slight increase in the variants organically fertilized with sheep manure in different doses, this fact being due to the poor assimilation by the plants of the fertilizers under unfavorable climate conditions, aspect observed also in the ADF content of the

feed (*table 1*). The NDF values for the species analyzed in the first phenophase were between 68.04 g·100 g^{-1} DM and 71.15 g·100 g^{-1} DM.

The results obtained in the other two phenophases studied (harvesting at the ear formation and harvesting to full flowering), also highlighthed the decrease of the NDF plant content in the fertilized variants compared to the unfertilized variant, but also an increase in the NDF values due to the development stage which the plant accumulates in the cells more cellulose (*table 1*).

The results regarding the content of the *Dichanhium ischaemum* species in ADF, show us that in the phenophase in which the harvesting was made at the plants height of 15-18 cm different fertilization variants, a decrease of the values of this parameter is observed in all fertilized variants compared to the control variant, the differences being very significant negative (*table 1*).

Thus, the values in this phenophase were between 32.75 g·100 g^{-1} DM and 35.39 g·100 g^{-1} DM depending on the fertilization variant.

With the advancement of the species in vegetation, there is a tendency to increase the content values in ADF as a result of the accumulation of cell walls (lignin and cellulose), from 35.49 g·100 g^{-1} DM to 41.0 g·100 g^{-1} DM in the case of unfertilized variants. There is also a decrease in ADF values in the other two harvesting phenophases as a result of mineral or organic fertilization (*table 1*).

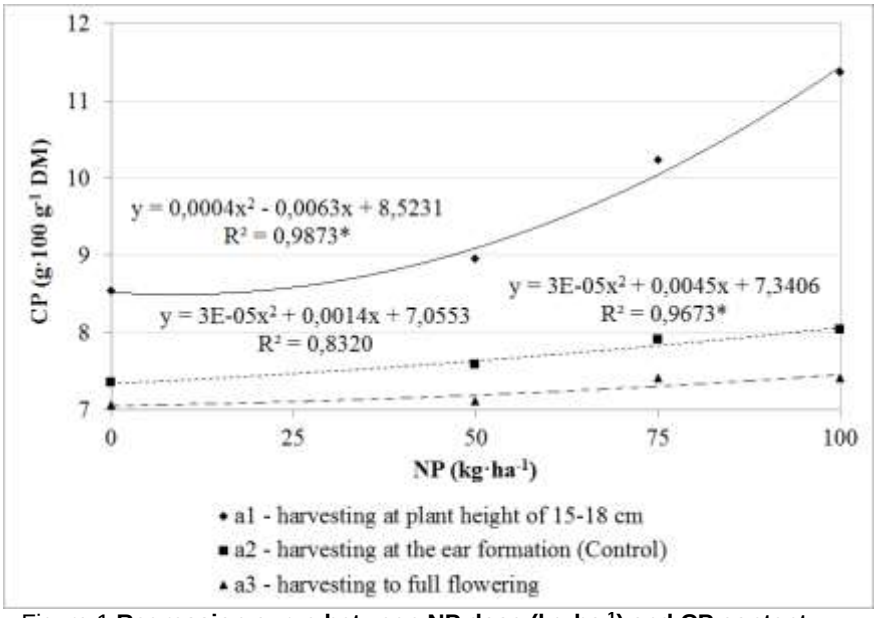

Figure 1 **Regression curve between NP dose (kg·ha^{-1}) and CP content**

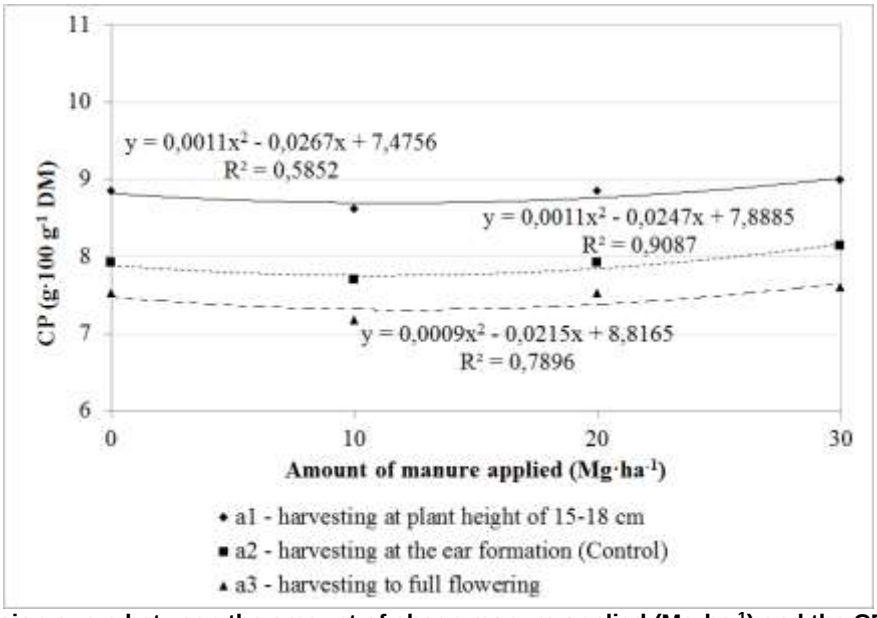

Figure 2 **Regression curve between the amount of sheep manure applied (Mg·ha^{-1}) and the CP content**

The results regarding the relative qualitative value of the species *Dichanhium ischaemum* (RFQ) (*table 1*), show us that the obtained RFQ values were influenced by the applied mineral and organic fertilization, but especially by the harvesting phenophase, with statistically assured differences in relation to the variant control.

The highest value of RFQ, of 84.29 was obtained in the variant harvested at the plants height of 15-18 cm in the variant fertilized with $N_{100}P_{100}$ kg·ha-^{1} annually, with an increase compared to the unfertilized variant taken as a control of 17.4%. Higher values of the RFQ in the first harvesting phenophase at the plants height the analyzed species of 15-18 cm were recorded in most experimental variants, with insignificant, significant, distinct and very significant differences from the control (*table 1*).

According to the results obtained, it is noted that the *Dichanhium ischaemum* species has a poor quality in the first phenophase in which the harvesting was made at the height of the plants of 15-18 cm depending on the applied fertilization, the quality of the species being correlated with its content in crude protein, as well as in cell walls (ADF and NDF).

Also, the obtained results confirm that with the advance of the species in vegetation (full flowering) the relative qualitative value of the species analyzed is reduced, by decreasing the crude protein content and accumulation of cell walls, so that the species acquires a very poor quality (*table 1*).

The relative qualitative feed value (RFQ) of the *Dichanthium ischaemum* species showed a general growth tendency with the increase of the applied NP doses, correlating significantly with these values (*figure 3*).

In the case of manure due to the unfavorable climatic conditions that negatively influenced the use of manure by plants, the relative qualitative value of the species (RFQ) correlated positively insignificantly with the studied phenophases (*figure 4*).

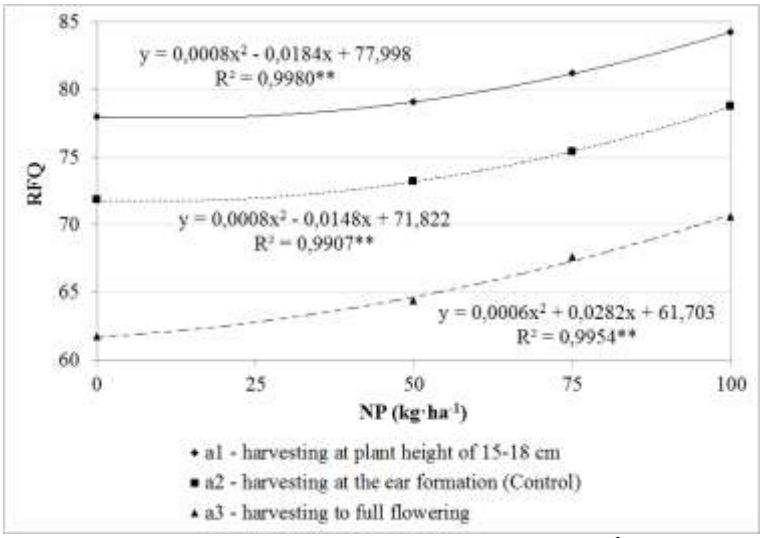

Figure 3 **Regression curve between NP dose (kg·ha^{-1}) and RFQ**

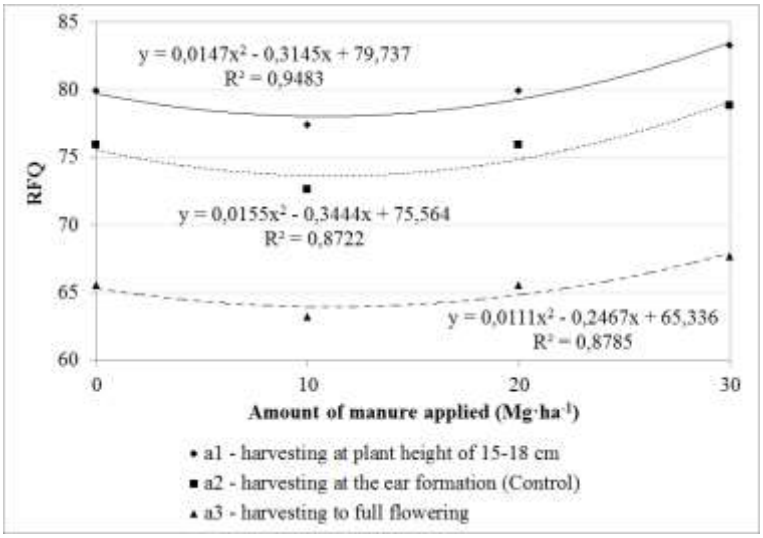

Figure 4 **Regression curve between the amount of sheep manure applied (Mg·ha^{-1}) and RFQ**

CONCLUSIONS

The obtained results show that the developmental stage is an essential factor that determines changes in the quality of the studied species *Dichanthium ischaemum*, the chemical composition being influenced by the harvesting phenophase, as well as the type of fertilizer and the applied doses.

The major factor that determines the composition and nutritional value of the species is the vegetation (development) phase of the plants at harvest.

Thus, according to the study, the relative qualitative feed value of the *Dichanthium ischaemum* species proved to be the highest during the vegetative growth, when the harvest was done at the plants height of 15-18 cm, the plants having a high protein content and a low cell wall.

Also, the results of the study highlight that as the plants age, the proportion of protein decreases, increasing the proportion of cellulose, hemicellulose and lignin (ADF and NDF), thus reducing the digestibility of the species. Both organic and mineral fertilizers influenced the quality of the species, the crude protein content increasing significantly compared to the unfertilized variant.

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RESEARCHES REGARDING THE MEASURES APPLIED FOR REDUCING THE WEEDS INFESTATION AT SEED HEMP CROPS UNDER THE CONDITION OF CENTRAL OF MOLDOVA

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Abstract

The hemp is one of the crops susceptible at weed infestation, weed appearance in the first vegetations phenophases lead at compromising the crop. Chemical intervention through herbicide application represents one method to control the weed appearance and spreading over the seed hemp crop. In this moment for seed hemp crop there is a limited range of approved herbicides. At A.R.D.S. Secuieni Neamț, for controling the weeds from seed hemp crop were experimentated a series of herbicides with different active substance to assess the product selectivity for the crop plant and efficacy under the climatic conditions of the years 2018 - 2019. During two years, the weeds identified from hemp crop was composed from 13 species, 11 from *Dicotyledonate* class and two from *Monocotyledonate* class. From *Dicotyledonate* class, the weed species which recorded the highest average density were *Atriplex patula* with 21.50 specimens /sqm and *Polygonum persicaria* with 15.05 specimens/sqm. *Setaria glauca*, the most representative species from *Monocotyledons* class recorded an average density of 5.88 specimens/sqm. By the weeds number/sqm, the species from *Dicotyledonate* class register a 89.20% share meaning a average density of 53.59 specimens/sqm and from the *Monocotyledons* class belong 6.49 specimens/sqm representing a share of 10.80% from the all the specimens identified. From all the 12 herbicides experimentated, two were applyed in preemergence and the rest of herbicides were applied to control the weeds after plant emergence. Regarding the hemp plant selectivity, the commercial products Lentagran 45 WP, Galera Super and Challenge 600 provoked different symptoms of phytotoxicity, but the hemp recovered after 30 days from applying the herbicides. The weeds control highest efficacy was obtained at the variant treated with Challenge 600 and it was 72%. For the herbicides Stratos Ultra, Fusilade Forte, Frontier Forte, Lontrel 300, Leopard Super și Select Super the efficacy had values between 62 and 67%.

Key words: weeds, seed hemp crop, herbicide

The competition between crops and weeds for nutritive elements, water and light in the first weeks from emergence in not favorable for seed hemp because of slow vegetation phenophase development. (Corbett *et al,* 2004; Prade T., 2011). Chemical intervention through herbicide application represents one method to control the weed appearance and spreading over the seed hemp crop. In this moment for seed hemp crop there is a limited range of approved herbicides.

Jankauskiene *et al,* (2014) study the weeds spectrum since the hemp emergence until harvesting without using any classical method to prevent weeds appearance. They found that weeds density was high in the first vegetation phenophases reaching 202 specimens/sqm, the climatic condition characterized by high temperatures and moderate rainfall contributed to the increase weeds appearance. Researchers identify 31 weeds species, the most frequent were register at plant emergence. Thereby in 2010 the most numerous species was *Chenopodium album L.*, in 2011 *Veronica arvensis* L. and in 2012 the species *Lamium purpureum L.*, *Thlaspi arvense L*., *Veronica arvensis* and *Poa annua L.*

The results obtained by Jankauskienė *et al,* (2015) support the important influence of hemp sowed at high seed density over the plant density at plant emergence and at harvesting and also that rainy periods are favorable to crops development and for weeds appearance too. The rainy periods are favorable to crops and weeds, the weeds average density varied depending on seed density from 166 specimens/sqm at variants sowed with 45 kg/ha to 140 specimens /sqm at 70 kg/ha.

In this paper are presented the results obtained within a seed hemp experience for establish the efficacy of some herbicides in the prevention and control of weeds, crop selectivity and influence on seed production.

[1]Agricultural Research-Development Station Secuieni

The data presented in this paper are the results of the observations and determinations made in the years 2018 and 2019 within the complex project PN III - P1 - 1.2 - PCCDI - 2017 - 0566 "Complex system of integral valorisation of some agricultural species with energy and food potential".

MATERIAL AND METHOD

The research was carried out at A.R.D.S SECUIENI - NEAMȚ between the years 2018 and 2019, the experience was located in the experimental field of the Plant Protection Laboratory, on a typical cambic chernozem soil, with pH in water 6.29, humus content 2.3, nitrogen index 2.1, P_2O_5 mobile 39 ppm, K_2O 161ppm. The experience was placed in the experimental field following the randomized blocks method in three repetitions. The variety used was Zenit created at SCDA Secuieni. Pre-plants were wheat (2018) and sunflower (2019). Soil works, fertilization, germination bed preparation work were performed according to the framework technology for cultivating hemp for seed (Trotuș et al, 1992, 2008, 2011, 2015).

The seed hemp was sowed in the optimum time, in the first decade of April. Immediately after sowing, pre-emergent herbicides were applied and the herbicides experienced in post-emergence were applied in the phenophases corresponding to the crop plants and weeds (*Table* 1).

From plant emergence to harvesting, maintenance work was carried out on specific crops of seed hemp, observations and determinations were made regarding the efficacy and selectivity of the herbicides experienced. The data obtained were statistically processed according to the method of analysis of variance, the effectiveness of herbicides was calculated using the Abott formula and the selectivity was evaluated according to the EWRS scale with grades from 1 to 9, in which 1 represents an unaffected plant and 9 affected plant as a percentage of 80 - 100%.

The climatic conditions recorded during the two years were very varied, the two years were characterized as thermally warm and under the rainfall aspect the first year (2017/2018) was characterized as normal and the second (2018/ 2019) as dry.

Regarding the recorded temperatures, in 2018, the months of April and May were hot compared to the same period of 2019 when the recorded temperatures were similar to the multiannual average (*figure 1*).

The distribution of precipitations during the vegetation period of the hemp was irregular, the precipitations being insignificant in April (14.8 mm) and May (23.4 mm) of 2018 compared to the same period of 2019 when in April and May it was recorded 38 mm and 95 mm respectively (*figure 2*).

Under the conditions of 2018, the germination of the seeds, the emergence and growth of the plants was slowed down, and the weed growth was quite staggered, their density was lower compared to the one registered in the years with normal precipitation and the weeds were more resistant to herbicides action.

Although the highest amounts of rainfall fell at the end of June in 2018, causing a late weeds appearance, the situation of 2019 with the more uniform distribution of rainfall in May and in the first decade of June caused a late weed appearance and plants who showed symptoms of phytotoxicity recovered after 30 days .

Therefore, the two very different climatic years influenced the weed appearance, the emergence of the crop, the crop selectivity and the effectiveness of the herbicides.

RESULTS AND DISCUSSIONS

During the two years the weeds identified match to 13 species of monocotyledonous and dicotyledonous weeds belonging to 10 botanical families.

The highest average density was recorded by *Atriplex patula* species of 21.52 specimens/sqm, and *Polygonum persicaria* of 15.05 specimens/sqm, and the lowest by the species *Cirsium arvense* - 0.17 specimens/sqm, *Sonchus arvensis* - 0.33 specimens/sqm and *Echinochloa crus - galli* - 0.61 specimens/sqm (*Table 2*).

According to the number of species divided by taxonomic classes, the 11 species of *Dicotyledonous* weeds have a weight of 84.62% of the total and the *Monocotyledons* - 15.38% (*figure 3*).

According to the number of weeds, the highest weight belongs to the class of *Dicotyledonate*, which represents 89.20% of the total collected specimens/sqm totaling 53.59 specimens/sqm. *Monocotyledonous* weed species recorded a weight of 10.80% with an average density of 6.49 specimens/sqm (*figure 4*).

Analyzing the weight of the weed species belonging to the *Dicotyledonata* class, we find that the species: *Atriplex patula* L. (40.16%), *Polygonum persicaria* L (28.08%) and *Galinsoga parviflora* Cav. (19.78%) have the highest values and the lowest share had the species *Cirsium arvense* (0.32%) and *Sonchus arvensis* (0.62%). The rest of the species identified *Abutilon theophrasti* Medik., *Amaranthus retroflexus* L., *Brassica rapae* L., *Convolvulus arvensis*, *Solanum nigrum* L., *Taraxanum officinale* L. recorded values between 1.23% and 2.80% (*figure 5*).

