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Improving the Grapevine Technology by Optimising the Utilisation of the Environmental Resources in the Murfatlar Vineyard

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1. Abstract

Optimizing the vine breeding technology in water stress conditions is useful to the wine producing companies from the Dobrogea area (an area with a pronounced dry climate).

This research was financed by the Research and Education Ministry through a special programme named AGRAL. It took place in 2001-2006 interval on Columna variety on a 3 ha plot.

The main objective of the research is the improving the actual vine breeding technologies in the Murfatlar vineyard by better use of the environmental resources in the condition of climate changing.

The conversion of intensive technology into a new balanced exploitation of the vine ecosystem was taken into consideration.

In the Murfatlar vineyard the climatic conditions of the latest six years has a different evolution in comparison with the multiyear mean, causing several specific features in the vine growing process. The climatic changes – the global warming processes affected also the quality of harvest.

Following these causes it must be adapted the breeding technologies in order to better use the environmental resources and to protect the vineyard ecosystem.

The main problem is to keep the healthy status of the grapes with a specific range of bio-selective pesticides and to choose the most efficient irrigation system.

2. Introduction

The integrated production concept is used in the agricultural system which obtain high quality food which utilizes resources and mechanisms of natural control aiming at replacing the interventions which are harmful for the environment and which assure a sustainable agriculture on the long term.

The *objective of the integrated production* (Bull. OILB, 1993, 2000) are:

- It is a holistic concept which assures the preserving of the ecosystem's equilibrium by biodiversity and natural resources conservation

- Undesirable side-effects are reduced (ex: the contamination of potable water with pesticides and nitrites) (Baicu, 1986,1996)
- It is a systemic approach centered on the whole farm as a basis unity, important strategies such as equilibrium of the nutrients circuit and optimum utilization of environmental resources can be applied
- Man is the key factor in the realization of the integrated production: his perspicacity, motivation, need to be prepared professionally are request needed to make a durable agriculture
- The nutrients circuit needs to be balanced and the loss must be minimum
- The soil fertilization need to be preserved and ameliorated
- Taking the decision regarding the protection of plants is done in concordance with the integrated control; integrated protection is applied to the harmful organisms (phytophags, weeds) "the fight" meaning eliminating the part of the pest population which generates effective losses
- Biological diversity needs to be encouraged regarding both genetic level and species from ecosystem, these forming the backbone of the ecosystem's stability, factor of the natural control and the landscape quality
- The product's quality needs to be evaluated regarding both the ecological parameter of the production system and through the classic criteria of internal and external qualities (Tardea, 1995)
- In viticulture obtaining an integrated production requires the preserving and fertilizing of the soil with moderate doses on one hand, and on the other hand the exact determination of the disequilibrium produce by "key" diseases and pests, on which the fate of the harvest relies
- From the conclusion of the research made on this topic in Romania we mention:
- The soil work must be limited, done at the right time and the fresh organic matter must not be buried deep (Dejeu, 1997, Olteanu, 2000)
- The fight against weeds: is recommend on one hand preemptive methods such as removing the dissemination sources, early spring soil ploughing, the soil's covering with dry herbs or other biological materials, on the other hand, the control will be done mechanically, manually and by burning
- The soil's inhering is the ecological and economic alternative for preserving the soil with a "equilibrating" role of the soil components (Condei, 1991)
- Using green fertilizers contribute to the reduction of the soils erasure, ameliorates the structure, being a control means of the chrolosis (Cotea, 1996), mainly through the cultivation of leguminous plants (Davidescu, 1994, Catanescu, 1987)
- The integrated control of the diseases and pests in viticulture relies on warning through the calculation of PED (the economical harm threshold), elaborating control schemes of disease and pests, using biological means (biological insecticides, pheronomal traps and others) (Filip, 1994), elaborating datum bases and foreseeing models (Ranca, 1998)

The Research Station Murfatlar is directly involved in research and extension in vineyards located on southeast of country area of this integrated breeding system.

The Murfatlar vineyard is situated in the Dobrogea region, in the South-East part of Romania, between the Danube river and the Black Sea coast.

The climate and the soil of the region make the quality of the Murfatlar wines.

Vineyards are placed on plateaus with blunt edges or slow slopes, S – SW oriented. The climate is excessive continental with large quantities of solar radiation, rich heliothermic resources and one of the driest climate of Romania. The influence of the sea plays a positive role in autumn, as thermal regulator.

Some *climatic data* (average for the last 40 years) are presented below:

- total annual temperature: 4103 degree C
- total active annual temperature (over 10 degree C): 3657 degree C
- number of possible vegetation days (with temperature higher than 10 degree C): 179
- total sunshine hours (April-October):
 - potential : 2936; real: 1604
- total annual precipitation: 413 mm
- total precipitation from April to October: 195 mm
- mean annual temperature: 11 degree C

The soil is mostly carbonated brown chernozem with 2-4 % humus, 7.5-8.3 pH, total CaCO₃ - 3-12 % and parental rock- loess.

Main breeds in vineyard are:

- for white wines: Pinot gris, Chardonnay, Sauvignon, Muscat Ottonel, Riesling Italian, Columna.
- for red wines: Pinot noir, Cabernet Sauvignon, Merlot, Feteasca neagra, Mamaia.

Direction of production is superior dry, half dry and sweet; white and red natural wines; special wines on high quality.

Mean production on hectare is 6 to 10 to/ha after the type of breed and the type of wine that will be obtained.

Sugar content at the harvest time is 196 - 260 g/l , depending on breed and wine type to be produced.

3. Material and Methods

The pilot plot is represented by a plantation with the Columna variety (Romanian variety for the white wines, created at Murfatlar), established in 1995.

