TESTING AND OPTIMIZATION METHODS AND CULTURAL PRACTICES OF VINES IN THE ECOLOGICAL SYSTEM THE PERIOD CONVERSION

EXPERIMENTAREA ŞI OPTIMIZAREA UNOR METODE ŞI PRACTICI DE CULTURĂ A VIȚEI DE VIE ÎN PERIOADA DE CONVERSIE LA SISTEMUL ECOLOGIC

NECHITA Ancuta[1], ZALDEA Gabi[1], DAMIAN Doina[1], ALEXANDRU L.C.[1], MOROȘANU Ana Maria[2]
e-mail: ancuta.vasile@yahoo.com

Abstract. *Technologies currently used in viticulture are based on a brutal human intervention in natural ecosystems causing, exhaustion in short time of natural fertility of the soil, environmental pollution and increased vulnerability of ecosystems vineyards. Both reducing energy consumption and preserving the ecosystems are representing the aim of remodeling and method optimisationduring the vine conversion period. In this regard, the wine center Copou Iasi were established specific technology area, differentiated from Feteasca albă and Feteasca regala. The suitability of the viticultural area Copou-Iaşi as organic culture of the vine is confirmed by the results obtained from observations and measurements of climatic factors, deployment phenophases of vegetation, soil moisture dynamics, weed spectrum of experimental plots, the degree of attack of pests and diseases as well as quantitative and qualitative assessment.*
Key words: *grapes, organic, conventional, climatic factors, quality*

Rezumat. *Tehnologiile de cultură promovate în prezent în viticultură reprezintă, în mare măsură o intervenție brutală a omului în ecosistemele naturale determinând epuizarea, în scurt timp a fertilității naturale a solului, poluarea mediului ambiant şi creşterea vulnerabilității ecosistemelor viticole. Remodelarea şi optimizarea unor metode şi practici de cultură a viței de vie în perioada de conversie vizează atât reducerea consumurilor energetice, cât şi păstrarea sau refacerea ecosistemelor. În acest sens, în centrul viticol Copou Iaşi au fost stabilite tehnologii specifice zonei, diferențiate pe soiurile Fetească albă şi Fetească regală. Rezultatele obținute în urma observațiilor şi determinărilor privind evoluția factorilor climatici, desfăşurarea fenofazelor de vegetație, dinamica umidității solului, spectrul de buruieni din parcelele experimentale, gradul de atac al bolilor şi dăunătorilor precum şi evaluarea producției cantitative şi calitative, confirmă pretabilitatea arealului viticol Copou Iaşi la cultura în sistem ecologic a viței de vie.*
Cuvinte cheie: *struguri, ecologic, conventional, factori climatici*

INTRODUCTION

In organic viticulture the main goal is to capitalize at maximum the capacity of the potential of the ecopedoclimatic area, the local traditions exploitation of the vine in order to increase the quality wine production (Ionescu *et al.,* 1986; Glăman, 2000;

[1] Vine and Wine Research and Development Station of Iaşi, Romania
[2] University of Agricultural Sciences and Veterinary Medicine of Iaşi, Romania

Roraru *et al.,* 2004).

In Europe the main winemaking countries presents a ascendant trend concerning the passage to organic culture system due to market demand and in particular the increasing of the consumption of vine products - organic wine (Stoleru *et al.,* 2008; Toncea, 2002; Jităreanu *et al.* 2003). Due the existence in Romania of small areas planted with organically vines, it was decided to investigate the variability of the main characters productivity for the quality varieties of the vines that are representative for viticultural center Copou Iasi and the pretability of the ecological technologies culture.

MATERIAL AND METHOD

For the experimentation and optimization of some methods and practices concerning the culture of the vine in the ecological system in the Iasi Copou viticultural center there were realized some experimental models (ecological variant - VE and conventional versions - VC) for Feteasca alba and Feteasca regala varietes. The agrotechnical measures, that are specific to the area and differentiated for the two varieties studied, were correlated with the climatic factors and consisted of pruning of the vine, burning shoot and spring plowing for the cultivated intervals; the control of weeds was done manualy by hoeing the row; mechanical mowing strips with lasting grassing; the control of the conventional diseases and pests was done in the ecological way; the operation during the anual vegetative period (weeding, tying the rods; pinching back). There were conducted observations and measurements on the vegetation phenophases, the soil moisture dynamics; the spectrum of weeds and the degree of infestation of the plots; the degree of attack of pests and diseases; the quantitative and qualitative assessment expressed by the average number of grapes on the vine; the average weight of a grape; the production off the hub; the content of the grape must in sugars and acidity.