Table 1

Herbicides experienced at seed hemp crops between 2018-2019 at A.R.D.S. SECUIENI Neamț

No	Experimental variant (Commercial product)	Dose l/ha p.c.	Active substance	Application time	Weeds
1	Dual Gold (std.)	1.5	S-metolaclor 960 g/l	Preemergent	Monocotyledonous and some dicotyledonous weeds
2	Dual Gold – Stratos Ultra	1.5 – 2.0	S-metolaclor 960 g/l – cicloxidim 100 g/l	Pre-emergent - postemergent	Annual and perennial weeds grasses
3	Dual Gold – Fusilade Forte	1.5 – 2.0	S-metolaclor 960 g/l - fluazifop-p-butil 150 g/l	Pre-emergent - postemergent	Annual and perennial grass weeds
4	Dual Gold - Frontier	1.5 – 1.4	S-metolaclor 960 g/l - S-dimetenamid 720 g/l	Pre-emergent - postemergent	Annual monocotyledonous weeds and some annual dicotyledonous weeds
5	Dual Gold - Lontrel	1.5 – 0.3	S-metolaclor 960 g/l - clopiralid 300 g/l	Pre-emergent - postemergent	Dicotyledonous weeds
6	Dual Gold - Lontrel	1.5 – 0.5	S-metolaclor 960 g/l - clopiralid 300 g/l	Pre-emergent - postemergent	Dicotyledonous weeds
7	Dual Gold - Leopard Super	1.5 – 1.5	S-metolaclor 960 g/l - quizalofop-p-etil 5 g/l	Pre-emergent - postemergent	Monocotyledonous weeds
8	Dual Gold – Select Super	1.5 – 1.5	S-metolaclor 960 g/l – cletodim 120 g/l	Pre-emergent - postemergent	Monocotyledonous weeds
9	Dual Gold - Galera Super	1.5 – 0.25	S-metolaclor 960 g/l - aminopiralid 40g/l + clopiralid 240 g/l + picloram 80 g/l	Pre-emergent - postemergent	Dicotyledonous weeds
10	Dual Gold – Lentagran	1.5 – 2.0	S-metolaclor 960 g/l – piridat 450g/l kg	Pre-emergent - postemergent	Dicotyledonous weeds
11	Challenge	3.0	Aclonifen 600 g/l	Pre-emergent	The dicotyledonous and monocotyledonous weeds
12	Challenge	2.5	Aclonifen 600g/l	Postemergent	The dicotyledonous and monocotyledonous weeds

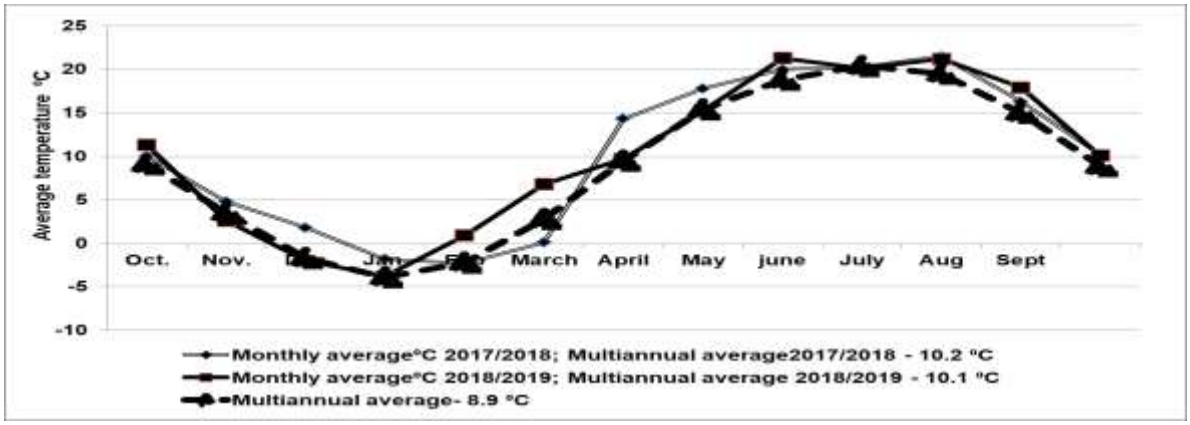

Figure 1 **The temperatures recorded at Secuieni - Neamț in the period 2018-2019**

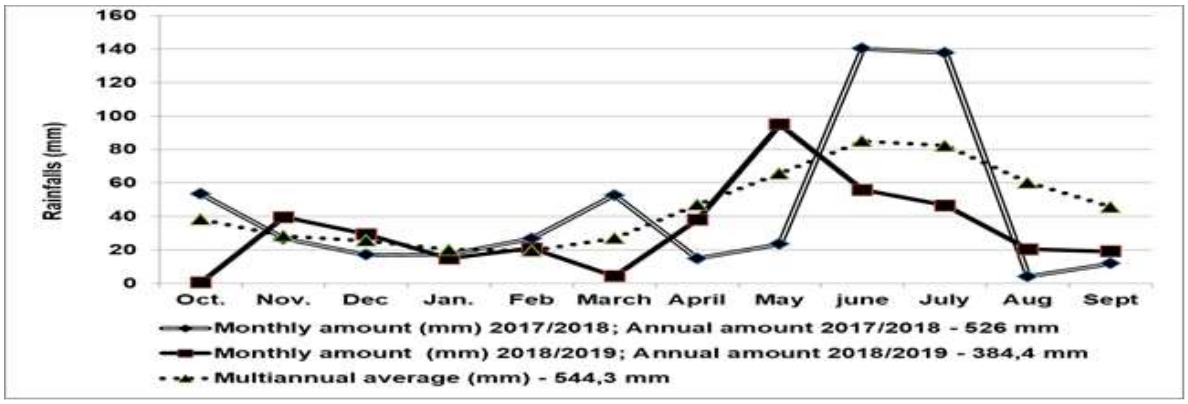

Figure 2 **Precipitation recorded at Secuieni - Neamț in the period 2018-2019**

Table 2

Weeds register at seed hemp crops located in the conditions of the Center of Moldova, Secuieni 2018 -2019

No	Species	Class	Family	Weeds density /sqm		
				Maxim	Minim	Average
1	*Abutilon theophrasti* Medik.	*Dicotyledonous*	*Malvaceae*	1.50	1.00	0.66
2	*Amaranthus retroflexus* L.	*Dicotyledonous*	*Amaranthaceae*	1.00	1.00	1.00
3	*Atriplex patula* L.	*Dicotyledonous*	*Chenopodiaceae*	59.00	1.00	21.52
4	*Brassica rapae* L.	*Dicotyledonous*	*Cruciferae*	2.00	1.00	1.50
5	*Cirsium arvense* L.	*Dicotyledonous*	*Asteraceae*	5.00	1.00	0.17
6	*Convolvulus arvensis* L.	*dicotyledonous*	*Convolvulaceae*	2.50	1.00	0.95
7	*Galinsoga parviflora* Cav.	*Dicotyledonous*	*Compositae*	32.00	2.00	10.60
8	*Polygonum persicaria* L.	*Dicotyledonous*	*Polygonaceae*	1.50	1.00	15.05
9	*Sonchus arvensis* L.	*Dicotyledonous*	*Compositae*	1.00	1.00	0.33
10	*Solanum nigrum* L.	*Dicotyledonous*	*Solanaceae*	3.50	1.50	0.81
11	*Taraxacum officinale* L.	*Dicotyledonous*	*Asteraceae*	1.00	1.00	1.00
12	*Echinochloa crus – galli* L.	*Monocotyledonous*	*Gramineae*	8.00	1.00	0.61
13	*Setaria glauca* L.	*Monocotyledonous*	*Gramineae*	53.00	1.00	5.88
Total	13	*Dicotyledonous:* 11 *Monocotyledonous:* 2	9 1	171.00	14.50	60.08

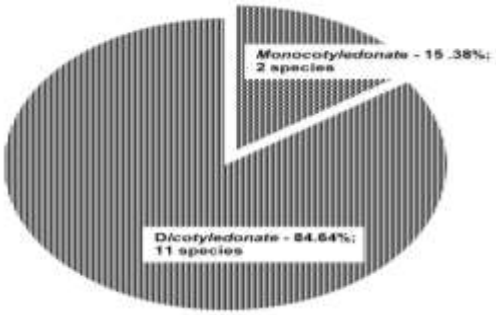

Figure 3 **Share of classes by number of species**

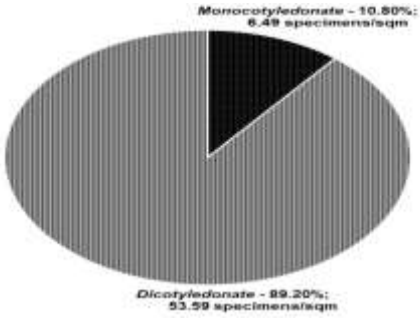

Figure 4 **Share of classes by number specimens /sqm**

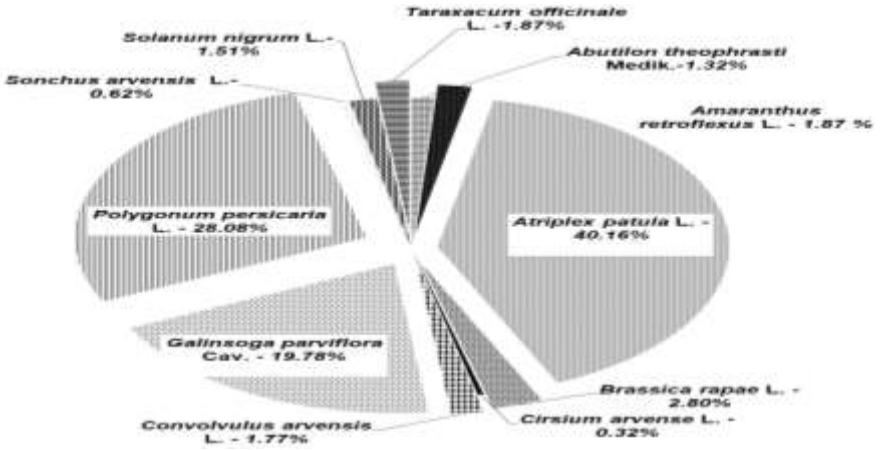

Figure 5 ***Dicotyledonate* class share of weeds species**

Of the 12 herbicides experienced, two were applied in pre-emergence - Dual Gold - 1.5 l / ha, which can use standard and Challenge 600 3.0 l / ha, and the rest in post-emergence.

The commercial products Lentagran 45 WP, Galera Super and Challenge 600 have caused various symptoms of phytotoxicity (leaf emboli, basal leaf necrosis, plant growth slow down) and the crop plant recovers after approximately 30 days from the application of herbicides (*Table* 3). The efficacy of herbicides applied in pre-emergence ranged from 48% (Dual Gold) to 72% (Challenge 600).

The herbicides Stratos Ultra, Fusilade Forte, Frontier Forte, Lontrel 300, Leopard Super and Select Super have efficacy values ranging from 62% to 67% (*table* 3).

The production of hemp was 558 kg / ha in the non-herbicide control and between 997 kg / ha and 1225 kg / ha in the herbicide variants, between the herbicide variants and the non-herbicide control, there were very significant production differences (*table 4*).

Table 3

Pre-emergent and postemergent herbicides efficacy applied to combat weeds from seed hemp crops, Secuieni-Neamț 2018-2019

No.	Experimental variant (Commercial product)	Dose l/ha c.p.	Active substance	Application time	Efficacy %	Selectivity EWRS Scale
1	Control	-	-	-	-	-
2	Dual Gold (std.)	1.5	S-metolaclor 960 g/l	Preemergent	48	1
3	Dual Gold – Stratos Ultra	1.5 – 2.0	S-metolaclor 960 g/l – cicloxidim 100 g/l	Pre-emergent - postemergent	65	1
4	Dual Gold – Fusilade Forte	1.5 – 2.0	S-metolaclor 960 g/l - fluazifop-p-butil 150 g/l	Pre-emergent - postemergent	67	1
5	Dual Gold - Frontier	1.5 – 1.4	S-metolaclor 960 g/l - S-dimetenamid 720 g/l	Pre-emergent - postemergent	62	1
6	Dual Gold - Lontrel	1.5 – 0.3	S-metolaclor 960 g/l - clopiralid 300 g/l	Pre-emergent - postemergent	67	1
7	Dual Gold - Lontrel	1.5 – 0.5	S-metolaclor 960 g/l - clopiralid 300 g/l	Pre-emergent - postemergent	65	1
8	Dual Gold – Leopard Super	1.5 – 1.5	S-metolaclor 960 g/l - quizalofop-p-etil 5 g/l	Pre-emergent - postemergent	67	1
9	Dual Gold – Select Super	1.5 – 1.5	S-metolaclor 960 g/l – cletodim 120 g/l	Pre-emergent - postemergent	62	1
10	Dual Gold – Galera Super	1.5 – 0.25	S-metolaclor 960 g/l - aminopiralid 40g/l + clopiralid 240 g/l + picloram 80 g/l	Pre-emergent - postemergent	72	3
11	Dual Gold – Lentagran	1.5 – 2.0	S-metolaclor 960 g/l – piridat 450g/l kg	Pre-emergent - postemergent	92	3
12	Challenge	3.0	Aclonifen 600 g/l	Pre-emergent	72	1
13	Challenge	2.5	Aclonifen 600g/l	Postemergent	86	6

Table 4

The influence of some herbicides applied for weed control on the production of seed hemp at A.R.D.S. SECUIENI, NEAMȚ, 2018-2019

No.	Experimental variant (Commercial product)	Dose l/ha c.p.	Application time	Seed production kg/ha	% compared to control	Diff. control kg/ha	Signif.	Diff. std. kg/ha	Signif. std.
1	Control	-	-	558	mt	Mt	mt	-439	000
2	Dual Gold(std.)	1.5	Preemergent	997	179	439	***	std	-
3	Dual Gold – Stratos Ultra	1.5 – 2.0	Pre-emergent - postemergent	1155	207	597	***	158	***
4	Dual Gold – Fusilade Forte	1.5 – 2.0	Pre-emergent - postemergent	1023	183	465	***	26	
5	Dual Gold - Frontier	1.5 – 1.4	Pre-emergent - postemergent	1068	191	510	***	71	**
6	Dual Gold - Lontrel	1.5 – 0.3	Pre-emergent - postemergent	1126	202	568	***	129	***
7	Dual Gold - Lontrel	1.5 – 0.5	Pre-emergent - postemergent	1225	220	667	***	228	***
8	Dual Gold - Leopard Super	1.5 – 1.5	Pre-emergent - postemergent	1080	194	522	***	83	***
9	Dual Gold – Select Super	1.5 – 1.5	Pre-emergent - postemergent	1007	180	449	***	10	
10	Dual Gold - Galera Super	1.5 – 0.25	Pre-emergent - postemergent	1037	185	479	***	40	
11	Dual Gold – Lentagran	1.5 – 2.0	Pre-emergent - postemergent	825	148	267	***	-172	ooo
12	Challenge	3.0	Pre-emergent	1008	181	450	***	11	
13	Challenge	2.5	Postemergent	622	111	64	**	-375	ooo
			DL 5%	40.9 kg/ha					
			DL 1%	55.6 kg/ha					
			DL 0.1%	74.5 kg/ha					

CONCLUSIONS

The weeds identified from the seed hemp culture totaled 13 species belonging to 10 botanical families.

According to the number of species, the 11 *Dicotyledonous* weed species account for 84.62% of the total and the *Monocotyledons* 15.38%.

According to the number of weeds, the highest share belongs to the class of *Dicotyledons* that participate with 89.20%, and *Monocotyledons* -10.80%.

The species *Atriplex patula* L. (40.16%), *Polygonum persicaria* L. (28.08%) and *Galinsoga parviflora* Cav. (19.78%) belonging to the *Dicotyledonata* class had the highest weights and the lowest were recorded at the species *Cirsium arvense* L. (0.32%) and *Sonchus arvense* L. (0.62%).

The commercial products Lentagran 45 WP, Galera Super and Challenge 600 have caused various symptoms of phytotoxicity (leaf emboli, basal leaf necrosis, plant growth slowdown) and the crop plant recovers after approximately 30 days from the application of herbicides.

The efficacy of herbicides applied in pre-emergence ranged from 48% (Dual Gold) to 72% (Challenge 600).

The herbicides Stratos Ultra, Fusilade Forte, Frontier Forte, Lontrel 300, Leopard Super and Select Super have efficacy values ranging from 62% to 67%.

The production of hemp was 558 kg / ha in the non-herbicide control and between 997 kg / ha and 1225 kg / ha in the herbicide variants, between the herbicide variants and the non-herbicide control, there were very significant production differences.

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IMPROVEMENT OF THE AGROLANDHAFT STRUCTURE DUE TO THE CULTIVATION OF PERENNIAL GRASSES ON ERODED SOIL

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Abstract

As it is known, natural steps are not just a value of forage production. Most of them occupying an intermediate position between arable land and water areas and the especially dense branch network, they have a high conservation role in agricultural landscapes: they protect the soil from erosion, the riverbanks of the rivers from clogging and channel destruction. However, forests also serve as a second powerful natural bio filter surface factor of water and soil, in fact, they form the quantity and quality of water resources in Ukraine. The purpose of the paper is to highlight the phytocenotic agricultural ecological bases and the agrotechnical basis for the formation of high productivity grass mixtures, their fertilization and their management.

Key words: forage, productivity, grass mixtures

Negative attitude towards soil nature, which has taken place for decades, intensive agricultural systems based on chemical substances have led to significant soil degradation, disturbing the ecological balance of agricultural ecosystems, determining the quality of agricultural products, contaminating radionuclides, heavy metals, carcinogens, pesticides, various chemicals. An alternative to this groundless attitude is the development of environmentally friendly agricultural systems that eliminate all problems of agricultural chemicals based on intensive agriculture.

The successful solution of the problem of growth in milk and meat production is only possible by creating a strong feed base, offering a complete and high quality variety of animal feed. With the increase of cereal production, the implementation of measures to intensify the field of forage production plays an important role in creating a forage base belonging to natural pastures. They often form the main feedstock for cattle during the summer season and are an important source of production of various types of cheap feed.

According to the improvement of technology and the use of natural pastures, they are able to provide 5.0-7.0 t / ha, and through irrigation - 10.0 t / ha of nutritional units. However, the productivity of natural pastures in the region until recently is too low (1.0-1.2 t / ha nutritional units). All of this leads to a lack of feed, adversely affecting the animal feed base. Especially by the very high share of arable land feed, in most cases, based on the high energy technology and cheap herbal feed sources in the production structure, especially in the energy and environmental crisis, the production of animals is reduced.

MATERIAL AND METHOD

The researches were carried out in 2014-2016 on the field of forage research of the ASA Institute of Forages and Agriculture in Cernăuți Ukraine. Black soil of slightly hydrolysed calcined chernozem, 0-30 cm of arable layer, was found to contain 13-14 mg nitrogen, mobile phosphorus forms - 9-10 mg, exchangeable potassium - 16-18 mg / 100 g, soil pH salt extraction - 6 5. Fertilizers (ammonium nitrate) introduced in spring, in the first and second mowing. Climatic conditions during the vegetation period (months IV-IX): precipitation, mm - in 2014 - 367.8; 2015 - 347.2; 2016 - 624.4; air temperature, ^{0}C - in 2014 - 18.4; 2015 —18.9; 2016 - 17.7

RESULTS AND DISCUSSIONS

Plow land, which is 2 times larger than normal (Merejco A.I., 1985, Polișciuc V.V., 1984 Rossolimo L.L., 1977), has an increasingly negative impact on the ecological situation not only in this region, but also in general in Ukraine, in particular regarding the reduction of water

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content in relation to the territory, sedimentation and pollution of the reservoirs.

Land reclamation works by creating long lasting mixtures with high water and soil protection carried out not only on meadow land, but also on agricultural land, especially in the rivers in the environment area is one of the most important tasks of the agricultural science and practice.

This underscores the need to study patterns of meadow fodder plants and to develop practical measures to create them, by efficiently using the genetic potential of plant resources, especially perennial leguminous and herbs, as well as using modern technologies for care and their use, including their structure and functioning in the autotrophic block.

From the study of the natural characteristics of the meadow ecosystems, the development of the scientific bases of the creation and rational use of the natural pastures has been carried out through many research experiences in our country and abroad (Andreev Lugovedenie N.G., 1971, Bogovin A. V., 1968, Kutuzova A.A., 1986, Kurgac V.G., 2006, Macarenco P. S., 1991, Minina I.P., 1970, Tomre R., 1974, Zurn F., 1972).

However, many fundamental questions regarding the creation of grasslands in the climatic conditions of forest steppe in western Ukraine have not been studied. The technological methods of their creation are energy consuming, taking into account the ecological, biological and phytocenotic factors, including potential species and new varieties of legumes and grasses, methods of forecasting and managing the performance of the cultivated grass since the improvement of their structural and functional organization. of the doses and proportions of fertilizers, irrigation and use of cenoses with great preservation properties of sown grass and introduction. For natural grasslands used for intensive cultivation, there must be slopes of more than 3°, flood zones and non-productive soils. Conditions for the supply of fodder grass for livestock thus significantly improve them.

According to the experimental data of the ASAU Institute of Fodder and Agriculture, meadows with mixtures of leguminous and grass of grass are preferred, because in the first years of use of forage plants a good harvest can be obtained, without nitrogen fertilizers and to increase the yield of protein. 1.5 times.

In our studies leguminous (red clover, alfalfa and others) accumulate an amount of biological nitrogen equal to 120-180 kg / ha nitrogen annually *(table 1*).

In order to prolong the harvesting period of the grass in optimum terms in each mowing period for 20-25 days, to improve the quality of the forage and the more efficient use of the labor force and the technique for the harvesting of the forage, grass mixtures should be sown with different maturation periods.

Scientific data from the Institute of Forage and Agriculture of the National Academy of Agricultural Sciences of Ukraine indicates that when the slopes are sown with four components: two leguminous and two grasses, they are more durable and more productive, they grow well in different weather conditions and on different soils. In the first 2-3 years, the grass contains at least half of the leguminouss, when the development is weak of one or two components, the grasses that have been preserved form a normal grass composition *(table 1)*.

Not taking into account the rapid development of the nitrogen fertilizer industry, the need for partial replacement of mineral nitrogen in meadows with the biological one increases for the following main reasons: 1) Nitrogen fertilizer production is a costly process (9 times as expensive as the symbiotic one of the leguminous plants) (Mișustin E.N., 1979); 2) the introduction of high doses of mineral nitrogen to produce a large harvest is dangerous for the environment (Sotnicov S.V., 1983); 3) the production of nitrogen fertilizers on meadows, especially in Ukraine, is insufficient.

Creating a mixture of herbs with a high content of legumes - is one of the most promising for the intensification of grasslands in Ukraine. Partial replacement of the mineral reserves with the symbiotic nitrogen reserves is an important reduction of the energy consumption, whose weight in the cereals mixes of intensive type often represents half of the total costs (Bogovin A., 1993, Kurgac V.G., 2006).

The arid conditions of 2015 have had a negative effect on the yield of herbs and, as a result, a large harvest is obtained only in the first crop.

The same trend was observed in the collection of nutritional units, digestible protein and exchange energy.

So, together with effective measures to solve the economic problem of increasing the production of cheap herbal feeds and improving them, a prominent place also occupies the creation of specially cultivated pastures instead of the degraded natural and degraded agricultural lands, especially on slopes, and soils with dangerous erosion in the agrolandhaft area. This is due to the fact that meadow crops play an important role, being in the danger zone of erosion; they fulfill their role of high conservation in agricultural

landscapes, are specific biofilters that maintain surface runoff and, due to their high absorption, act as reservoirs.

Table 1

Productivity of different types of multiannual grasses used as hay (2014-2016)

Mixtures	Harvest, green mass, t/ha				Harvest on 1 ha			
	Years			average	Dry subst, t	Nutrit. units,t	Digestib protein, t	Exch energy GJ/ha
	2014	2015	2016					
1. Cereal mixture - *Bromus inermis Leus* (12 kg / ha) + *Festuca pratensis Huds* (9) *Phleum pratensis Huds* (2) + *Arrhenatherum elatius* L (3)	16.4	6.3	228	152	2.83	2.13	0.269	2.83
2.Grain mixture + N45	25.0	14.3	28.0	20.2	3.75	2.81	0.356	3.75
3.Grain mixture + N90	32.5	26.0	31.5	27.0	5.02	3.77	0.477	5.02
4.Grain mixture + N180	42.5	29.7	37.5	32.9	6.12	4.59	0.582	6.12
5.Mixture of cereals (50% of the full norm) + *Trifolium pratense L* (I2 kg / ha)	45.0	30.4	38.8	38.1	6.86	5.56	0.750	7.13
6.Grain mixture (50% of full norm) + *Lotus corniculatus L* (5 kg / ha)	40.0	14.6	17.0	23.8	4.05	3.24	0.443	4.21
7.Mixture of cereals (50% of the full norm) + *Trifolium repens* (10 kg / ha)	32.0	19.2	18.2	23.2	4.16	3.33	0.455	4.32
8.Grain mixture (50% of full norm) + *Medicago. sp* (10 kg / ha)	45.0	27.4	421	38.1	6.50	5.25	0.845	6.50
9. *Medicago. sp* (20 kg / ha)	46.0	23.5	56.9	42.1	7.16	5.73	0.988	7.16
10. *Trifolium pratense L* (20 kg / ha)	45.0	46.0	32.5	41.1	6.99	5.59	0.783	7.27
DA - 0.95 t/ha	1,12	1,43	1,3					

Bioenergy assessment of perennial herbs. Human productive activities in agricultural production, as in other fields, are reduced to the processes of energy conversion by various technologies. At the same time, the energy consumption per unit of production increases significantly. Numerous experimental data suggest that, at the current level of agricultural development, in order to increase the productivity of crops 2 times, it is necessary to increase 4-10 times the total energy costs (Klapp E., 1961, Kirilesco O.L., 2012).

In the production of fodder, on the value of the energy consumption, the crops and their relation in the structure of the sown surfaces, the optimization of the rotation system of the placement crops, depending on the soil and the environmental conditions and the distance from the production centers to the distribution spaces, have a significant importance, within the soil fertility restoration culture.

In the growth of perennial grasses, the energy exchange efficiency per hectare ranged between 28.3-72.7 GDj *(table 1)* and was the lowest during the sowing of the grasses without fertilization; the most expensive for growing perennial herbs is the technology that uses the introduction of N_{180} to perennial grasses, energy per hectare has been growing 32.3 GDJ. Natural energy was used at the sowing of alfalfa and clover and in mixtures with grass grasses *(table 2)*.

The energy efficiency rate here is 5.24 - 4.24, while in pure grass seed sowing is 1.89 - 4.26. Thus, each total mega joule of energy spent for the cultivation of alfalfa, clover and grass mixtures, makes it possible to obtain energy yields 27.6 - 41.0% higher than when planting herbs in monoculture. Similarly, the technology and the reimbursement of the total costs of the exchange energy in the crop varied *(table 2)*.

Under acute energy shortages, high and unstable prices for agricultural machinery and fertilizers, the evaluation of the efficacy of feed production technologies and separate processing methods should be based on energy equivalents, which together with the traditional economic method makes it possible taking into account the energy that accumulates in the culture, as well as the living energy. It must also become one of the main factors in shaping the price policy in the field of feed production.

Table 2

The bioenergetics efficiency of perennial herbs in 2014-2016

Mixtures	Total energy consumption		Coefficient of energy efficiency	Energy consumed at 1 production center, MDj	
	GDj / ha	in oil, kg/ ha		nutrition units	digestible protein
1. Cereal mixture - *Bromus inermis Leus* (12 kg / ha) + *Festuca pratensis Huds* (9) *Phleum pratensis Huds* (2) + *Arrhenatherum elatius L* (3)	6.95	139	4,26	246	2583
2.Grain mixture + N45	15.9	318	2,36	566	4466
3.Grain mixture + N90	25.2	504	1,99	668	5283
4.Grain mixture + N180	32.3	650	1,89	704	5550
5.Mixture of cereals (50% of the full norm) + *Trifolium pratense L* (l2 kg / ha)	13.6	272	5,24	245	1813
6.Grain mixture (50% of full norm) + *Lotus corniculatus* L (5 kg / ha)	11.1	222	3,79	343	2410
7.Mixture of cereals (50% of the full norm) + *Trifolium repens* (10 kg / ha)	10.7	214	4,04	321	2352
8.Grain mixture (50% of full norm) + *Medicago. sp* (10 kg / ha)	15.3	306	4,24	267	1810
9. *Medicago.sp* (20 kg / ha)	14.5	290	4,93	254	1467
10. *Trifolium pratense L* (20 kg / ha)	14.2	284	5,11	254	1814

In the production of fodder, on the value of the price policy in the field of feed production

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THE INFLUENCE OF TREATMENTS WITH DIFFERENT PHYTOSANITARY PRODUCTS (FUNGICIDES) ON THE ATTACK OF SOME PHYTOPATHOGENIC FUNGI AND ON WHEAT HARVEST – APACHE VARIETY - IN 2018 PEDOCLIMATIC CONDITIONS OF THE EASTERN BARAGAN

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Abstract

This study aims at monitoring the dynamics of the occurrence and evolution of the attack of some pathogenic agents to French wheat variety, Apache. Among these, we mention: *Puccinia recondita* f. sp. *tritici* (sin. *Puccinia triticina*) which produces wheat's brown rust and *Septoria* sp. which produces wheat's brown leaf spotting (septoriosis). Also, the influence of applying these fungicides on the harvest was monitored, as compared to the untreated control variant. One experiment with 7 variants (6 variants with phytosanitary treatment, plus one control variant not treated) was taken into consideration for this study, for which the following homologated phytosanitary products for wheat (according to PEST –EXPERT) were used, as follows: FALCON 460 EC (triadimenole 43 g/l + tebuconazole167 g/l + spiroxamine 250 g/l), MYSTIC 250 EC (tebuconazole 250 g/l), BUMPER 250 EC (propiconazole 250 g/l), TOPSIN 500 SC (thyophanate-methyl 500 g/l). The treatment variants were the following: V1 - FALCON 460 EC 0.7 L/HA 1 treatment applied at spike's releasing (12.05.2018), V2 - FALCON 460 EC 0.7 L/HA 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018), V3 - MYSTIC 250 EC 0.5 L/HA 1 treatment applied at spike's releasing (12.05.2018), V4 – MYSTIC 250 EC 0.5 L/HA 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel' filling (1.06.2018), V5 – BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0,75 l/ha 1 treatment applied at spike's releasing (12.05.2018),V6 – BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0,75 l/ha 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel' filling (1.06.2018) and V7 – untreated control variant. The experiment was placed in Latin square; the 7 variants being placed in 7 repetitions. Among the pathogenic agents under monitoring, *Puccinia recondita* f.sp. *tritici* fungus, producing the brown rust, had produced the greatest attacks. The fungi of Septoria sp. variety producing the leaf's brown rust (septoriosis) and *Blumeria graminis* f.sp. *tritici* fungus, producing wheat's mildew, produced rare attacks. The first two leaves placed under the spike had been analyzed for the above. These observations had led to the conclusion that for all 6 treatment variants, the degree of attack (D.A. %) of the two diseases was more reduced than at the untreated control variant. The harvests of the treated variants were as follows: V1 - 8434 kg/ha, V2 - 8866 kg/ha, V3 - 8742 kg/ha, V4 - 9072 kg/ha, V5 - 8907 kg/ha, V6 - 8701 kg/ha and V7 (control variant not treated) - 8454 kg/ha.

Key words: *Puccinia* spp., *Septoria* spp., latin square

The wheat, *Triticum aestivum*, is attacked by many pathogenic agents, such as: mildew - *Blumeria graminis* f.sp. *tritici*, brown rust - *Puccinia recondita* f. sp. *tritici*, brown leaf spotting - *Septoria tritici*, *Septoria nodorum*, stem's fusariosis and spike's burn *Giberella zeae*, *Giberella avenacea* (Iacob Viorica, Hatman M., Ulea E., Puiu I., 1998). The first half of the year 2018 was difficult for wheat, in what concerns the climatic conditions. Few rainfalls and high temperatures had been registered in this period. In the year 2018, April and May months were especially hot and droughty. For example, in April, the average temperature registered was 15°C and the rainfalls amounted in total to only 1.5 l/m². In May, the average temperature registered was 18.5°C and the rainfalls amounted in total to 25.4 l/m², relatively few for this month. Accordingly, the conditions for the attack of some pathogenic agents specific to wheat were less favorable as compared to previous years. However, *Puccinia recondita* f. sp. *tritici* fungus, producing wheat's brown rust (Velichi E., 2012) made known its presence. During vegetation period, this pathogenic agent formed uredorspors and teliospors (*figure 1*). *Puccinia recondita* f. sp. *tritici* attacks the wheat crops every year, at relatively high attack intensities, even if the year is droughty in April and May. The other pathogenic agents mentioned dangerous for wheat

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crop were signaled rarely in the climatic conditions of the year 2018

Table 1

The results of the experiment (the first treatment applied at straw's extension, the second at kernel' filling) with fungicide products (6 variants of treatment + 1 untreated control variant) in what concerns the cumulated attack (D.A.%) of *Puccinia recondita* f. sp. *tritici* fungus ("flag" leaf and the next leaf) (16th June, 2018)

	"Flag" leaf			The second leaf		
Variant	**D.A%**	**Difference as compared to the control variant**	**Signifi cance**	**D.A%**	**Difference as compared to the control variant**	**Significance**
-V1 FALCON 460 EC 0.7 L/HA 1 treatment applied at spike's release (12.05.2018)	0.85	29.19	***	3.91	38.18	***
-V2 FALCON 460 EC 0.7 L/HA 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018)	5.58	24.46	***	10.62	31.47	***
-V3 MYSTIC 250 EC 0.5 L/HA 1 treatment applied at spike's release (12.05.2018).	2.35	27.69	***	11.01	31.08	***
-V4 MYSTIC 250 EC 0.5 L/HA 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018)	10.31	19.13	***	11.04	31.05	***
-V5 BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0.75 l/ha 1 treatment applied at spike's release (12.05.2018).	8.84	21.2	***	14.31	27.18	**
-V6 BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0.75 l/ha 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018).	16.94	13.1	***	23.99	18.1	*
-V7 Untreated control variant	30.04	-	-	42.09	-	

LD D.A. % for "flag" leaf
LD 5%= 2.56
LD 1%= 3.42

LD D.A. % for the second leaf
LD 5%= 16.1
LD 1%= 21.36

Table 2

The results of the experiment (the first treatment applied at straw's extension, the second at kernel' filling) with fungicide products (6 variants of treatment + 1 untreated control variant) in what concerns the harvest (t/ha) obtained at all variants treated as compared to the untreated control variant (16th June, 2018)

Variant	**Harvest (t/ha)**	**Difference as compared to the control variant (t/ha)**	**Significance**
-V1 FALCON 460 EC 0.7 L/HA 1 treatment applied at spike's release (12.05.2018)	8.434	-0.020	Not significant
-V2 FALCON 460 EC 0.7 L/HA 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018)	8.866	0.412	**
-V3 MYSTIC 250 EC 0.5 L/HA 1 treatment applied at spike's release (12.05.2018).	8.742	0.288	**
-V4 MYSTIC 250 EC 0.5 L/HA 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018)	9.072	0..618	**
-V5 BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0.75 l/ha 1 treatment applied at spike's release (12.05.2018).	8.907	0.453	**
-V6 BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0.75 l/ha 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018).	8.701	0.347	*
-V7 Untreated control variant	8.454	-	-

LD 5% = 0.162 t/ha LD 1% = 0.217 t/ha

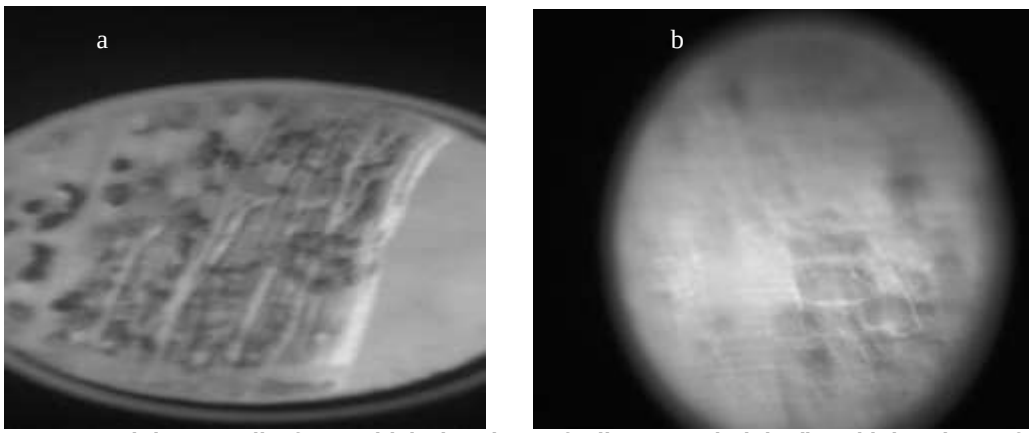

Figure 1 ***Puccinia recondita* f. sp*. tritici* – bearings of teliospores (original) and b bearings of uredospores**

Figure 2 **Aspects from the experimental field (original)**

MATERIAL AND METHOD

These experiments comprised 6 phytosanitary treatment variants (fungicide products containing various active substances) and one untreated control variant. The variants of the experiment were the following:

-V1 FALCON 460 EC 0.7 L/HA 1 treatment applied at spike's release (12.05.2018).

-V2 FALCON 460 EC 0.7 L/HA 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018).

-V3 MYSTIC 250 EC 0.5 L/HA 1 treatment applied at spike's release (12.05.2018).

-V4 MYSTIC 250 EC 0.5 L/HA 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018).

-V5 BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0.75 l/ha 1 treatment applied at spike's release (12.05.2018).

-V6 BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0.75 l/ha 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018).

-V7 Untreated control variant.

The experiment was placed in Latin square; the 7 variants being placed in 7 repetitions. Each experimental plot had an area of 15 m^2 (5 x 3m). The total number of experimental plots was 49. The surface of an experimental variant was of 15 m^2 x 7 repetitions = 105 m^2. The total area of the experiment was of 105 m^2 x 7 = 735 m^2. The treatments had been performed manually, with a "Vermorel" type of equipment. "Trend" adjuvant product was added, in concentration of 0.03%, in the spraying solution. Weeds were fought against with the help of Mustang herbicide in a dosage of 0.5 l/ha applied, separately, with the Vermorel. An insecticide product was also added (Karate Zeon – 0.15 l/ha) in the herbicide solution for fighting against cereals' bugs - *Eurygaster* sp. The purpose of the experiment had been the efficiency of the mentioned phytosanitary products, as reported to their price, as well as the efficiency and respectively, the profitability of applying one or two phytosanitary treatments during the wheat's vegetation period.

The assessment of the attack's frequency (F %), of attack's intensity (I %) and respectively of the degree of attack (D.A. %) was done separately, on each and every experimental plot, being analyzed 10 plants / experimental plot. The degree of affectation (attack intensity I%) of the last two leaves was assessed, especially of the "flag" leaf

which has the greatest contribution to the spike's production at strawy cereals. The phytosanitary analyses on the plants' samples had been done with the help of the stereo-microscope and of the optic microscope at the laboratory of Braila's Phytosanitary Office – National Phytosanitary Authority, institution subordinated to the Ministry of Agriculture and Rural Development. These analyses have revealed the presence of *Puccinia recondita f.sp. tritici* fungus in the analyzed samples, which produces wheat's brown rust. Other pathogenic agents specific to wheat were signaled totally sporadic.

For assessing the production of each variant under study, samples of kernels from each experimental plot, 5 samples each / plot, had been analyzed by spot check. Each sample contained 10 plants, so 50 plants had been taken from each experimental plot, for which the harvest was weighted manually. The delimitation of each sample was done with a metric frame with an area of 0.25 m^2 (0.5/0.5m). The average of the samples from the experimental plots was used for calculating the harvest of each and every experimental parcel. The statistic interpretation was executed with the help of limit differences (LD %) (Săulescu N).

The used variety, Apache, is a French variety of wheat, produced by the company Limagrain. The variety is a semi-forward sort and presents a good tolerance to the attack of some pathogenic agents specific to wheat, such as: rust - *Puccinia* sp. and fusariosis - *Fusarium* sp. (LG. Romania 2019).

The assessment of the attack of pests can be done with the help of the following values (Methods of Prognosis and Warning 1980):

- Frequency of attack (F %);
- Intensity of attack (I %);
- Degree of attack (D.A %).

-Attack's frequency represents the relative value of the number of plants or organs of the plant under attack (n) reported to the number of observed plants or organs (N). The value of the frequency is established by direct observation on a number of plants or organs, according to the case and to the conditions, existing different methods of sample taking and of performing the observations. In the case of our observations, for the foliar diseases, the number of attacked plant organs out of the total of observed plant organs (leaves) was taken into consideration, being thus established the attack's frequency expressed in percentages %. In the case of blight, it is used the number of attacked wheat spikes, as reported to the total number of observed wheat spikes. The frequency is calculated with the formula F%= nx100/N.

-Attack's intensity represents the degree or percentage in which a plant or a plant's organ is attacked and how much from the surface of the plant or of the organ analyzed (leaf, fruit) is covered by the diseases under study.

-The assessment of the surface under attack is done with the naked eye or with the magnifying glass, assessing the percentage occupied by spots or burns caused by the pathogenic agent. There can be noted the affectation percentages, or grades can be given for each plant or organ attacked by the disease and/or by the pest. The usage of grades can make easier data summarization in a great extent. It can be used a scale with 6 degrees of intensity, as follows:

- Grade 0 no attack
- Grade 1 attack between 1 – 3%
- Grade 2 attack between 3 – 10%
- Grade 3 attack between 11 – 25%
- Grade 4 attack between 26 – 50%
- Grade 5 attack between 51 – 75%
- Grade 6 attack between 76 – 100%

After data's summarization, the attack's intensity is determined by the formula:

$$I\% = \frac{\Sigma (i \cdot f)}{n}$$

Where:
I% – attack's intensity (in %);
i – intensity according to the grade given to the organ or plant under attack;
f – number of cases (plants, organs) attacked;
n – number of plants attacked.
Grades from 1 to 6, separately, to the "flag" leaf and to the next leaf situated beneath it had been awarded in our experiment.

-The degree of attack is the expression of the extension of the severity of the attack onto the crop or onto the total number of plants on which we perform the observations. The value expression of DA is given by the relation:

$$D.A\ (\%) = \frac{F \times I}{100}$$

In most cases, there is a negative correlation between the degree of attack of a pathogenic agent or pest and the quantitative and/or qualitative level of the production of a crop.

RESULTS AND DISCUSSIONS

The 2017 – 2018 agricultural year was less favourable to the occurrence of the attack of the complex of pathogens specific to wheat, as compared to the previous years. April and May months were hotter and with few rainfalls. During these months, only 1.5 l/m^2 rainfalls were registered in April and 25.4 l/m^2 rainfalls were registered in May. The average temperatures recorded were 15°C in April and 18.5°C in May.