RESULTS AND DISCUSSIONS

The analysis of the main climatic elements of the year 2014 was compared to the multianuale averages (1981 - 2010) and showed an increaseof the annual average temperature from 9,8°C to 10,3°C and also modified values of the thermal balance. Therefore, the global thermal balance was 3219.0°C compared to 3168.4°C, the active thermal balance 3076,7°C against 3048,9°C and the useful heat balance was 1426.7°C compared to 1386.0°C Ttable 1).

The absolute minimum air temperatures recorded in the end of January of 20.6 °C and in the first day of February of 17.3°C affected the normal primary buds in the grapevine. The absolute maximum temperature in air recorded in the august was 34,2°C. The amount of precipitations recorded was very irregular distributed, totaling 377.1 mm during the vegetation period, under the normal 398.1 mm.

Among the synthetic character climate indicators there are included: the hydrothermal coefficient with a value of 1.2, indicating that the moisture was sufficient and correlated with the temperature, ensuring in this way the conditions for large and quality productions; the real heliothermic index with a value of 2.0 indicating an increase in the thermal resources and being optimal for the ripening of the late varieties; the bioclimatic index vineyard (7.0) shows that in the viticultural

center Copou Iasi, the thermal resources have increased thanks the background of optimal water resources; the oenoclimatic aptitude index (IAOe) with a value of 4354,8 indicates a middle favorability for the culture of vine varieties for table and wine grapes; the annual of aridity index Martonne (28,05) indicates a semi-humid steppe climate for the viticultural center Copou Iasi.

Table 1

The values of climatic elements of 2014 compared with multi annual averages.

Climatic elements studied	Multiannual average (1981-2010)	2014
Global thermal balance, ∑tºg,ºC	3168,4	3219,0
Active thermal balance, ∑tºa,ºC	3048,9	3076,7
Useful thermal balance, ∑tºu,ºC	1386,0	1426,7
Mean temperature of July, °C	21,0	21,5
Mean temperature of august,°C	20,3	21,6
Mean temperature of september,°C	15,6	16,9
Annual average temperature, ºC	9,8	10,3
Absolute minimum temperature in air, ºC	-27,2/ 28.12.1996	-20,6/31.01
Absolute maximum temperature in air, ºC	42,3/ 20.07.2007	34,2/14.08
Number of days with maximum temperatures > 30°C	17,3	22
∑ annual real heatstroke, (hours)	2044,4	1971,1
∑ real heatstroke during vegetation season, hours	1448,2	1405,2
Σ annual rainfall, mm	579,6	618,0
Σ season vegetation rainfall, mm	398,1	377,1
Hydrothermal coefficient, (CH)	1,3	1,2
Real heliothermic index, (IHr)	2,0	2,0
Bioclimatic index vineyard (Ibcv)	7,1	7,0
Oenoclimatice aptitude index (IAOe)	4106,1	4354,8
Annual aridity index Martonne ($I_{ar\text{-}DM}$)	30,3	28,05

The determinations conducted during the growing season from the soil concerning the humidity on both variantes: those worked on the ranges maintained as a field and those with long-term natural grassing have highlighted the optimal growth and development of the vine stocks. Concerning the month of august it was registered amomentary reduction of water reserves in the soil and an increase of the deficit.

From the observations concerning the succession and the physiological phenophases realized for each variety studied, it can be highlighted the fact that the onset of vegetation occurred by budbursting for the variety Fetească alba on April 20th, followed by Fetească regală on 22th April, under a heat balance situeted between 18 6 and 27,3˚C. The flowering, a phenophase which defines the fructification and the influence on the grapes production, started on 5th June, the duration andthe end being influenced by the climatic with cumulative action of the genetic and agrotechnical factors. In these circumstances the earliest blooming succed in the case of Feteasca alba (05th june), followed closely by the variety Fetească regala (6th june). The useful thermal balance that also conditioned the phenophase had values of 255,7˚C respectively 257,0˚C. The grapes have reached full ripening after 22th September for the Feteasca alba variety and ended on 26th September with the variety Feteasca regala. During the vegetation period, from budburst to the the fall leaves the two varieties had values of 184 (Feteasca alba) and 182 (Feteasca regala).

The determinations realised on the composition of the vegetation on the intervals between the rows of plots and the proximity areas have highlighted the importance of the work of mechanical cultivators and mowers. On grass strips, the annual species (terofite) had a low frequency, best results being registred by the perennial species in particular hemicriptophytes (resistant to compression) and the meadowland vegetation was characterised by the same phenomenon. High values of the of frequency were recorded for the following species: *Agropyron repens, Lolium perenne, Poa angustifolia, Trifolium repens, Trifolium pratense* and *Achillea millefolium*. The predominant species in the intervals maintained as a field were those with a very deep root system as: *Amaranthus retroflexus, Chenopodium album*, *Solanum nigrum* etc (annual species), *Convolvulus arvensis*.