In what concerns the dynamics of the occurrence of pathogens to wheat, we mention that the pathogenic agent which occurred in the experiment in the year 2018 was *Puccinia recondita* f.sp. *tritici* fungus producing the wheat's

brown rust. Attacks of the fungi variety like *Septoria* sp. producing septoriosis at wheat were sporadic. No attacks of the following fungi were observed: *Blumeria* (*Erysiphe*) *graminis* f.sp. *tritici* producing wheat's mildew and those of *Giberella* sp. variety, producing wheat's fusariosis.

When analysing the data from Table 1, we observe that the degree of attack of the pathogens under monitoring, on each variant of treatment, is the following:

-V1 FALCON 460 EC 0.7 L/HA 1 treatment applied at spike's release (12.05.2018) determined a degree of attack (D.A.%) of *Puccinia recondita* f.sp. *tritici* fungus of 0.85% at "flag" leaf and of 3.91% at the second leaf, so lower by 29.19% and respectively by 38.18% as compared to untreated control variant (V7).

-V2 FALCON 460 EC 0.7 L/HA 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018) determined a degree of attack (D.A.%) of *Puccinia recondita* f.sp. *tritici* fungus of 5.58% at "flag" leaf and 10.62% at the second leaf, so lower by 24.46% and respectively by 31.47% as compared to untreated control variant (V7).

-V3 MYSTIC 250 EC 0.5 L/HA 1 treatment applied at spike's release (12.05.2018) determined a degree of attack (D.A.%) of *Puccinia recondita* f.sp. *tritici* fungus of 2.35% to the "flag" leaf and of 11.01% at the second leaf, so lower by 37.69% and respectively by 31.08% as compared to untreated control variant (V7).

-V4 MYSTIC 250 EC 0.5 L/HA 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018) determined a degree of attack (D.A. %) of *Puccinia recondita* f.sp. *tritici* fungus of 10.31% at the "flag" leaf and of 11.04% at the second leaf, so lower by 19.13% and respectively by 31.05% as compared to untreated control variant (V7).

-V5 BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0.75 l/ha 1 treatment applied at spike's release (12.05.2018) determined a degree of attack (D.A.%) of *Puccinia recondita* f.sp. *tritici* fungus of 8.84 % at the "flag" leaf and 14.31% at the second leaf, so lower by 21.2% and respectively by 27.18% as compared to untreated control variant (V7).

-V6 BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0.75 l/ha 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018) determined a degree of attack (D.A. %) of *Puccinia recondita* f.sp. *tritici* fungus of 16.94% at the "flag" leaf and 23.99% at the second leaf, so lower by 13.1% and respectively by 18.1% as compared to untreated control variant (V7).

-V7 Untreated control variant presented a degree of attack of *Puccinia recondita* f.sp. *tritici* fungus of 30.04% at "flag" leaf and 42.09% at the second leaf.

All differences in what concerns the degree of attack (D.A. %) are statistically assured, according to Table 1.

Out of the analysis of Table 2, the harvest differences as compared to untreated control variant V7 can be also observed, as follows:

-V1 FALCON 460 EC 0.7 L/HA 1 treatment applied at spike's release (12.05.2018) had achieved a practically equal harvest (-0.020 t/ha) to the one of the untreated control variant, i.e. 8.434 t/ha as compared to 8.454 t/ha achieved by the control variant.

-V2 FALCON 460 EC 0.7 L/HA 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018) had achieved a practically equal harvest 8.866 t/ha, so by 0.412 t/ha higher than that of the control variant.

-V3 MYSTIC 250 EC 0.5 L/HA 1 treatment applied at spike's release (12.05.2018) had achieved a harvest of 8.742 t/ha, so by 0.288 t/ha higher than that of the control variant.

-V4 MYSTIC 250 EC 0.5 L/HA 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018) had achieved a harvest of 9.072 t/ha, so by 0.618 t/ha higher than that of the control variant.

-V5 BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0.75 l/ha 1 treatment applied at spike's release (12.05.2018) had achieved a harvest of 8.907 t/ha, so by 0.453 t/ha higher than that of the control variant.

-V6 BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0.75 l/ha 1 treatment applied at straw's extension (21.04.2018) + 1 treatment applied at kernel's filling (1.06.2018) had achieved a harvest of 8.701 t/ha, so by 0.347 t/ha higher than that of the control variant.

-V7 Untreated control variant had achieved a harvest of 8.454

Harvest differences: the crops are ensured statistically (**distinctly significant and *significant), except for V1, which achieved a harvest practically equal to the one of the control variant (-0.02 t/ha difference).

CONCLUSIONS

The 2017 – 2018 agricultural year had been favourable to the wheat harvest. 2017 – 2018 winter was rich in rainfalls. The spring was droughty, but the plants had achieved very good

harvests due to the large reserve of water remained in the soil since winter.

The observations made in the spring of the year 2018 on the wheat experiment – Apache variety, have led to the following conclusions and recommendations:

1-The attacks of the pathogenic agents were more reduced than in the previous years. Among them, the only pathogenic agent which made its presence known was *Puccinia recondita* f.sp. *tritici* fungus which produces at wheat the disease known under the name "brown rust".

2-For a reliable protection of the wheat crop, in case of using Apache variety, we recommend the application, in the years with droughty springs, of one single treatment with fungicide products containing only one single active substance, such as, for example, MYSTIC 250 EC in the homologated dosage of 0.5 l/ha. In the conditions when in the year 2019, a price of around 0.7 lei/ kg of wheat is foreseen, the selection of the fungicide product is especially important from price point of view. For example, the cost of the product FALCON 460 EC in the year 2019 is around 160 lei/l and 0.6 - 0.7 l/ha is applied. Accordingly, the approximate cost is 96-112 lei/ha/treatment. MYSTIC 250 EC fungicide costs in 2019 approximatively 120 lei/l and 0.5 l/ha is applied, so the cost per ha/treatment is 60 lei. BUMPER 250 EC fungicide costs around 130 lei/l. Topsin 500 SC fungicide costs around 63 lei/l. An approximate price / ha of 80 lei/ha results for the dosage used in the experiment.

The harvest increments as compared to the untreated control variant (V7) were the following:

-V1 FALCON 460 EC 0.7 L/HA 1 treatment applied at spike's release was 0.02 t/ha. This variant does not offer conclusive results.

-V2 FALCON 460 EC 0.7 L/HA 1 treatment applied at straw's extension +1 treatment applied at kernel's filling was 0.412 t/ha, amounting to 288.4 lei/ha.

-V3 MYSTIC 250 EC 0.5 L/HA 1 treatment applied at spike's release was 0.288 t/ha amounting to 201.6 lei/ha.

-V4 MYSTIC 250 EC 0.5 L/HA 1 treatment applied at straw's extension +1 treatment applied at kernel's filling was 0.618 t/ha, amounting to 463.5 lei/ha. This variant had proved to be the most profitable in the climatic conditions of the year 2018, as by using Apache variety, the profit offered by the harvest increment being 343 lei/ha.

-V5 BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0.75 l/ha 1 treatment applied at spike's release was 0.453 t/ha amounting to 317 lei/ha.

-V6 BUMPER 250 EC 0.25 l/ha + TOPSIN 500 SC 0.75 l/ha 1 treatment applied at straw's extension + 1 treatment applied at kernel's filling was 0.347 t/ha amounting to 242.9 lei/ha.

Apache wheat French variety had presented, in the climatic conditions of the year 2018, a good behavior in what concerns the attack of the pathogenic agents specific to wheat.

The exchange rate Leu/€ for the first 7 months of the year 2018 was 4.7396 lei/1€, according to the website of the Romanian National Bank.

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INFLUENCE OF SURFACE AND SUBSURFACE DRAINAGE SYSTEMS ON THE SUSTAINABLE DEVELOPMENT OF THE RURAL ENVIRONMENT IN THE MOLDOVA RIVER WATERSHED

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Abstract

Agriculture plays a strategic role worldwide, as it is the main sector responsible for population food security and has, at the same time, a special contribution to the general sustainable economic development and environmental protection process. In order to regulate the water regime on the surface and on the profile of the soils in the hydrographic basin of the River Moldova, four surface and subsurface drainage systems with an area of 8761 ha of which 3059 ha with works underground drainage were arranged from 1978 to 1980. The improvement of the physical, physicochemical and biological properties of the soil as a result of the hydro and agropedoameliorative works allowed the cultivation of large areas of land previously used as grazing and hay land, as well as the cultivation of a wide range of agricultural plants. The drying-drainage works performed have resulted in high yields in both normal and heavy rainfall years. The constant high yields have resulted in higher income per area unit and, implicitly, in the improvement of the standard of living of the rural population. The 40-year life of the surface and subsurface drainage systems, and the poor management and lack of maintenance works, especially after 1990, require rehabilitation and sustainable exploitation measures, given the major importance of agriculture in the life and development of rural areas.

Key words: sustainable exploitation, drying-drainage, soil productivity

The agricultural landscape has been continuously shaped and reshaped since the early Holocene. Throughout human history, societies have left traces of agricultural activities in the entire world. Moreover, studies have shown that the collapse of many civilizations was linked to accelerated soil degradation caused by agricultural practices (Denevan W. M., 2001; McNeill J.R. and Winiwarter V., 2010; Montgomery D.R., 2012).

The management of soil systems influences soil productivity and food security. Adeel Z. et al., 2005, define land degradation as a persistent deterioration of its productivity, in which soil plays a major role. Land degradation is caused by several factors, both biophysical (climate, topography, hydrology and soil characteristics) and human (land use and management, policies and governance, migration, poverty and exploitation of natural resources). Land degradation processes have been noticed worldwide (Torres L. et al., 2015, Xie L. W. et al., 2015, Obalum S. E. et al., 2012; Reed M. S. and Stringer L. C., 2016).

The fate of contemporary civilization depends on the soil as a source of resources, goods and services (Keesstra S. D. et al., 2012).

For a better use of soil resources, drying-drainage works were carried out in many parts of the globe with land affected by excess humidity. Agricultural drainage protects the basic resources that contribute to food production, supports and contributes to increasing agricultural output and better rural products, protects investments in the irrigation sector and increases the value of land. However, the main goal of agricultural drainage is to create in the roots area an environment that supports plant development and optimizes agricultural production. Drainage should be seen as an indispensable part of sustainable land management, although further research is still needed in this direction (Halbac R., 2014).

MATERIAL AND METHOD

The Moldova river basin is located in the NE part of the Eastern Carpathians and in the NW of the Plateau of Moldova (*figure 1*). The basin is bounded by $25^0$08'37″ - $26^0$58'35″ meridians east longitude and $46^0$55'37″ - $47^0$43'38″ parallels north latitude.

Many geographers (Coteţ P., 1973, Posea G., 1974) include this area in the Subcarpathia region, as an external hilly piedmont plateau unit.

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Figure 1 **Localization of the Moldova river basin in Romania**

The natural conditions of the Baia piedmont plain favor the occurrence and maintenance of excessive humidity both on the surface and underground. The flood plain of Moldova River and the strip-shaped 1.5 km wide terraces, which are almost parallel to the Moldova riverbed, running from NW to SE, with mild 1-5% slopes, with flat areas and many small depressions, allow the water to stagnate.

The wet climate specific to the Moldova River watershed area, the heavy rainfalls of 1-5 consecutive days and the low evaporation and perspiration rates are the main cause of excessive humidity in hardly permeable soils (Nitu T. et al., 1985).

Four surface and subsurface drainage systems (Rotopăneşti-Rădăşeni-Fântâna Mare, Drăgoieşti-Berchişeşti, Bogdăneşti-Baia, and Băişeşti-Dumbrava), consisting of 8761 ha of dried-drained land, of which 3059 ha with underground drainage works, were developed between 1978 and 1980 in order to remove excessive water from the Moldova River valley and terraces in Suceava county (*figure 2*).

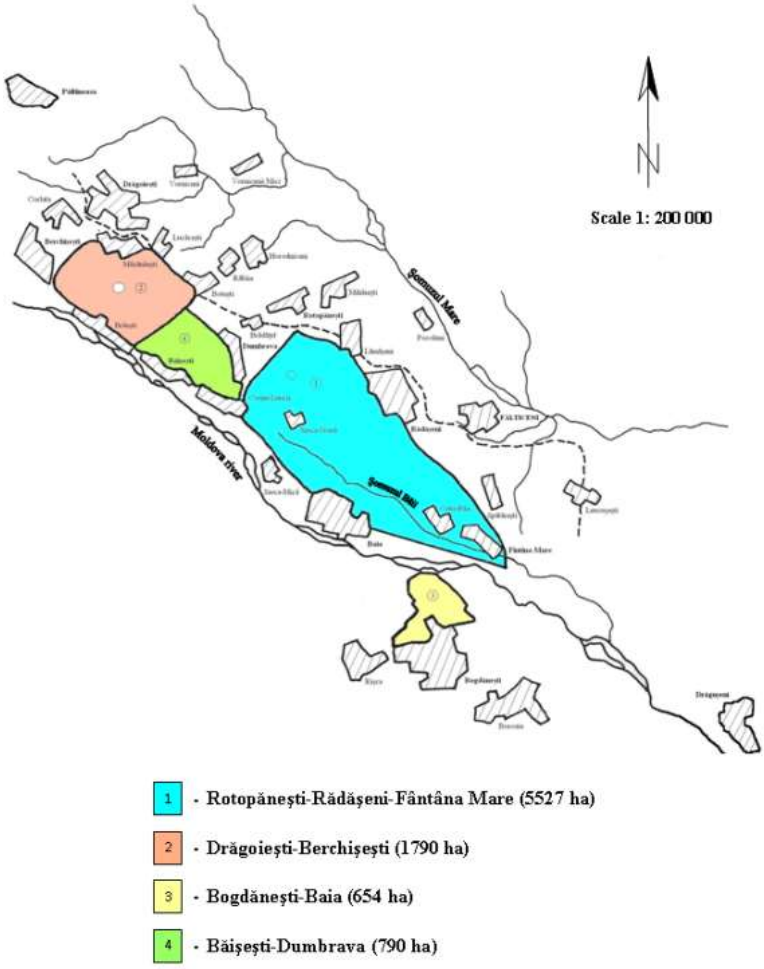

Figure 1 **Surface and subsurface drainage systems of the Moldova River flood plain in the County of Suceava**

In order to highlight the influence of the surface and subsurface drying-drainage works carried out in the Moldova River watershed, Suceava County, we conducted field observations, read the ANIF Territorial Branch for Land Improvements Suceava archives and collected data from the local halls of the administrative-territorial units in the area, as well as from the Statistical Yearbook of Romania.

RESULTS AND DISCUSSIONS

The drying-drainage works have contributed to the overall improvement of the agrophysical condition and to the optimization of the aerohydric regime of the soil. In the conditions of the underground drainage associated with the modeling of the terrain in ridges, the about 43-56% of the stagnant water from precipitations fallen throughout 1-5 consecutive days was removed due to underground drainage works and land shaping in the bedding with ridges and furrows (Moca V. et al., 1996).

The improvement of the physical, physico-chemical and biological properties of the soil determined the increase of the arable area by 1846 ha, in general, at the expense of pastures and meadows, whereas the agricultural area decreased by approximately 108 ha due to drainage ditches and operating roads (*table 1*). Prior to development, pasture and meadow land was frequently affected by excessive water from the melting of snow and/or rainfall. Also, due to the stagnation of water for a long time, the pastures and meadows had a poor-quality flower composition, as hygrophilous plants predominated. After its development, this land was replanted with valuable fodder plant species and the percentage of hygrophilous plants was considerably lower.

Table 1

Evolution of the Destination Classes of the Drying-Draining Systems in the Moldova River Basin (according to the A.N.I.F. – Suceava Branch documentation)

Category of use	Surface (ha)				Differences
	Before fitting		After fitting - 1990		
	ha	%	ha	%	ha
Arable	5610.97	64.04	7456.97	85.11	1846.00
Pastures	1168.51	13.34	427.48	4.88	-741.03
Rough	1344.09	15.34	131.42	1.50	-1212.67
Orchards	7.86	0.09	7.86	0.09	0
Total agricultural	**8131.43**	**92.81**	**8023.73**	**91.58**	**-107.70**
Forestry	255.15	2.91	216.83	2.47	-38.32
Waters	28.92	0.33	20.30	0.23	-8.62
Channels	10.59	0.12	140.03	1.60	129.44
Exploitation roads	88.99	1.02	125.40	1.43	36.41
Court-construction	230.91	2.63	234.15	2.68	3.24
Non-productive	15.45	0.18	1.00	0.01	-14.45
Total non-agricultural	**630.01**	**7.19**	**737.71**	**8.42**	**107.70**
Total area	**8761.44**	**100.00**	**8761.44**	**100.00**	-

Prior to its development, due to the excess water, the arable land had a very low productivity, the average yields in rainy years being reduced by about 25-50% compared to those obtained in normal precipitations years (*table 2*).

The development of systematic underground drainage systems together with the conduct of agricultural land improvement works have enhanced soil fertility, both by increasing the pH values and by increasing the content of nutrients (Moca V. et al., 1998).

The decrease of the agricultural area by 108 ha (*table 1*) was compensated by the increase of higher use categories of land and by constant high yields per hectare, due to the provision of adequate agricultural plant growth and development conditions.

Table 2

Mean Yields in Agricultural Crops before and after Development (according to the A.N.I.F. – Suceava Branch documentation)

No.	Culture	Average production (kg/ha)		
		Before fitting		After fitting
		Years normal	Years with excess	
1.	Wheat-rye	1440	640	2000
2.	Barley	1400	570	2200
3.	Corn	2250	1000	2300
4.	Potatoes	11000	6000	20000
5.	In the throat	3750	2250	4000
6.	Clover	3500	2000	4000
7.	Fodder plants	5000	3500	5500

Between 1980 and 1990, the improvement of soil characteristics as a result of the drying-draining works and of the use of modern agricultural technology has brought about a substantial increase in agricultural production and higher quality produce. Thus, according to the data recorded in the accounting books, yields of about 7-8 t/ha of maize grain, 30-40 t/ha of potato, 5-6 t/ha of fiber flax, 4-5 t/ha of wheat, 50-60 t/ha of fodder kohlrabi and 90-100 t/ha of fodder beet were obtained.

The increase in yield per hectare on dried-drained land is also reflected by the yields obtained under experimental conditions on a glossic albic pseudogley luvisol in the Baia Field. The yields obtained within the experimental field have frequently reached 5-7 t/ha in grain maize, 35-45 t/ha in autumn potatoes, 7-8 t/ha in fiber flax and 4-5 t/ha in wheat (Nitu T. et al., 1985).

Agricultural policies and land laws adopted after 1990 have had a major impact on sustainable land management, in particular on the management of improved land. The small arable surface per capita in the studied area has led to the fragmentation of the land into strip-like plots. For a long time (1990-2015), land works were carried out on individual plots, which resulted in the occurrence of furrows in the border line area and a ridge in the middle of the plot. Thus, rainfall water would stagnate for a long time with negative effects on the plants in the furrow area. Year in, year out, these furrows have led to significant harvest losses caused on the one hand by the delays in the sowing and harvesting works, and on the other hand by the use of inadequate agricultural machinery and equipment. Land use on individual plots, the lack of adequate agricultural machinery, the absence of new varieties and hybrids, the application of an irrational crop rotation and, sometimes, the preference for single-crop farming have led to the turning of many arable plots into hay land.

Some land areas, which underwent drying-drainage works, have been ploughed together, on drying sectors, since 2016. Land reparcelling, the use of modern agricultural equipment, and of the newest varieties and hybrids, and the use of agricultural technologies specific to improved land have led to constant high yields (*table 3*).

From the analysis of table 3 we can observe large differences of production obtained in the cultivation of potato, maize and wheat on the plots individually worked and the surfaces worked together. Also, by comparing the productions obtained in the studied area with those obtained at Suceava county level and at national level, it is ascertained the high productivity of soils in this area.

According to the data in table 3, there are significant yield differences between potato, maize and wheat crops on individual plots as compared to larger land areas. Also, comparisons between yields in the studied area and yields in both Suceava country and the entire country have enabled us to notice the high soil productivity in this area.

The regulation of the aerohydric regime in the soil, and also the climate changes allowed the diversification of the structure of the agricultural crops by introducing new crops, such as: sunflower, rapeseed, buckwheat, beans and even medicinal plants, on small surfaces.

Soil productivity influences the standard of living of the rural population, as, for most of these inhabitants, agriculture is the only occupation that generates income and, hence, welfare.

Table 3

Mean Yields for the Main Agricultural Crops in 2016 (according to local data and Statistical Yearbook)

No.	Culture	Average production (kg/ha)			
		Study area		Suceava county	Nationally
		individual plots	fused area		
1.	Wheat-rye	2800	5200	4000	3900
2.	Corn	4000	8500	5400	4600
3.	Sunflower	1200	2900	2400	2000
4.	Potatoes	14000	24500	18800	14500
5.	Clover (green table)	12000	18000	13000	14000

Despite the high agricultural potential of the studied area, the poor organization of this sector due to the fact that there are no large farms, but rather small individual plots, prevents the use of new technologies, which makes rural development dependent on the weather conditions. If it is properly exploited, the existing agricultural potential allows a more efficient employment of the work force, thus contributing to making real progress in reducing rural poverty and income disparities between the rural and urban population. However, the competitiveness of agri-food products must be associated with the sustainability of their production.

The use of improved land requires adequate agricultural policies designed to facilitate agricultural production, sustainable livelihoods and sustainable land management.

Rural development issues are diverse and they are addressed by different governmental structures, which due, on the one hand, to the lack of precisely formulated and coherent rural environment objectives and, on the other hand, to poor communication, fail to have the expected outcomes.

After 40 years of operation, over 50% of the drying-draining works carried out in the Moldova River basin require some rehabilitation works. The trend is to rehabilitate, modernize and sustainably use existing systems rather than to implement new systems. Efficient drainage water management can help both avoid water stagnation and minimize soil degradation.

CONCLUSIONS

Due to the drying -drainage works carried out in the Moldova River watershed, the arable area increased by about 1850 ha, increasing its share on the total improved land area from 64% to 85%. The increase of the arable area was made possible by the cultivation of land with lower uses, especially hay land, the percentage of which decreased from 15% to 1.5%, whereas the pastures dropped from 13% to 5%.

The improvement of the physical, physico-chemical and biological properties of the soil, as a result of the application of hydro and agropedoameliorative works, allowed the cultivation of a varied assortment of agricultural plants and the obtaining of high constant yields.

Due to the fragmentation of improved dried-drained land in numerous plots of different sizes and orientations, drainage is reduced and water collection and evacuation is diminished in the drained section, which particularly affects the plants growing near the furrows formed between the plots.

The need to ensure the maintenance of a high productive potential of the soil requires, as a matter of urgency, the implementation of local measures consisting of informing and educating people in order to raise awareness on the role of drying-drainage works, of stimulating the use of dried land plots by exempting the users of charges and taxes, and, last but not least, of the organization of a rational grazing practices.

The process of land reparcelling in the area seems to be long lasting and not at all simple, due to a number of reasons: the high number of the strip-like plots, unclear property relationships, aged owners more reluctant to the association and roads offering poor access to the agricultural land.

The 40-year life of the surface and subsurface drainage systems, and the poor management and lack of maintenance works, especially after 1990, require rehabilitation works. The global trend is to rehabilitate, modernize and sustainably use existing systems and not to implement new surface and subsurface drainage systems. Efficient drainage water management

can help both avoid water stagnation and minimize soil degradation.

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SWAMPY SOILS IN THE LOWER DNIESTER MEADOW OF MOLDOVA

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Abstract

Swampy soils in the Lower Dniester floodplain are distinguished by high biogenesis at the early stage of their development. This is due to the fact that not abiotic rocks are involved in the primary soil formation, but redeposited of river basin erosion products, which are the upper, most fertile soils - grey soils, chernozems and alluvial soils. The swampy soils at the beginning of the silty stage and long before the vegetation settled on them already contain enough organic matter and all the necessary nutrients for plants. For the same reason, the development rate of most floodplain swampy-silty soils turns out to be extremely high fertility and they acquire signs of zonal soil formation relatively quickly. The phenomena of salinization and alkalinization of swampy-silty soils are confined to a later stage of their development (meadow-swampy). Usually, salinization starts from the marginal periphery of the marshes and very slowly penetrates into the inland areas of the floodplain. The riverbed edge of the marshes can remain non-saline for a very long time. Without drainage the development of swampy soils, the salinization begins immediately after its embankment and drainage. The inevitability of this process has been confirmed by the improvement practice of melioration the swampy soils in the lower reaches of Dniester floodplain.

Key words: Lower Dniester, Soil fertility, Swampy soils, Soil genesis.

In the Dniester floodplain the swampy soils are spread mainly in its lower reaches. They occupy large areas in the flat and wide depressions of the near-central and central regions of the floodplain terrace. Higher along the valley, they are found in fragments and are confined to the mouths of areas of the right-bank tributaries - the Bothna, the Bull, the Ikel (Calașnic A., 2008).

The total area of swampy soils, including those already drained and reclaimed is about 5.7 thousand hectares or 10.4% of the entire floodplain area within the borders of Moldova. They are formed under various associations of marsh or meadow-marsh vegetation under conditions of constant (within 30 cm of the surface) or periodic excessive moistening of both surface and ground waters (Подымов Б.П., 1969).

Depending on the nature and moisture regime, as well as the characteristics of the oxidation-reduction processes and other chemical properties, the swampy soils are divided into three subtypes: sub-aquatic, clayey-marshy, and clayey-peaty-marshy (Подымов Б.П., 1970).

The soils of the last subtype in the territory of the Dniester floodplain of the Moldavian territory have limited distribution; their total area does not exceed 200 hectares. They are not well understood in present.

After another opinion (Ursu A., 2011) the swampy soils are hydromorphic soils formed under the influence of permanent moisture surplus and are divided into: typical, gleyic, and peaty.

After Cerbari V. (2001) the swampy soils are formed under the influence of permanently groundwater in the 30 cm from the surface. In the formation of these soils contributes the gleyic processes, which manifests them from the surface horizon. The gleyic horizon has the upper limit in the first 50 cm. In accordance with the characteristics and structure of the genetic horizons of the profile, determined by the pedogenetic conditions, the swampy floodplain soils are classified in the following subtypes: peaty, humiferous, silty, and fluvial.

The profile of the swampy soil combines the morphological features of both the marshy and meadow processes. Under conditions of groundwater salinity, swampy soils are saline to varying degrees (Florea N., Munteanu I., 2012). Swampy soils are characterized by the accumulation of the finest mineral particles (silt) and semi-decomposed remains of bog vegetation (Урсу А. *et al*, 1988).

Drainage and subsequent cultivation of swampy soils leads to a drastic change in their structure and water-physical properties: intensive decomposition of plant residues occurs, the activity

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of aerobic microflora increases, etc. (Подымов Б.П., 1970).

MATERIAL AND METHOD

The profile of the swampy soil was laid in the in the acclivous lowering of terrace of right bank of the Dniester River near the village of Kopanka (Republic of Moldova) at the distance of 250 m from the foot of the slope of the floodplain terrace and 50 m from the shallow drainage canal. The site is used for agricultural crops, but cane rhizomes have retained their viability. The profile of the swampy soil is poorly differentiated into horizons.

Layer 0-25 cm – dark-gray or almost black color in wet conditions, clayey-loamy, slightly compacted, with an unclearly expressed lumpy-powdery structure; by all indications, it very gradually passes into the next, subsurface horizon, contains shells of mollusks, weakly decomposed stems and rhizomes of reeds; often include small, brown ferrous grains; there are no salt efflorescences.

Layer 25-60 cm – black color, clayey-loamy, with an obscure, poorly expressed lumpy structure, humid; has a very weakly compacted; the lower part of the layer is gleyzation and is in a capillary-saturated state; when drying the cut walls from a depth of 50 cm and below, the salt efflorescence appears. This layer is the same in appearance as the previous one, but contains many rhizomes of reeds, slightly colored from the outside in a brownish color. Part of the rhizomes is in a semi-decomposed state, but the bulk is vital.

Layer 80-120 cm - dark gray color, with a bluish tinge, clayey-loamy, structureless, very weakly compacted and strong gleyzation, is in a water-saturated state; the water level in the section was established at a depth of 110 cm; the smell of hydrogen sulfide is very weak in the layer.

Uniform effervescence from hydrochloric acid was noted throughout the soil profile. Analysis methods of soil samples are classic.

RESULTS AND DISCUSSIONS

Of all the swampy soils in the Dniester floodplain, the most widespread are various subtype species - swampy clayey-loamy, soils. The fresh, varieties of heavy mechanical composition (clayey and silty) are usually confined to the inner regions. Along the periphery there are gleyzied, salinized, solonetzated, alkaline-salinized, saline-solodized, and even solodized silty-swampy soils are found. They are formed under the cover of continuous reed or reed-rigorous thickets in conditions of periodic flooding by river waters on clayey and loamy lake-estuary floodplains during the evolution of subaquatic soils (Cerbari V., Strgărecku Gh., 2016).

The frequency and duration of flooding varies widely, depending on the hydrological features of the year and the topographic conditions of a particular section of the floodplain.

In dry years, the territories occupied by these soils are flooded only during the spring flood for 40-80 days. In wet years the surface of these soils almost all the time did not come out from under the water. Corresponding to the hydrological conditions, the oxidation-reduction conditions of soil formation it also differ extremely pronounced impermanence and may experience sharp changes in one direction or the other (Ursu A., 2011).

The humus horizon of the swampy clayey-loamy, soil may have different thickness, but signs of gleyzation process in it are always found from the surface itself and to the full depth of the profile. Neoplasms of trivalent iron compounds are confined to the upper part of the profile in the form of very fine solid brown color grains and reddish brown efflorescence and membrane on the edges of structural units.

The color of the humus horizon in a wet state is black or dark-gray with a bluish or greenish tint. For comparison the surface of virgin soils is everywhere covered with a thin layer of felt from semi-decomposed stems of reed, cattail, kugi and algae. At a depth of 25-60 cm there is an accumulation of reed rhizomes - live and dead.

In the present, the most of the swampy clayey-loamy, soils of the Dniester floodplain have been drained, plowed up and used in agricultural production mainly under vegetable and field crops. The virgin areas are preserved in the lower reaches of the river. Swampy clayey-loamy, soils after drainage and plowing oxidize relatively quickly and lose most of the previously acquired signs of the marshy (swampy) process.

The considered swampy soil is characterized by clayey-loamy mechanical composition of the entire upper one meter thick. Deeper, it is somewhat easier; the content of the physical clay fraction is reduced to 45%, and silt - to 25%. The silt fraction is relatively weakly micro-aggregated, about one fifth of it is in a free state. The content of the fraction >0.1 mm is about 5%. Dispersion coefficient (after Kaczynski) show increasing values with depth of profile *(table 1 and 2).*

In general terms, the soil to a depth of 100 cm is granulometric uniform, which indicates the relative stability of hydrological conditions throughout the entire period of its formation.

The morphological profile of the soil is not clear differentiated by genetic (soil-genetically) horizons. The content of organic matter in the 0-10 cm is 5.1% and carbonates are 3.1% *(table 3).*

Compared to other soils of the Dniester floodplain, the highest humus content (4-5%) in the layer 0-70 cm is observed.

Table 1

Granulometric composition of the Swampy clayey-loamy soil

Depth, cm	Fractions content, %; particle size. mm					
	1.00-0.25	0.25-0.10	0.10-0.05	0.05-0.01	0.01-0.005	0.005-0.001
0-10	0/0	4/8	18/26	24/40	6/10	18/11
30-40	0/0	3/6	14/22	34/44	13/12	14/12
50-60	1/2	5/8	13/20	24/27	7/12	16/14
90-100	0/2	4/6	12/22	30/36	9/12	15/15
110-120	2/3	5/8	10/15	37/25	10/8	13/16

Table 2

Silt and physical clay fractions content of the Swampy clayey-loamy soil

Depth, cm	< 0.001 mm, %	<0.01 mm, %	Dispersion coefficient
0-10	31	58	17
30-40	21	49	18
50-60	34	56	21
90-100	30	54	23
110-120	25	45	22

Table 3

Physical-chemical parameters of the Swampy clayey-loamy soil

Depth, cm	Hm*	$CaCO_3$	Humus	N_{total}	C:H	pH
	%				units	
0-10	3.9	3.1	5.1	0.36	8	7.8
10-20	3.8	2.8	4.8	-	-	7.9
20-30	4.0	2.5	4.9	-	-	8.0
30-40	4.2	2.3	4.6	0.29	9	8.0
40-50	4.1	1.9	4.0	-	-	8.0
50-60	4.3	3.4	4.3	-	-	8.2
60-70	3.7	3.0	4.6	-	-	8.1
70-80	3.7	4.2	3.9	0.24	9	8.2
80-90	3.9	4.4	3.6	-	-	8.2
100-110	3.6	5.5	2.8	-	-	8.5
110-120	3.6	3.8	3.5	0.28	7	8.6
120-130	3.7	4.1	2.0	-	-	8.4

HM - Hygroscopic moisture*

This is probably due to the presence of raw organic matter previously accumulated under anaerobic conditions and not yet fully mineralized. In any case, even more mature soils (meadow-marshy and meadow) rarely contain such humus content in them (Martin C.W., 2010; Junhong, *et. al*, 2012).

Calcium dominates in the composition of absorbed cations with a significant proportion of magnesium. Their ratio is 2 : 1 in the upper part of the profile and 1.5 : 1 - in the lower. An increased content of absorbed sodium is also noted here - 2 mg/eq. or 7.3% of the sum. The sum of exchange cations is 30-37 mg/eq. per 100 g of soil.

The content of mobile phosphorus compounds (according to Machighin) varies in profile from 4 to 7, potassium exchangeable - from 20 to 26 mg/100 g of soil *(table 4).*

Table 4

Agrochemical parameters of the Swampy clayey-loamy soil

Depth, cm	Nh*	P_2O_5	K_2O	Ca^{++}	Mg^{++}	Na^{+}	Sum
	mg /100 g soil			mg-eq /100 g soil			
0-10	12	7	26	23.9	12.2	0.4	36.5
30-40	10	7	24	18.3	14.3	0.6	33.2
70-80	10	6	23	17.7	10.8	1.4	29.9
110-120	8	4	20	16.1	11.7	2.2	30.0

**Nitrogen hydrolysable*

Thus, these young hydromorphic and litomorphic swampy soils contain in large quantities the main plant nutrients - nitrogen, phosphorus, potassium and microelements.

The distribution and accumulation of total form of Zn, Ni, Pb, Cr and Cd is associated with biogenic accumulation in the soil layer of 0-10 cm. The accumulation of the geochemical barrier (30-40 cm) is obvious - the beginning of the gleyic horizon. In the 60-80 cm of soil layer the total Zn (77 mg/kg) and Cr (275 mg/kg) was accumulated *(table 5).*

Table 5

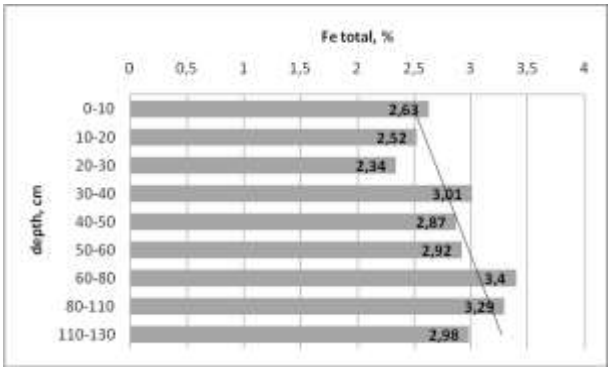
Content of total microelements of the Swampy clayey-loamy soil

Depth, cm	Zn	Co	Ni	Pb	Cr	Cd
	mg/kg					
0-10	68.5	8.4	12.6	16.7	250.1	1.19
10-20	67.7	7.8	12.1	17.6	250.8	1.09
20-30	38.2	7.7	12.1	16.4	176.8	1.10
30-40	54.0	12.6	11.8	16.0	242.3	1.10
40-50	52.0	12.8	11.8	12.2	241.6	1.05
50-60	60.6	12.3	12.4	11.6	238.2	1.05
60-80	77.1	11.7	12.2	13.1	275.0	0.95
80-110	71.9	10.5	9.9	14.3	251.8	0.83
110-130	71.9	11.0	11.8	10.4	285.6	074
Content limits	**0.4-195**	**0.1-4.7**	**0.1-1.5**	**0.01-0.6**	**200-300**	**0.01-0.3**

The swampy soils contain enough iron total forms: 2.34-3.40%. The distribution laws are manifested by the increase of the content in depth, highlighting the gleyic horizons with higher content of Fe total *(figure.1).*

The average content of chemical elements determined in swampy soils has been shown to fall within the "total content limit in Republic Moldiva soils". This content is considered to be normal for swampy soils, considering their pedogenesis and evolution. Therefore, immediately after draining, they acquire high agricultural production qualities.

However, one should take into account the real possibility of their salinization in the conditions of insufficiently effective artificial drainage of the territory.



Figire.1. **Distribution of Fe total in swampy clayey-loamy soil**

In the profile under consideration, there are clear signs of salt pulling to the upper horizons. Despite the still very low degree of salinization (0.2-0.4%), the current trend is a certain danger, since the level of groundwater is located at a depth at which the capillary rim can rise to the very surface of the soil.

The above data characterize one of the most widespread varieties of swampy soils, but others, despite some features of their material composition and properties, differ slightly from it. Sharp differences in the soils of this subtype are at a later stage of their development. With the gradual natural drainage and slugging of the floodplain, the marshy process of soil formation diminishes, is replaced by meadow, and in the process of further evolution, swampy soils give rise to numerous varieties of meadow soils.

From the ecological actions point of view to improve the ecological situation in the region, local development plans for the territory are not yet available, including landscape development plans, anti-erosion measures and soil status monitoring. One of the reasons is that the legislation does not provide for a control mechanism and an obligation to take appropriate action.

CONCLUSIONS

At the beginning of the meadow stage, there is a sharp differentiation of the former bog soils according to the degree and types of salinization, alkalinity, "graininess" and other characteristics. It is at this stage of development that the marsh soils with the most mechanical structure acquire the properties of fusion, which in the future turn out to be a difficult obstacle to the formation of the soil profile corresponding to the peculiarities of the zonal soil formation.

Flooded swampy soils are distinguished by high biogenesis at an early stage of their development. The swampy soils at the beginning of the silt stage and long before the vegetation settled on them already contain enough organic matter and all the plant nutrients. For the same reason, the development rate of most floodplain swampy soils turns out to be extremely high, and they acquire signs of zonal soil formation relatively quickly.

Currently, the most of the swampy soils in the Dniester floodplain have been drained, plowed up and used in agricultural production mainly under vegetable and field crops. Swampy soils after drainage and plowing oxidize relatively quickly and lose most of the previously acquired signs of the swampy process.

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GIS FOR PRECISION FARMING – SENZOR MONITORING AT MOARA DOMNEASCA FARM, UASVM OF BUCHAREST

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Abstract

Precision farming is an intelligent way of approaching agricultural activities, which involves the use of advanced machines and technologies to streamline the agricultural process and ensure the control of agricultural production. Practicing precision farming represents, for Romanian farms, the best step towards progress, based on the technologies in the field, from automatic GPS systems to soil sensors, helping farmers to obtain the best results in a more efficient way, efficient and simpler, without wasting energy and resources. Part of modern technology is represented by sensors that can monitor different parameters related to soil and atmosphere. The obtained values must be monitored and processed in some agricultural applications, as well as of the Geographic Information Systems (GIS) that allow the spatialization of the data and the creation of specific thematic maps, which come to the support of the farmers for optimal decisions.

For the monitoring of the agricultural land, images taken with a drone (eBee Classic UAV) were used, which were the basis for making the maps needed to place the Teralytic sensors for monitoring the following soil parameters: Humidity, Salinity, Soil temperature, pH, Nitrates, Potassium, Phosphorus, at three different depths (15 cm, 45 cm and 91 cm). The research has shown the importance of using GIS techniques in spatializing the data obtained from these sensors and developing specific thematic digital maps that support farmers to make decisions regarding the programming of various agricultural works depending on the type of crop.

Keywords: precision farming, GIS, UAV, ground sensor, digital map

Precision farming is an intelligent way of approaching agricultural activities, which involves the use of advanced machines and technologies to streamline the agricultural process and ensure the control of agricultural production. Practicing precision farming represents, for Romanian farms, the best step towards progress, based on the technologies in the field, from automatic GPS systems to soil sensors, helping farmers to obtain the best results in a more efficient way, efficient and simpler, without wasting energy and resources. Part of modern technology is represented by sensors that can monitor different parameters related to soil and atmosphere. The obtained values must be monitored and processed in some agricultural applications, as well as of the Geographic Information Systems (GIS) that allow the spatialization of the data and the creation of specific thematic maps, which come to the support of the farmers for optimal decisions.

MATERIAL AND METHOD

The concept of precision farming is relatively new in Romania, compared to western Europe, where farmers have reached a high level of use of this concept. Precision farming offers support for farmers who use:

- data collection using satellite images from the Copernicus operational service using Sentinel data https://land.copernicus.eu/global/themes/vegetation
- crop analysis using remote sensing and multispectral analysis that generates an early report on the health status of the crop, monitoring crop yield, soil moisture, controlling the occurrence of pests;
- UAV technology, on the plane or helicopter platform on which a multispectral camera is installed that can give us real-time information about the crops that are inspected;
- agricultural equipment and machines equipped with GPS technology, variable nozzles (for seeders, fertilization equipment and application of treatments);
- sensors that monitor various operating parameters of agricultural equipment and machinery as well as grain flow in the case of harvesting;
- sensors for monitoring various chemical parameters, temperature and soil moisture.