The specific climatic conditions of the 2014 were favorable for the development of the main pathogen: vine mildew, powdery mildew and downy mildew of grapes. In those circumstances there were observed consequences on both the conventional variant and the ecological one on which were applied seven treatments (Table 2 and 3). Because of the hail that occurred in early July and effected the growth in phenological stage of the grains, there were applied two treatments with Bouille bordelaise. In august, because of low rainfall registered (34,8 mm), the degree of attack of pathogens was reduced and there weren't needed no treatments.

Table 2

Phytosanitary treatments carried out the year 2014 - variant conventional

Date	Target organism	The phytoprotection product use	Dose/ha
29.04	*Uncinula necator + Eriophies sp.*	Mixture sulfocalcic	12 L
18.05	*Plasmopara viticola + Uncinula necator*	Antracol + Kumulus	3,0 kg, 3,0 kg
31.05	*Plasmopara viticola + Uncinula necator*	Mikal + Topas	3,0 kg, 0,25 L
12.06	*Plasmopara viticola + Uncinula necator*	Mikal + Topas	3,0 kg, 0,25 L
22.06	*Plasmopara viticola + Uncinula necator*	Folpan + Kumulus	1,5 kg, 3,0 kg
03.07	*Plasmopara viticola + Uncinula necator*	Bouille bordelaise + Kumulus	5,0 kg, 3,0 kg
21.07	*Plasmopara viticola + Uncinula necator*	Bouille bordelaise + Kumulus	5,0 kg, 3,0 kg

Table 3

Phytosanitary treatments carried out the year 2014 - variant ecological

Date	Target organism	The phytoprotection product use	Dose/ha
29.04	*Uncinula necator + Eriophies sp.*	Mixture sulfocalcic	12 L
18.05	*Plasmopara viticola + Uncinula necator*	Bouille bordelaise + Kumulus	3,0 kg, 3,0 kg
31.05	*Plasmopara viticola + Uncinula necator*	Funguran + Thiovit	2,0 kg, 3,0 L
12.06	*Plasmopara viticola + Uncinula necator*	Kocide + Kumulus	1,5 kg, 3,0 kg
22.06	*Plasmopara viticola + Uncinula necator*	Kocide + Kumulus	1,5 kg, 3,0 Kg
03.07	*Plasmopara viticola + Uncinula necator*	Bouille bordelaise + Kumulus	5,0 kg, 3,0 kg
21.07	*Plasmopara viticola + Uncinula necator*	Bouille bordelaise + Kumulus	5,0 kg, 3,0 kg

In assessing the aggressiveness main vine pathogens were made observations and values were calculated on the intensity, frequency and degree of attack for each variety. The effectiveness of treatments varied between 60 and 98% from ecological version and between 66 and 100% conventionally cultivated variant (Table 4 and 5).

Table 4

The evolution of pathogens in experimental plot cultivated with Fetească albă

Pathogenic agents	Phenologi-cal stage BBCH	Organs analy-zed	Elements determined						Efficacy treatments %	
			Intensity %		Frequency %		Degree of attack %			
			VE	VC	VE	VC	VE	VC	VE	VC
Plasmopara viticola	15	leaf	0	0	0	0	0	0	-	-
	60	leaf	4,65	2,71	5,10	3,0	0,23	0,12	95	97
	65	leaf	4,75	11,0	5,62	3,64	0,26	0,40	97	96
	71	leaf	3,74	6,5	14,99	3,0	0,56	0,20	96	99
		grape	2,60	4,5	6,57	3,0	0,22	0,14	93	96
	81	leaf	8,54	22,0	32,61	5,23	2,83	1,1	71	89
		grape	7,0	14,50	33,27	13,58	2,33	1,97	76	80
	85 - 87	leaf	9,32	32,74	56,01	13,76	5,3	4,50	69	74
		grape	8,12	10,5	16,35	10,52	1,42	1,10	75	81
Uncinula necator	15	leaf	0	0	0	0	0	0	-	-
	60	leaf	0	0	0	0	0	0	-	-
	65	leaf	0	0	0	0	0	0	-	-
	71	leaf	7,50	13,65	55,10	24,43	4,19	3,33	87	90
		grape	1,04	0	1,41	0	0,05	0	98	100
	81	leaf	20,00	25,12	54,86	42,30	10,70	10,62	80	80
		grape	9,55	4,47	24,31	45,75	2,34	2,04	82	84
	87	leaf	22,38	24,92	56,36	50,42	12,61	12,17	82	83
		grape	14,02	10,66	56,83	53,16	8,20	5,69	63	74
Botrytis cinerea	87	grape	0	0	0	0	0	0	-	-