At the Moara Domneasca Farm School, near Bucharest, belonging to the University of

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Agronomic Sciences and Veterinary Medicine of Bucharest, we proposed the creation of an application based on GIS technology that will allow the monitoring of agricultural crops. In this sense, a digital map of the agricultural farm had to be made based on a photogrammetric flight made with a UAV (eBee Classic) drone (https://www.sensefly.com/drone/ebee-mapping-drone/). Based on the obtained images, the orthophotoplan and the Digital Land Model were made, which were the basis for the digital map of the farm. Also, other older analogue maps were used from which information was extracted regarding the organization of agricultural land, pedology of plots, etc.*(*Zufferey J.C. *et al*, 2010; Zhang C.**,** Kovacs J., 2012*).*

Figure 1 - **UAV eBee and GPS SOUTH S82-V**

For information on soil properties we have proposed the use of eight Teralytic sensors. These sensors are specially designed for soil monitoring and can determine soil moisture, salinity, soil temperature, pH, nitrates, potassium and phosphorus. The sensors are of wireless type transmitting the measurements made at three different depths (15 cm, 45 cm and 91 cm) (https://teralytic.com).

RESULTS AND DISCUSSIONS

The flight was carried out with the eBee Classic drone, resulting in a mosaic of images, which, after specific processing, led to the production of the orthophotoplan and the Digital Land Model (*figure 2, 3 and 4*). Based on these images, the vegetation stage of the various agricultural crops can be traced and can visually assess the areas in which to intervene in order to improve the vegetation stage situation. To be eloquent for the different vegetation stages of agricultural crops, the flight should be repeated at least once a month during May-September.

After processing the images taken by the drone with the Postflight Terra 3D software, we could see the new constructions built up in the last years and who are not on the initial maps. Some of the old buildings were demolished in order to build the new one.

Within the GIS application developed on the ESRI platform - ArcGIS 10.3, the images obtained with the drone were stored and processed, as well as the various vector maps previously made with the plan of culture and pedology and the chemistry of the parcels within the farm.

Using GPS and GIS technology you can accurately determine the location of crops and then record information on the quality and chemistry of the cultivated land, so that the quantities of nutrients are used only on the land that needs them in order to increase the production increase;

In order to improve the information regarding the soil properties, we chose a homogeneous plot on which we installed the eight Teralytic sensors (*figure 6*). These sensors provided information on soil properties: moisture, salinity, temperature, pH, nitrates, potassium and phosphorus. The measurements were made at three different depths: 6 " (15 cm), 18" (45 cm) and 36 "(91 cm).

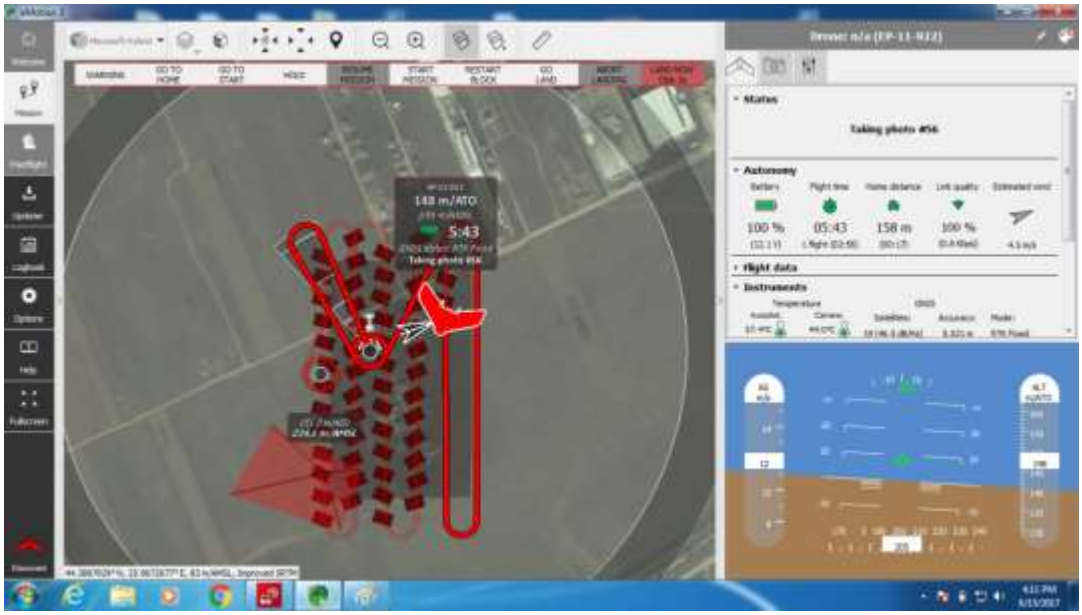

Figure 2 **Image recording and drone route**

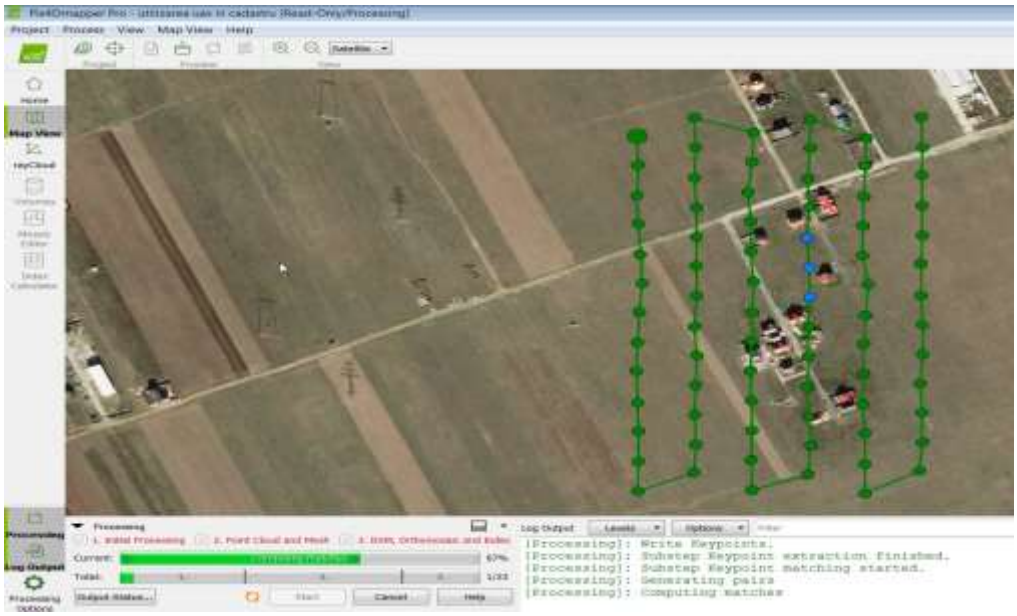

Figure 3 **Exemple of flight plan**

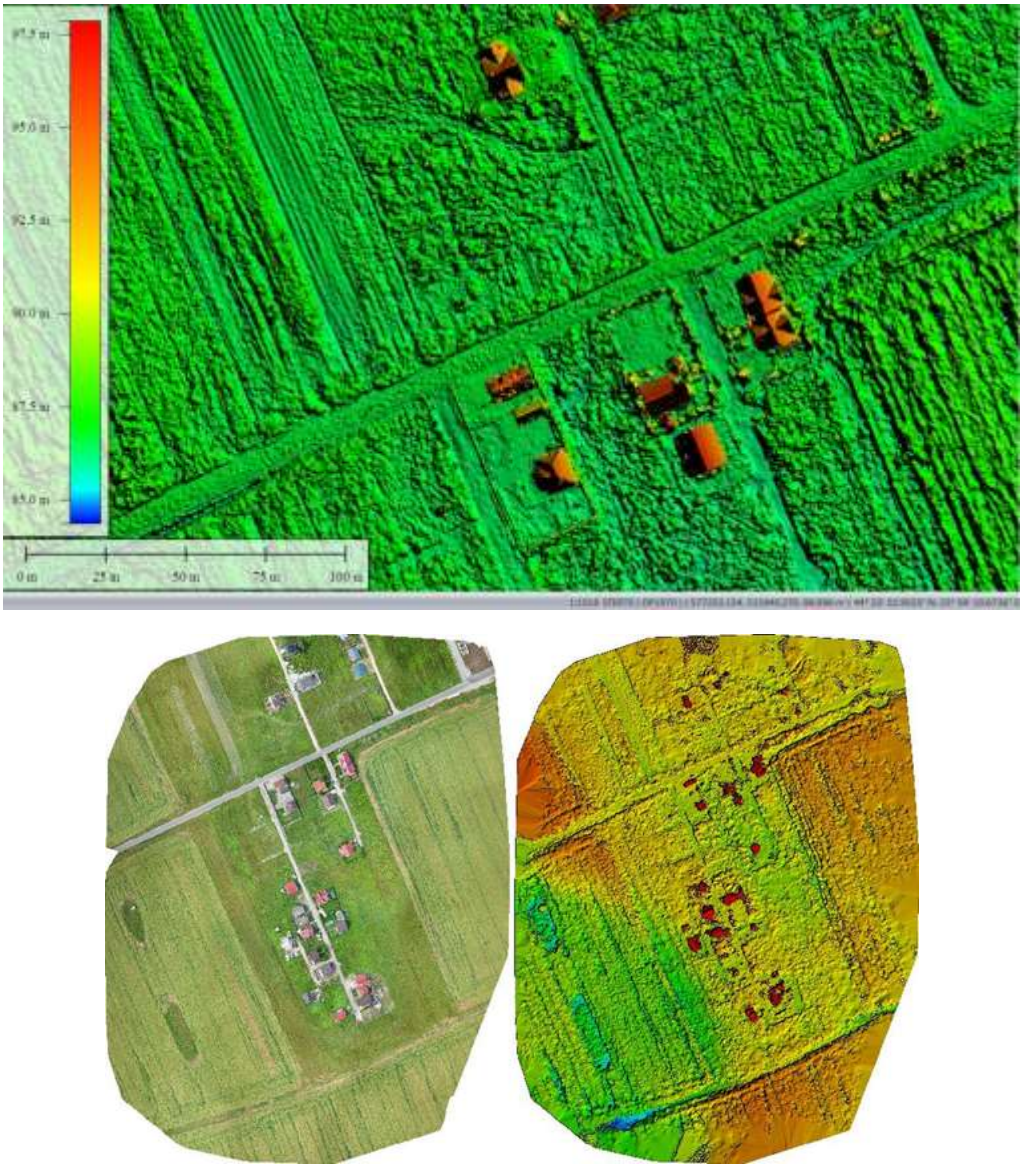

Figure 4 **Orthophotomozaic and Digital Land Model**

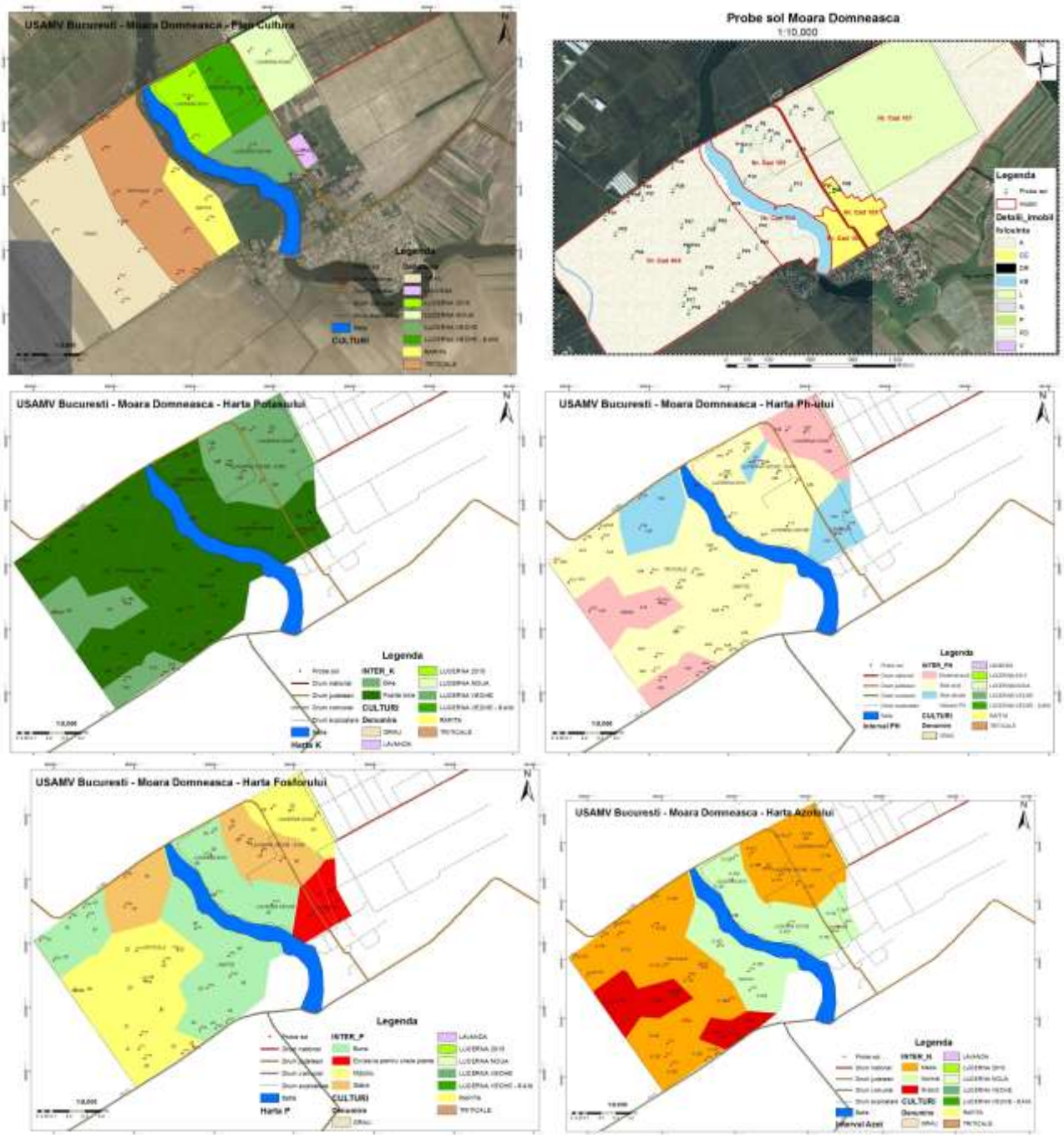

Figure 5 **Vector maps with ancient measuremnts**

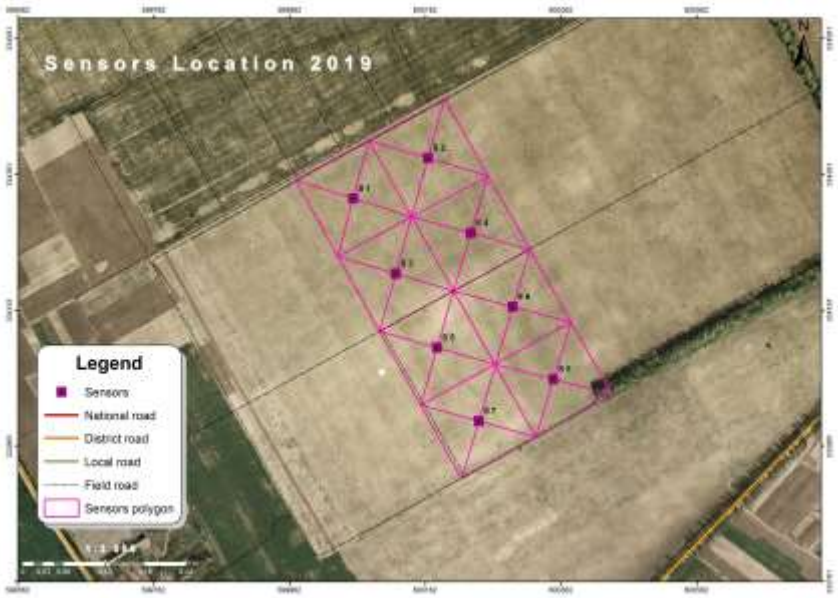

Figure 6 **Orthophotomozaic and Digital Land Model**

CONCLUSIONS

A software that uses accurate data from the field must be developed step by step and we consider that it must be started of course with the mapping of the land, without a precise cartographic support we cannot develop a complete GIS (Geographic Information System). Precision farming means measuring and keeping track of all the data resulting from the measurements you make, and for this you need an integrated system that uses a data management application to help us get the most out of it. decisions. We know at every moment what happens to our plants, if they have sufficient humidity, if they need treatments or we can estimate, with 90% accuracy, the production that we are going to harvest at the end of the vegetation period.

In conclusion we recommend the use of UAV / Drone equipment in order to perform information updating. The eBee drone can be equipped with different camera sensors, RGB, thermal, infra-red. This gives the opportunity to capture images that can be used also for vegetation monitoring, moisture level, etc.

With less equipment and with only one day in the field we succeeded to gather enough information to update the maps and to build a GIS for the Moara Domneasca Farm School.

ACKNOWLEGMENTS

We are grateful for the direct help received from the team of SysCAD Solutions S.R.L., who executed the drone flight and took over the aerial images necessary to realize the orthophoto and Digital Terain Model.

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https://teralytic.com/

ELIMINATION OF WATER EXCESS FROM BUILDINGS PERIMETER

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Abstract

For the purpose of ensuring the stability and normal exploitation of buildings, the land on which they are built and their foundation must comply with certain conditions. The growing demand for houses, office buildings, industrial halls, etc. especially in the big cities has also determined the expansion of buildings on less favourable lands, with excess humidity, landslides, etc. The high level of groundwater causes most problems, including significant damages to civil and industrial constructions, both during their execution as well as during their use and exploitation. This paper presents a method to eliminate the excess of water from groundwater and rainfall, in the case of buildings with lower ground floors. To remove the excess of water from the foundation, it is recommended to carry out a perimeter drainage at a level lower than the foundation base. In buildings with lower ground floors, filter columns spaced at 2.5-5.0 m facilitate the collection and evacuation of the excess of water. Moreover, in order to accelerate excess water removal, drainage can be doubled by placing a drainage tube at a depth of 1-1.5 m, distanced at 1.0-3.0 m from the face of the building, so as to take over the water from leaks from the surface of sidewalks, framings, parking lots, etc. Drainage lifetime can be increased by protecting the filter layer with geotextile material. By executing a drainage adequate to the constructions, an efficient elimination of excess water is ensured, the hydrostatic pressure exerted onto the walls is reduced, the formation of dampness and mould is avoided, allowing for a proper use of the spaces in basements and a longer lifetime of buildings.

Key words: groundwater, building drainage, drainage tube, prism filter, geotextile material

Water preservation is a prerequisite for a durable exploited environment. The effect of water flow reductions on the operation of the drainage systems of buildings must be understood and embedded in designing the sewer networks of the buildings (McDougall J. A. *et al*, 2003).

In the last years, the collection of rainwater became an integral part of the durable water management system. Although there are many studies showing the feasibility of using rainwater collection systems within a management system, they are not used and operated on a wider scale (Ward S. *et al*, 2012).

The local drainage systems consist of the sewer systems of the buildings and of drainage networks around the buildings and locally, on the streets, they are essential for everybody. The issues caused by the hydrostatic pressure of underground waters and surface waters on the foundations of the constructions, foundation walls, highways, supporting walls etc. are well-known (Chad M.K. and Rodney J.K., 1992; Ashley R. *et al*, 2007; Butler D. *et al*, 2018).

Water infiltration into the basement walls of buildings is a permanent issue to be solved by architects and designers. If the water is not removed from the base of foundations critical problems cam appear in the rooms placed at ground level, the infiltrations affecting also the resistance walls of the building (Radulescu *et al*, 2010). Moreover, water accumulation around the buildings makes the soil heavier to the detriment of walls that have sometimes to bear a double pressure compared to the normal situations (Alexandrescu I., 2010). Such kind of issues emerges due to a lack of measures of water elimination, to improper drains or due to wrong methods of sealing the walls to water infiltration.

In order to eliminate humidity from basement floors, Pratt J. M. proposes in 2003 the use of underground drainage pipes for underground water with rectangular section, impermeable to their lower part with slits (elongated openings) on the sides and the upper part. The pipes are placed below the floor near the foundation wall and have the role to takeover and transport the water infiltrated outside the building.

As the surfaces occupied by constructions extended, the surface of natural green areas decreased to the detriment of concrete platforms (Asakawa *et al*, 2004; Hickman C., 2013). The undersized sewage networks and sometimes their absence lead to the concentration of a large quantity of rainwater on the reduced green areas having an adverse effect on the neighboring constructions.

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MATERIALS AND METHOD

Real estate investments had a significant rise in the last 30 years in Romania. The economic crisis which affected Romania slowed down the rhythm of developments and the investors became more sensible to the need of sustainability, viable and durable constructions and high quality services contributing to the increase of the property value and its trading potential and the service providers of this field became more careful to the needs of the investors. Sustainability has implications on the entire construction process of a building, starting from designing and construction to the subsequent maintenance and operation.

In order to eliminate the rainwater excess and the phreatic input from the foundations of the constructions with basements, a method was adapted derived from the elimination of the water excess from agricultural lands made up from absorbing drains and filtering columns.

In case of the underground drainage associated with land modeling in ridge bands from the farm fields, the literature in the field recommends for improving the collecting conditions of absorbing drainages placed under ditches to erect columns of filtering materials from the drainage level to ditch level. The insertion of filtering columns, in the case of farm fields allows the increase of column size and reduction of collection-discharge network.

An economic solution of the modeling system of the land in ridge bands consists of performing water caption from ditches with collecting drains, located perpendicular on the bands, at long intervals (about 75 m) and the discharging process of each ditch in the collecting drain being made by means of a prism in granular filter material. The prism raised from drain level to the land surface realizes the ditch-drain hydraulic connection, this one being protected against plugging by a layer of geotextile (Barbu Floru, 1986).

Determining the level differences in order to create a slope for water flowing within the drain lines was made by topographic measurements with the help of accurate geometric leveling instruments.

RESULTS AND DISCUSSIONS

The increasing demand in the last years, especially after 2013, of residential buildings and offices but also the higher standards of the potential buyers determined the real estate developers to carry out sustainable and durable constructions as well as high quality services. The demand of residences in the big cities including in Iasi Municipality, as close as possible to the cultural and commercial centers and industrial parks determined the erection of constructions also on less favorable lands with a high level of the phreatic water, a higher inclination degree of the lands etc. (*Figure 1*).

Figure 1 **Constructions near Iasi Municipality**

Water stagnation within the foundations of the constructions must not be neglected. If the water level rises then a hydrostatic pressure is put on the walls and the floor inside the building while the water inside the foundation rises to the same level from outside. If the water fails to pass the floor and the walls, the latter have to withstand a high pressure than the one taken into account on designing. Moreover, the water seeps into walls and foundation by fissures, joints or construction defects and, if the hydrostatic pressure persists, in the end the water will also seep inside the building. Designing the walls and floors for residential foundations and sub-basements which are strongly enough to withstand such hydrostatic pressure is not usually practiced due to the costs. Consequently, methods were developed to prevent the accumulation of hydrostatic pressure due to underground and surface waters.

In order to use the spaces of the sub-basements of constructions in a correct way, besides the protection of the sub-basement walls on the outside with a waterproof layer, mechanical protection layer etc., it is necessary to take measurements also for the removal of the water excess inside the foundation. The elimination of the water excess due to abundant rainfall and especially from the groundwater can be done by carrying out a marginal drainage at foundation level (*figure 2*).

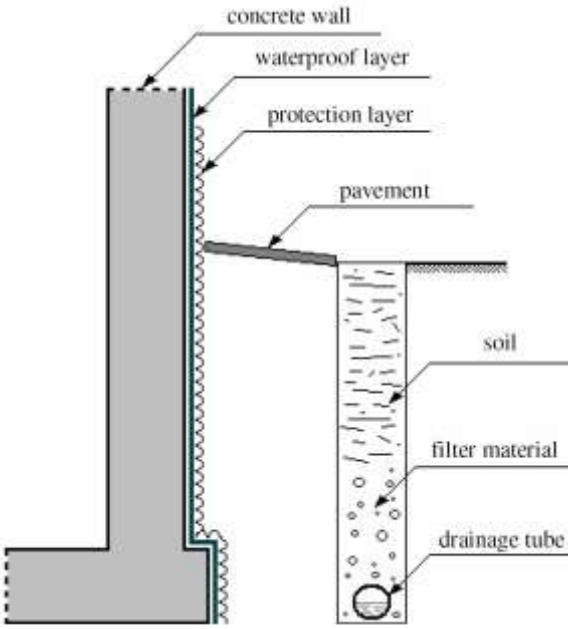

Figure 2 **Construction drainage scheme**

The marginal drainage consists from the execution of several drainage trenches at a distance of 1-3 m from the sub-basement walls so that the drainage tubing will be laid down upright on the sidewalk's edge. The drainage trenches consist in the execution of a ditch of 0.40 m width upstream at foundation level and downstream at a greater depth, thereby providing a longitudinal slope of about 2% for the water collected from the drainage tubing to flow.

From a technical and economical point of view, the most affordable drainage tubing is the one manufactured from corrugated plastic with transversal slits of 2 mm width available on the market in different sizes. The corrugated PVC tubes have high flexibility which allows their mechanized layout, providing the continuity of the drainage lines. Such tubes are fastened via sleeves and are connected via a series of fittings.

In order to avoid the silting of the drainage tubes, it is recommended to use filtering material manufactured from ballast with layers of 40-120 cm thickness depending on the depth of the foundation and the intensity of the humidity excess.

The increase of the operation period of the drainage within constructions can be made, besides wrapping the drainage tubing in geotextile material, by sealing the ballast filtering layer with geotextile material (*figure 3*).

When adapting the drainage alternative, the water coming from the drains of roofs and concrete platforms must not be neglected in conditions of climatic changes with large quantities of water fallen in short time periods and having a high intensity.

Figure 3 **Marginal drainage at the level of the foundation layer**

Chad M. K. and Rodney J. K., in 1992, recommended for the increase of the effectiveness of water excess elimination from foundations the association of the horizontal drainage with a system of perforated vertical drainage pipes spaced at maximum 2 m which collect the water coming from underground and transporting it to the horizontal drains.

The same effect can be achieved by collecting and discharging the water coming from underground and from sidewalks accumulated due to rainfall by the filtering columns of a diameter of 0.30-0.60 m spaced at 2.5 - 5.0 m consisting of ballast from the level of the filtering layer up to the surface of the land (*figure 4*).

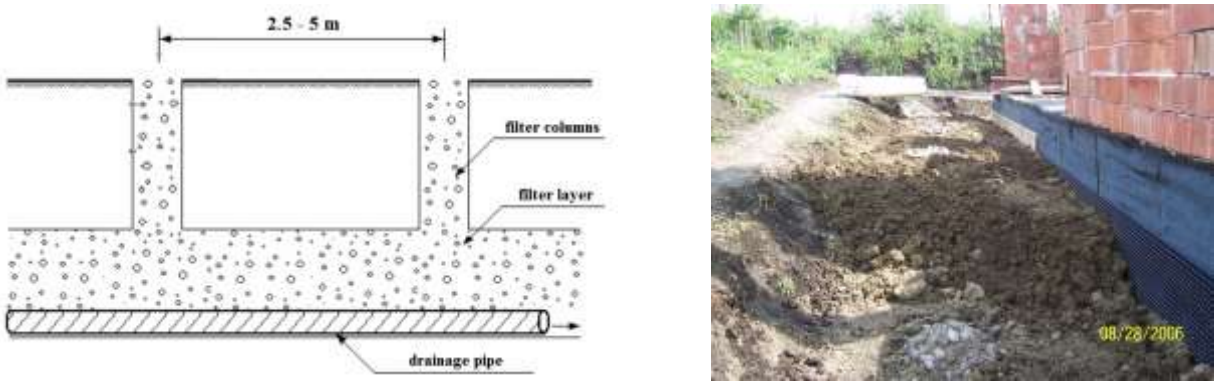

Figure 4 **Drainage with filtering prism in constructions**

In the case of a greater depth of the foundation as well as in the case of large concrete surfaces on the premises of constructions (sidewalks, alleys, parking lots etc.), the drainage can be doubled by placing a drain tube at a depth of 1 - 1.5 m, spaced at 1.0 - 3.0 m from the construction in order to take the water coming from the leaks of sidewalks, frameworks, parking lots etc. (*figure 5*).

Figure 5 **Doubling the marginal drainage**

Considering the climate changes which involve periods with abundant rainfall alternating with long dry spells, we have to talk about the durable use of water. For the durable management of water coming from the drainage network of constructions, its collection is advised into a collecting basin and its use for irrigation of households (*figure 6*).

There are a series of materials for the drainage of water from the outside of the foundation such as: high density polyethylene membrane, membrane supported by fabric, insulated drainage panels etc. which are mounted on the external walls according to various techniques and methods. However, such materials are expensive and need qualified staff and expensive mounting labor and this is the reason why most of residential entrepreneurs, in order to maintain the price competitiveness of their houses, do not use such drainage systems. Moreover, most of the materials are not resistant to a series of oil based products which are used frequently as waterproofing materials on the outside of foundations before the application of the drainage systems.

Consequently, the drainage alternative consisting of a horizontal drainage combined with filtering columns and doubling the drainage line for buildings with foundations of greater depth represents an improved drainage solution. This

alternative does not need qualified staff for mounting, can be executed at low costs so that it can be used both for residential structures and for other more expensive structures without significantly increasing the construction costs.

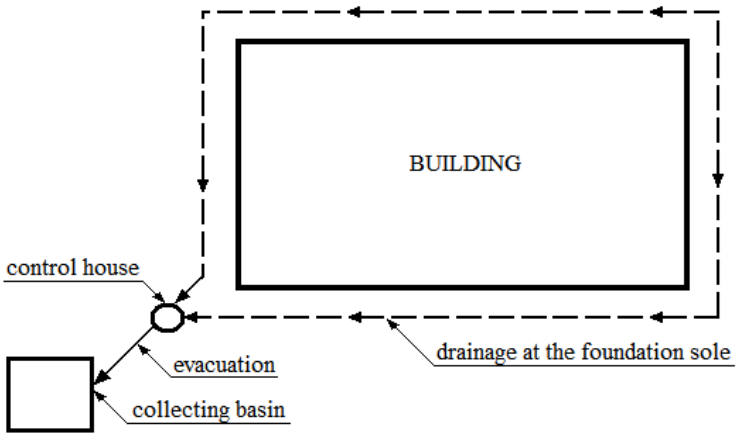

Figure 6 **Marginal drainage and collection basin**

CONCLUSIONS

The elimination of the water excess from the foundations of the constructions determines the reduction of the hydrostatic pressure on the basement walls, providing an increased stability and normal operation of the construction.

An adequate drainage system for the constructions with basement provides a quick elimination of the humidity excess, maintains the dryness of the basement walls, thereby avoiding the formation of dampness and mold in the basement rooms and their consequences.

The drainage system consisting of horizontal drainage combined with filtering columns and doubling the drainage line, in the case of buildings with foundations of great depth, manufactured from corrugated PVC tubing and with ballast filtering material, can be executed by unqualified staff and low costs. Therefore, it can be used both for residential structures and for other more expensive structures without a significant increase in the costs of the construction.

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STRUCTURAL MODELING AND OPTIMIZATION OF AGROZOOTECHNICAL BUILDING

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Abstract

Within this analysis the structural and behavioral differences will be highlighted for external actions in this paper, but also the adaptation of the structure to the technological conditions imposed by the architectural and functional design of the agrozootechnical building structure. The construction will be considered for Iasy County. Thus, the prefabricated reinforced concrete frame structure with the corresponding roof panels from hot rolled profiles type IPE, will have the spatial cooperation between frames ensured by the stiffening beams that join the pillars in the longitudinal profile of the building. The pillar joints will be considered as articulated. The steel structure will have rigid-pole-beam joints, and the spatial co-operation will be ensured by the vertical contraventions present at the level of the pediments between the pillars, but also at the level of the marginal beams only between the marginal pillars. They will also be willing roof plane countervailing for increased rigidity of the wind and Earthquake. The wooden structure will have ensured the spatial cooperation between the frames only through the panels roof, not including other elements of braking and stiffening. The joints will be rigid between the pillar and the beam, and the continuity of the roof panels will be ensured by mounting the multinail plates at their joints. The structural optimization will be done through a comparative study of the three structural variants and the proposal of the one that meets all the beneficiary requirements.

Key words: Structural optimization, agrozootechnical farm, steel structure, wood structure and prefabricated reinforced concrete

Agrozootechnical farms in rural development policy have required continuous modernization and constant adaptation to the needs of the society by correctly dimensioning of their structure as well as increasingly flexible structures capable of covering as large as well as economic openings in order to be implemented by farmers. Structural modeling (Gavriloaia *et al*, 2009; Lungu I *et al*, 2010; Hohan R *et al*, 2012; Mihai P., 2010; Mihai P *et al*, 2007) and the optimization (Barbuta *et al*, 2014; Judele L *et al*, 2015; Judele L *et al*, 2018; Lepadatu *et al*, 2018; Lepadatu *et al*, 2005; Lepadatu *et al*, 2009) of their shapes and dimensions require advanced knowledge of structural calculation since the behavior of different materials in dynamic actions (Corobceanu *et al*, 2010a; Corobceanu *et al*, 2010b; Gavriloaia *et al*, 2016) is different. Thus, in this paper we approach a current theme (Alecu *et al*, 2018; Amarandei C. *et al*, 2011) which through the proposals made with structures of the agrozootechnical farm in three constructive variants (concrete, steel and wood) and comparative studies offer a wide range of choice and a customized optimization.

MATERIAL AND METHOD

The present work is about a construction with agrozootechnical destination, having the height regime "P". The building has a regular shape in the plan, being inscribed in a rectangle with dimensions 35x242 m, located in Iasi County. The projected building will have the strength structure of prefabricated reinforced concrete frames class C25 / 30 for both main beams, stiffening beams and columns. The columns will have a square section with a side of 30 cm, the main beams will have the dimensions 20x60 cm, and the stiffening beams will have the size of 20x50 cm. The main beams will have an angle to the horizontal plane of 15 ° and will support the roof purlins made of metal profiles IPE 270, class S235.

The infrastructure of the building will be made from insulated foundations of prefabricated reinforced concrete type C25 / 30, under columns
The perimeter closure elements that will keep the biological inventory for the scope for which it was proposed for design and implementation will be made of high density polyethylene covers automatically activated according to the wind

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speed, humidity and temperature of the external atmospheric environment.

RESULTS AND DISCUSSIONS

Case A. Concrete frame structure

Prestressed concrete frame structure with steel purlins roof

The frame type structure of prefabricated reinforced concrete with the roof purlins related to hot rolled profiles type IPE, will have ensured the spatial cooperation between the frames provided by the stiffening beams that join the columns in the longitudinal profile of the building. The pole-beam joints will be considered as articulated.

At the level of the roof, profiles will be arranged as closure elements of cut sheet of type TR 106 R. Also on the south side of the frame over the sheet elements will be placed photovoltaic panels with dimension 196x98.5 cm In both sides of the frame, over the roof, respectively photovoltaic panels, a cable system will be applied to defrost the snow and ice in winter. There will be made partition elements of reinforced masonry with a thickness of 25 cm.

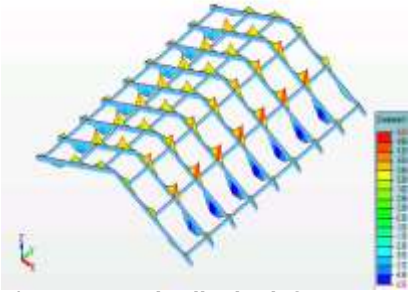

Figura 1 **Longitudinal reinforcement percentage required Az main and stiffening beams**

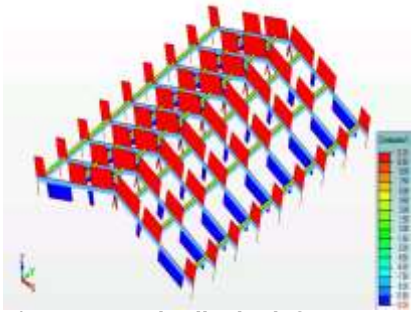

Figura 2 **Longitudinal reinforcement minimum percentage**

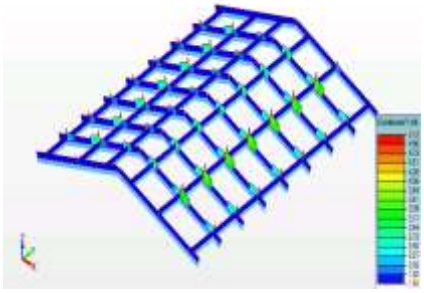

Figura 3 **Transversal reinforcement percentage required Atz for main and stiffening beams**

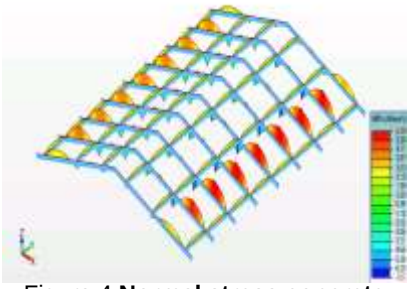

Figura 4 **Normal stress concrete value on z direction**

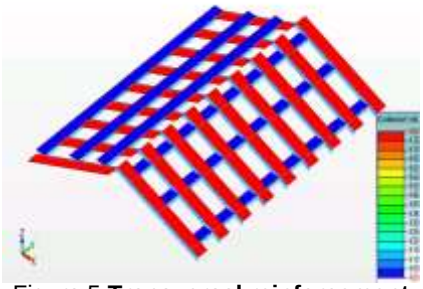

Figura 5 **Transversal reinforcement percentage required Aty for main and stiffening beams**

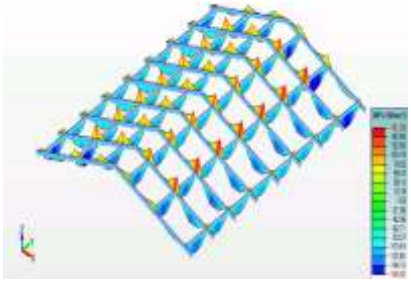

Figura 6 **Normal stresses on the reinforcement steel bars on z direction for main and stiffening beams**

Case B. Steel frame structure.

Frame structure with **steel profile**

The metallic structure will have rigid column-beam joints, and the spatial co-operation will be ensured by the vertical breaches present at the level of the pediments between the columns, but also at the level of the marginal beams only between the marginal beams. Also, there will be placed breaches on the roof plane to increase the rigidity of the wind and earthquake.

This structure will be composed of columns made of HEA 300 profiles, main beams of thick sheets welded with the shape of profile I with the web dimensions 650 * 2.5 and two flanges 300 * 2.5. Roof panels will be made of IPE 270 profiles. Vertical breaches will be present at the level of the pediment walls and breaches in the roof plane in the first beam, respectively the two central beams of the construction. These breaches will consist of profiles CHS 101.4C and CHS101.2C respective.

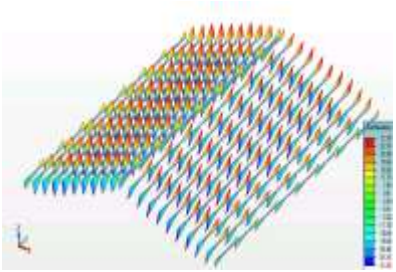

Figura 7 **Representation of the Fz efforts at the level of the roof panels on the maximum winding**

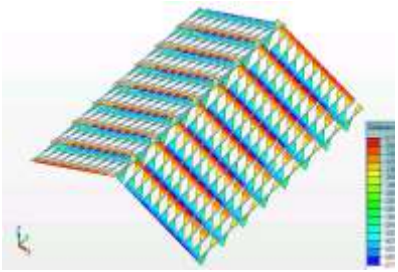

Figura 8 **Representation of the Fy efforts at the level of the roof panels on the maximum winding**

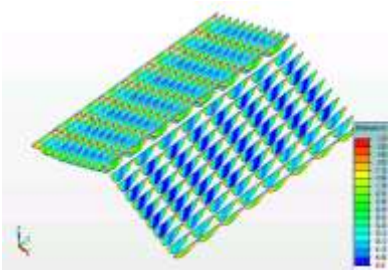

Figura 9 **Representation of the My efforts at the level of the roof panels on the maximum winding**

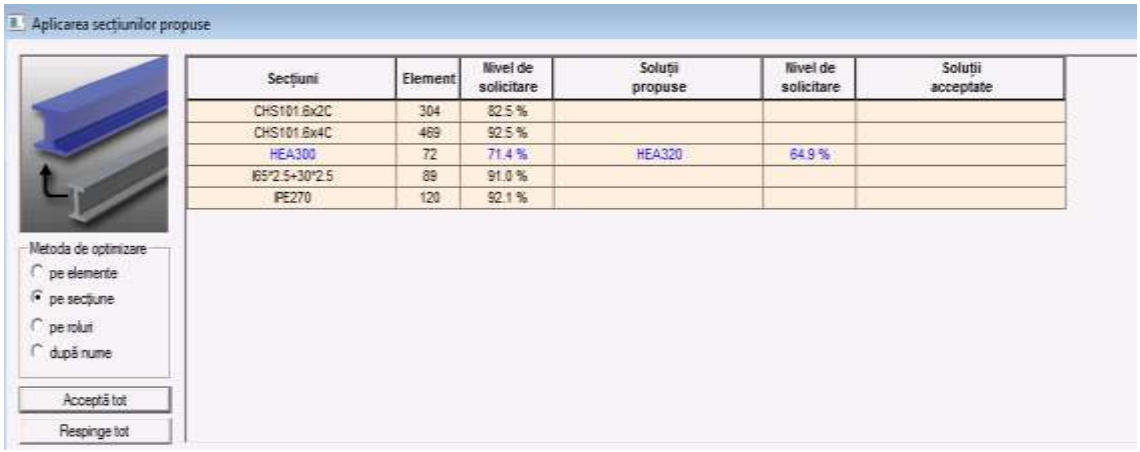

Figura 10 **Buildings sections optimization under resistance and stability conditions expressed as a percentage**

Case C. Wood frame structure

Wood frame structure with rectangle wood purlins roof

The wooden structure will have ensured the spatial cooperation between the frames only through the roof purlins, not including other elements of breaches and stiffening. The joints will be rigid between the pole and the beam, and the continuity of the roof purlins will be ensured by the mounting of multinail plates to their joints.