Table 5

The evolution of pathogens in experimental plot cultivated with Fetească regală

Pathogenic agents	Phenologi-cal stage BBCH	Organs analyzed	Elements determined						Efficacy treatments %	
			Intensity %		Frequency %		Degree of attack %			
			VE	VC	VE	VC	VE	VC	VE	VC
Plasmopara viticola	15	leaf	0	0	0	0	0	0	-	-
	60	leaf	4,75	2,32	5,62	3,0	0,26	0,06	93	98
	65	leaf	9,0	3,0	11,00	25,0	0,99	0,75	92	94
	71	leaf	10,18	3,21	13,50	33,0	1,37	1,06	92	94
		grape	8,90	2,5	5,47	4,4	0,48	0,11	90	98
	81	leaf	7,39	7,25	18,55	17,85	1,37	1,29	88	88
		grape	11,30	6,79	11,50	13,65	1,30	0,92	88	91
	85 - 87	leaf	8,31	10,11	83,0	57,65	6,90	5,82	60	66
		grape	4,47	5,06	45,75	35,77	2,17	1,80	75	80
Uncinula necator	15	leaf	0	0	0	0	0	0	-	-
	60	leaf	0	0	0	0	0	0	-	-
	65	leaf	0	0	0	0	0	0	-	-
	71	leaf	6,41	7,88	63,0	41,42	4,04	3,34	90	92
		grape	4,4	0	2,5	0	0,11	0	97	-
	81	leaf	20,15	24,36	77,60	58,72	15,52	14,30	78	80
		grape	6,86	5,60	33,99	24,84	2,33	1,39	87	92
	87	leaf	15,12	11,81	32,41	34,19	4,90	4,03	94	95
		grape	2,9	3,0	31,0	29,0	0,90	0,87	96	96
Botrytis cinerea	87	grape	0	0	0	0	0	0	-	-

Note: VE - ecological variant; VC - conventional variant

The climatic conditions and plant protection that were mentioned above showed that the harvests varieties studied have realized their biological potential (Table 6) with no significant differences between ecological and conventional variant. The grape production was variable from one variety to another the most productive proved to be Fetească albă with 8.94 to 9.62 t/ha.

Table 6

Grape production and quality varieties achieved by studied in year 2014

Parameters determined	Fetească albă		Fetească regală	
	ecological variant	conventional variant	ecological variant	conventional variant
Production, kg/vine	2,36	2,54	2,10	2,18
Production, t/ha	8,94	9,62	7,00	7,26
Weight of a grape, g	174	168	180	172
Weight 100 grains, g	184	182	196	195
Sugars, g/l	206	213	196	199
Total acidity, g/H_2SO_4	6,4	6,5	5,7	5,6

CONCLUSIONS

The ecopedoclimatic conditions for viticultural center Copou of Iasi make it possible the adoption and the gradual implementation of the system of ecological culture of the vine.

The results reaction of the attack of the main pathogens and the main characteristics of productivity and quality, attests the pretability of the vine varieties Fetească albă and Fetească regală for a ecological culture.

***Acknowledgments**: The paper was developed in the project within the Sectoral Plan ADER 2020 PS 1.1.14 entitled "Developing a set of methods and techniques for growing vines organically, focusing on main and secondary sale of products resulting from the vineyards, to reduce energy consumption in the semi-subsistence"*

REFERANCES

1. Ionescu A., Plotoagă G., 1986 – *Ecologie şi protecția ecosistemelor*. Editura Bucureştii Noi, Constanța.

2. Jităreanu G., Samuil C., 2003 – *Tehnologii de agricultură organică*, Editura Pim, Iaşi.

3. Rotaru Liliana, Voiculescu I., 2004 - *Tehnici culturale de creştere a calității în viticultură,* Editura "Prahova" Ploieşti.

4. Stoleru V., Grădinariu G., Munteanu N., Jităreanu G., Istrate M., Rotaru Liliana, Vrabie I., Senic I., 2008 - *Ghid de bune practici în producția agricolă ecologică*. Editura "Stef", Iaşi

5. Toncea I., 2002 - *Ghid practic de agricultură ecologică*. Editura Academic Press, Cluj-Napoca.

6. Glăman Gh., 2000 - *Producția horticolă integrată sau biologică*. Hortinform 3: 91.