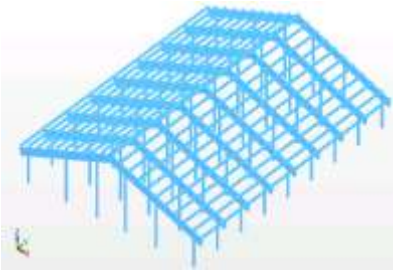

Figura 11 **Wood Structural Model**

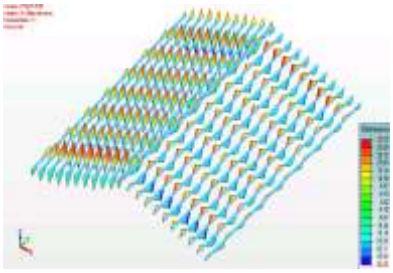

Figura 12 **Wood Structural Model**

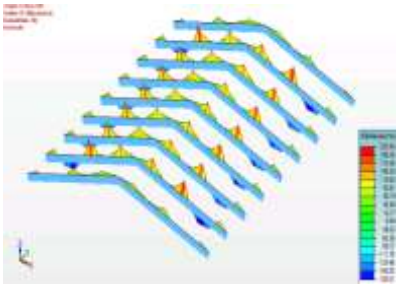

Figura 13 **Representation of the My efforts at the level of the roof panels on the maximum winding**

CONCLUSIONS

In this paper we highlighted the structural and behavioral differences in the external actions, but also the adaptation of the structure to the technological conditions imposed in the architectural and functional memory of the building. Following this study the following aspects were highlighted:

The frame-type structure of reinforced concrete shows an over-dimensioning from the initial pre-dimensioning conditions for the values of the loads of its own weight, the useful loads, the loads from the snow and the wind, but it presents a too flexible behavior, respectively with relatively

large displacements following the seismic action for the given site.

In this context I consider partially impossible to achieve the structure on the proposed functional plan. In order to improve the behavior of the seismic actions, respectively for limiting the displacements, I recommend the adoption of specific measures through the arrangement of additional reinforcements at the level of the main beams and the poles, but under an efficient evaluation of the costs of realization.

The metallic structure shows a favorable behavior towards the actions to which it was subjected after the analysis. The presence of roof and pole vaults greatly limits lateral displacement. It provides a very good report regarding the use of sections in the construction elements, respectively an adequate dimensioning that prevents the use of excess materials. However, one of the problems of this structure is the relatively high volume of labor, with effects, of course, in the total cost of construction. The structure from wood material also has a good behavior towards the actions presented in the last chapters with relatively small effects, a rational use of the sections. One of the problems that could occur is the "massiveness" of the main beam, which presents some exceptional dimensions in my opinion.

ACKNOWLEDGEMENTS

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EFFECTS OF STORAGE TEMPERATURE, DURATION AND INOCULATION METHODS ON *BRADYRHIZOBIUM JAPONICUM* GROWTH WITH SOYBEAN

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Abstract

The positive effect of root-nodulating strains of *Bradyrhizobium* spp in soybean in terms of biological nitrogen fixation and plant growth and development is still a main focus in the present. According to the literature, a concentration of 10^5-10^6 bacteria on the seed, will guarantees that the root can be infected during the germination process, and in this way will achieve early nodulation. In this research the effects of storage temperature, duration and inoculation methods on the survival of *Bradyrhizobium japonicum* growth on soybean seeds and the performance of soybean bacterial inoculant on seeds under field conditions were determinate. The results showed that the storage of the inoculated seeds at low temperature (5-10°C) can assure a very good root infection in order to obtain a higher nodule number and after 90 days, whether the inoculation was done in station or factory. The registered results showed values which ranged from $0.03*10^5$ to $5.06*10^5$ CFU/seed. In case of the performance of soybean bradyrhizobia inoculants on seeds under field conditions we determined that from the soybean tap roots, the highest number of nodules was 138, while the lowest number was 42 nodules. Regarding the total weight of the nodules prevailed from the tap roots, the highest registered values was 4748.0 mg. In case of secondary roots, the highest number of nodules was 353, while the lowest number was 103.

Key words: *Bradyrhizobium japonicum*, inoculation, storage temperature and duration, soybean nodules

Root-nodule bacteria included in the group of α-*Proteobacteria*, are fixing atmospheric nitrogen in the symbiosis with leguminous plants inducing the formation of nodules on the roots and are members of the following genera *Bradyrhizobium*, *Rhizobium*, *Sinorhizobium*, *Mesorhizobium, Azorhizobium* and *Allorhizobium*

Soybean [*Glycine max* L. (Merr.)] is gaining importance as a diversifying crop in cereal dominating cropping system. In Romania, has occupied an area of 165,140 hectares with an annual production of 416.4 million tons and with an average yield of 2.5 tons/ha (FAO, 2017). Inoculation of soybean with *Bradyrhizobium japonicum* (*Bacteria*, α-*Proteobacteria*, *Alphaproteobacteria*, *Rhizobiales*, *Bradyrhizobiaceae*; Rivas *et al*, 2009) is a common agricultural practice in order to allow an efficient nodulation of the plant and to increase nodule number and/or nodule weight. The success of inoculation will improve grain yield and let in soil a higher amount of nitrogen. Besides, the bacteria will protect the roots from the attack of pathogens due to production of diverse microbial metabolites (siderophore, rhizobitoxin) and will increase the uptake of phosphorus and other minerals (Deshwal *et al*, 2003)

The characteristics of *Bradyrhizobium* spp. are rod-shaped, nonspore-forming cells, motile with one polar or subpolar flagelum, aerobic, Gram-negative, cell-sized of 0.5-0.9 μm and 1.2-3.0 μm, the optimum growth temperature is 25-30°C at pH 6-7 (Holt *et al*, 1994).

The seed ready to sow is a technology that offers numerous advantages in the pre-sowing process because it considerably simplifies the producer's tasks and reduces production costs. In this way, the quantity of product used is reduced and also guarantees the application of adequate doses of fungicides, insecticides, inoculants and bio-inductors of high complementarity. Today's technologies are designed to reduce the impact of pesticides on bacteria, increasing the compatibility between the inoculant and the seed treatment chemicals. Seed inoculants are mainly applied by adhering the product before sale or at sowing. Bacterial survival on the seed is mainly affected by three factors: desiccation, the toxic nature of seed

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coat exudates and storage temperatures. Early studies demonstrated that bacteria survival on seeds improves if the peat-based or vermiculite-based inoculants were applied 4 or 8 weeks after inoculant production, respectively (Albareda M. *et al*, 2008).

Despite the long history of inoculation of legumes and clear laboratory demonstration of the ability of a wide range of other beneficial microorganisms to improve crop performance, there are still very few commercially available microbial seed inoculants (O'Callaghan, M., 2016)

The objective of this study was to determine: (1) effects of storage temperature, duration and inoculation methods on the survival of *Bradyrhizobium japonicum* growth with soybean and (2) the performance of soybean bradyrhizobia inoculants on seeds under field conditions.

MATERIAL AND METHOD

In order to determine the presence and the average number of bacterial colonies of the genus *Bradyrhizobium* per seed (CFU/seed), 13 samples of soybean seeds from Dekabig variety were received. Twelve samples were previously inoculated in laboratory or in station with Rizoliq LLIS + Premax LLI biopreparate (250 ml + 50ml/100 kg seed), while the 13th was the untreated control.

To obtain information about the CFU/seed value for *Bradyrhizobium* spp., YEMA nutritional medium (yeast extract-mannitol-agar) in variants with Congo red with antibiotic (vancomycin) was used.

In order to obtain manageable concentrations of bacteria the serial dilution technique (log dilution) was used. A log dilution is a tenfold dilution, meaning the concentration is decreased by a multiple of ten. To complete a tenfold dilution, the ratio must be 1:10. A sample size of 1 ml was added to 9 ml of sterile distillated water to equal a total of 10 ml. For our experiment we used the dilution 10-3 and 10-4 in five repetitions. Inoculation was done using the spread method with 1 ml of appropriate dilutions and placed on the surface of the nutritive medium. The sample was then evenly coated on the agar surface using a sterile glass spreader (triangle rod). After inoculation the Petri dishes were placed in an incubator at a constant temperature of 28°C for 7 days. After incubation, each bacterial cell from the dilution has formed a single colony which was counted.

The 12 inoculated samples used in the experiment had the following indications:

• V1: seed inoculation carried out at the station 90 day before sowing, storage T= 15-20ºC
• V2: seed inoculation carried out at the station 90 day before sowing, storage T= 15-20ºC
• V3: seed inoculation carried out at the station 60 day before sowing, storage T= 15-20ºC
• V4: seed inoculation carried out at the station 60 day before sowing, storage T= 15-20ºC
• V5: seed inoculation carried out at the station 30 day before sowing, storage T= 15-20ºC
• V6: seed inoculation carried out at the station 30 day before sowing, storage T= 15-20ºC
• V7: seed inoculation carried out at the station 30 day before sowing, storage T= 5-10ºC
• V8: seed inoculation carried out at the station 90 day before sowing, storage T= 5-10ºC
• V9: seed inoculation carried out at the station 60 day before sowing, storage T= 5-10ºC
• V10: seed inoculation carried out in the laboratory 30 day before sowing, storage T= 5-10ºC
• V11: seed inoculation carried out in the laboratory 90 day before sowing, storage T=5-10ºC
• V12: seed inoculation carried out in the laboratory 60 day before sowing, storage T= 5-10ºC

The untreated control had the code NI-T0 (V13).

In order to determine the nodules number on the main and secondary roots, and also their weight, the soybean plants (12 variants; V1-V12; 3 repetitions/variant) from soybean Dekabig variety were received from a private company. After receiving the plants, they were placed in Berzelius glasses with water, in order to easily detach the remaining soil particles adhering to the roots. On the same day, the nodules from the main and secondary roots were counted and weighed.

RESULTS AND DISCUSSIONS

Analysing the effects of storage temperature, duration and inoculation methods on the survival of *Bradyrhizobium japonicum* on soybean seeds the results showed value which ranged from $0.03*10^5$ to $5.06*10^5$ CFU/seed (*table 1*).

Values within the range recommended by the specialized literature (10^5-10^6 CFU/seed) were recorded for the 6 samples kept at a temperature of 5-10ºC after inoculation, regardless of the location where the seed inoculation was made. In case of seeds inoculated under laboratory conditions and stored at 5-10°C, after the determination of CFU/seed it was observed that the highest value was obtained in case of the variant V12 with $2.42*10^5$ CFU/seed (*table 1*). The values obtained for the seeds inoculated in the station ($5.06*10^5$ CFU/seed) were higher compare to the values from seeds inoculated under laboratory conditions, and this being due to the non-uniformity of the seed samples brought to the analysis.

The lowest values, under literature recommendation (10^5-10^6 CFU/seed), were recorded in the case of inoculated seeds stored at 15-20ºC (*table 1*). In this case, the highest CFU/seed values were obtained from the variant

V4 ($0.12*10^5$). In both location, where inoculations were made, the results revealed, that the number of CFU/seed decrease over time.

Table 1

***Bradyrhizobium* spp. bacteria counting (CFU/seed)**

Variant	Location of inoculation	Days after inoculation	Storage temperature	Bacteria counting (CFU/seed)
V1	Laboratory	90	15-20ºC	$0.03*10^5$
V2	Laboratory	60	15-20ºC	$0.06*10^5$
V3	Laboratory	30	15-20ºC	$0.10*10^5$
V4	Factory	90	15-20ºC	$0.12*10^5$
V5	Factory	60	15-20ºC	$0.06*10^5$
V6	Factory	30	15-20ºC	$0.03*10^5$
V7	Factory	30	5-10ºC	**$5.06*10^5$**
V8	Factory	60	5-10ºC	**$2.56*10^5$**
V9	Factory	90	5-10ºC	**$3.78*10^5$**
V10	Laboratory	90	5-10ºC	**$1.47*10^5$**
V11	Laboratory	60	5-10ºC	**$1.46*10^5$**
V12	Laboratory	30	5-10ºC	**$2.42*10^5$**

In case of the performance of soybean bradyrhizobia inoculants on seeds under field conditions we determined that from the soybean main (sin. primary, tap) roots, the highest number of nodules was recorded for the seed preparation variants V8 (138 nodules), V10 (137 nodules) and V12 (130 nodules), while the lowest number was recorded for V2 (42 nodules) and V1 (47 nodules) (*table 2*).

From the secondary (sin. fibrous, tap) roots, the highest number of nodules was recorded as in the case of the main roots, for V8 (353 nodules), V12 (284 nodules) and V10 (242 nodules) variants, while the lowest number was recorded for V5 (103 nodules), V1 (105 nodules), respectively V2 (133 nodules) (*table 2*).

Regarding the total weight of the nodules prevailed from the main roots, it recorded the highest values for V8 (4748.0 mg), V6 (4252.5 mg) and V10 (4156.4 mg), and the lowest weight was recorded for V5 (1914.1 mg), V1 (1957.9 mg) and V9 (2130.2 mg) variants. Analyzing the total weight of the nodules taken from the secondary roots, the highest registered values of approx. 7630 mg were found for V7 and V8 variants. The lowest values were recorded for V5 (1413.1 mg) and V9 (2284.6 mg) (*table 2*).

It was observed, that the best results regarding the previously analyzed factors, have been recorded in the case of variants V8, V10 and V12. Variant 8 (V8) recorded the best values also at the previous time of sample collection (beginning pod – R3 stage), being from this point of view the recommended inoculation variant.

Table 2

Nodule number and nodule total and average weight (per plant) obtained after seed inoculation

Variant	Main (primary) root		Average weight	Secondary root		Average weight
	Nodules no.	Nodules total weight (mg)	mg	Nodules no.	Total weight (mg)	mg
V1	47	1957.9	56.4	105	3950.0	36.6
V2	42	2788.6	69.8	133	3452.8	26.8
V3	65	3356.6	44.3	172	3357.2	22.7
V4	81	3962.6	45.7	183	4555.7	23.6
V5	66	1914.1	28.5	103	1413.1	13.9
V6	92	4252.5	43.6	187	4615.8	23.9
V7	64	4012.6	78.3	233	7630.3	33.2
V8	138	4748.0	36.0	353	7628.5	20.0
V9	108	2130.2	18.8	151	2284.6	15.2
V10	137	4156.4	29.9	242	3832.2	15.9
V11	104	3076.0	31.1	200	3599.6	20.5
V12	130	3205.4	27.0	284	4489.8	21.9

Comparing the average weight of a nodule collected from the main (primary) root between beginning pod (R3) and full maturity (R8) reproductive (R) stages, was notice that overall the weight of the nodules has increased, and this fact corresponds to a higher

amount of nitrogen that will remain in soil. The highest average weight per node, in the case of the main root, was recorded in the case of variant 7 (V7) for both sampling periods (*figure 1*).

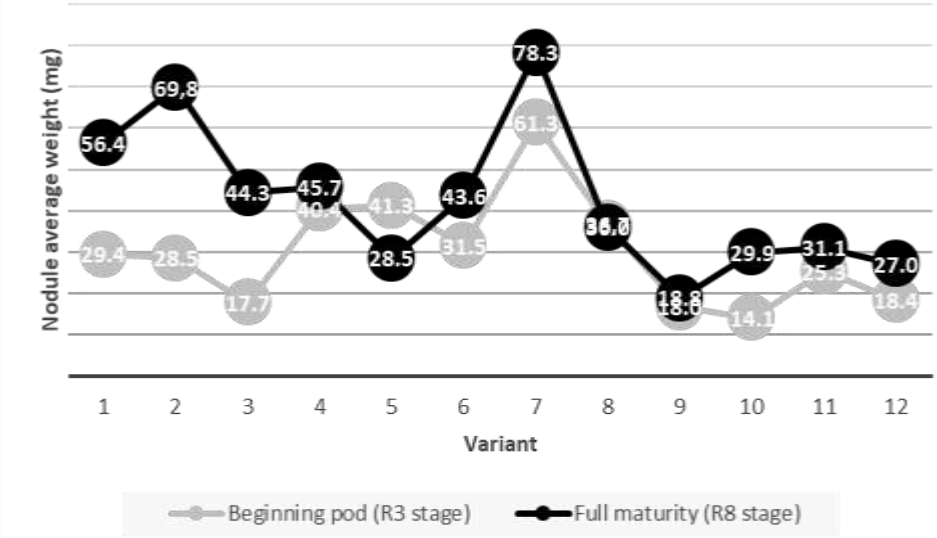

Figura 1. **Comparison of the nodule average weight collected from the main root between R3 and R8 reproductive (R) stages**

In the case of nodules collected from the secondary roots between the same reproductive (R) stages we notice that the average weight of a nodules was fluctuating, and the highest average weight per nodule was registered in the case of variant 1 (V1), followed by V7 (*figure 2*).

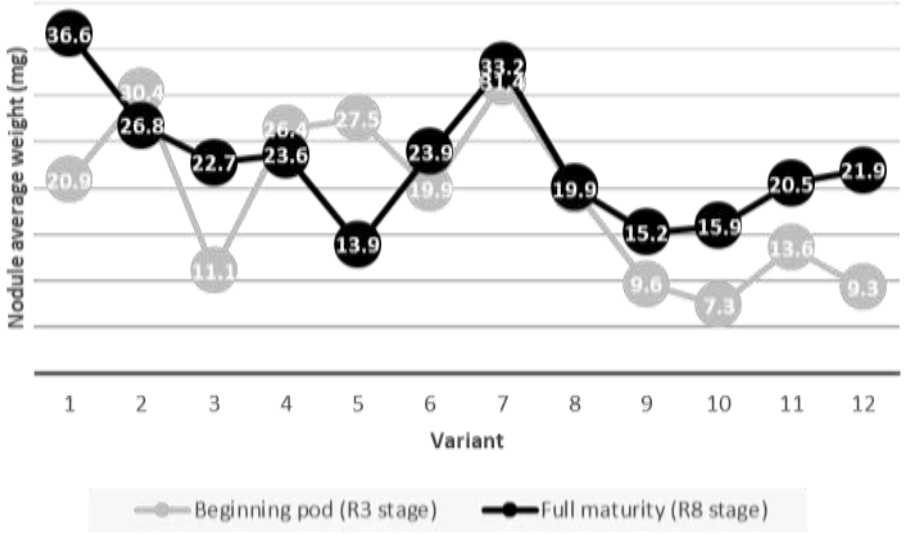

Figura 2. **Comparison of the nodule average weight collected from the secondary roots between R3 and R8 reproductive (R) stages**

CONCLUSIONS

Analyzing the effects of storage temperature, duration and inoculation methods on the survival of *Bradyrhizobium japonicum* on soybean seeds the results revealed, that the number of CFU/seed decrease over time, but if the inoculated seeds are stored at low temperature (5-10°C), the number of bacteria can assure a good root infection even after 90 days. If the inoculated seeds are stored 30 days at 15-20°C, will not assure the minimal number of bacteria necessary for a good nodulation.

In case of the performance of soybean inoculated with *Bradyrhizobium* spp., stored at 5-10°C at least 30 days and then sowed on fields, the results obtained at level of main and secondary roots showed much better results as nodules number and average weight in comparacy with the seed material stored at higher temperature (15-20°C).

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