The vines are grafted on the rootstock Berlandieri x Riparia – Sel. Oppenheim 4, the plantation distance being 2.5 x 1m, the form of leading being Guyot on semi-trunk.

The soil is typical chernozem with a favorable fertility to the growing vine – having middle humus content: 2.7% and small to medium supplier with nutritive substances.

The general slope is 2% with southern exposure.

The following activities have been accomplished:

- The monitoring of the main climatic factors and of the water status content of the soil;
- Establishing and executing of some technological research with minimal inputs – reducing the number of the agro-phytotechnic work, drip irrigation and fertilization
- Establishing a control program of the health status of the plantation accentuation on the biotechnical methods;
- Utilizing and evaluating the efficacy of a drip irrigation system.

4. Results and Discussions

Climate conditions in the 2001-2006 period have had a different evolution in comparison to the multi-annual mean (tables 1 and 2) determining a series of peculiarities in the growth and development processes of vines.

Analyzing the thermal evolution we notice a moving of the maximal values of the annual and real (over the 10 °C – the biological threshold of the vine development) thermal sums from the summer months towards the spring ones, respective in the March-June interval. During all years the annual temperature mean was higher than the multiyear mean registered between 1960 – 1990 period.

The 2001 year was excessively dry, the precipitation fallen in the vegetative period (89.3mm) represented only 32% of the multi-annual mean during the same interval. The other years are characterized through a non-uniform repartition of the precipitations, thus moths without precipitations (January, February, May) and months with excessive precipitation (March, September, October in 2002, August in 2003 and 2005, September in 2004, July in 2006) being observed.

In this context of hydric deficit in soil the atmospheric dryness has been present with unusual strength in the May – October interval 2002 and in the April-June months in the most of the other years. The drought effect can be observed through the little growth of the shoots and sometimes through the involution of the flowers in tendrils. In august 2001 a falling of the leaves from the shoot top was noticed. This disturbed the physiologic processes of the plants.

The precipitation fallen in the autumn-winter period was insufficient thus assuring a humidity accessible normally only in the surface horizon of the soil (0-20 cm). Alternatively on the 20-100 cm depth, where the maximal spreading of the vine roots was registered at the end of March a deficit of utile water of over 600 mc/ha. The deficit doubled at the end of the summer months.

Month	Multiyerly mean	2001	2002	2003	2004	2005	2006
I	0,5	3,5	0,1	0,8	-2,5	3,3	-3,2
II	1,3	2,7	7,3	-4,3	2,1	-0,7	0,3
III	4,2	9,7	8,5	3,4	8,6	4,5	7,1
IV	10,2	10,8	10,3	9,0	12,3	11,2	11,5
V	16,2	16,1	18,5	21,2	15,8	18,0	17,1
VI	20,4	21,2	23,3	24,2	21,4	21,9	22,7
VII	22,6	27,9	27,2	25,2	23,9	24,3	24,2
VIII	22,6	25,2	23,4	24,7	22,8	24,4	26,3
IX	17,6	20,0	18,1	16,3	18,6	20,5	18,6
X	12,0	13,4	13,2	11,5	15,7	12,1	13,8
XI	7,2	5,6	9,9	6,8	8,8	6,4	7,1
XII	2,3	-2,3	-1,4	2,6	4,1	3,1	4,7
Year mean	11,0	13,0	13,3	11,8	13,8	12,4	12,5

Table 1. The average monthly of temperature, Murfatlar, 2001-2006

Year Month	Multiyearly mean	2001 Rains (mm)	2002 Rains (mm)	2003 Rains (mm)	2004 Rains (mm)	2005 Rains (mm)	2006 Rains (mm)
I	31,0	0,0	0,0	35,1	60,5	35,1	17,7
II	33,0	49,0	7,4	30,7	12,0	30,7	35,6
III	21,7	43,2	101,9	19,2	28,2	19,2	76,6
IV	33,5	18,0	18,4	1,4	24,2	1,4	34,1
V	50,2	11,9	7,2	140,8	7,8	140,8	73,7
VI	53,2	24,3	25,9	65,2	22,4	65,2	16,7
VII	35,6	1,8	20,7	31,9	31,4	31,9	130,1
VIII	31,6	2,0	33,9	144,0	16,1	144,0	69,9
IX	41,6	28,5	71,9	11,6	167,4	11,6	86,6
X	30,2	2,8	118,8	8,9	74,1	8,9	4,8
XI	40,4	53,5	27,9	25,0	9,3	104,1	25,8
XII	34,0	37,3	45,7	19,5	93,6	29,9	7,5
Sums	419,8	288,6	479,7	533,3	547,0	622,8	579,1

Table 2. Monthly and yearly precipitations, Murfatlar, 2001-2006

Establishing and executng of technological work with minimal input:

- Two variants of pruning where practiced with a 24 and 32 buds on plants
- No chemical treatment was used of the weeds, choosing instead to manually remove them
- The some work was eliminated on the canopy such as tying the shoots on fills, cutting the top of shoots, the removing of the leaves during the vegetation period
- 2 irrigation were applied of 200 mc/ha each and 2 fertilizations (100kg/ha) with a complex fertilizer with microelements (N:P:K - 19:19:19 supplemented with Mg and Mn) at the flourishing and berry growing phenophasis.

Establishing a program of integrated control

A fight integrated program of the main diseases and pests in the pilot plot was established and executed, the highlight being on utilizing biotechnological methods. In the plantation was used sexual pheromones traps called ATRABOT for keeping the pest population of grape mouth (*Lobesia botrana* Den. et Schiff) under control (figure 1). The integrated control scheme applied in the conditions of 2003 year on the Columna variety at Murfatlar (table 3) assured an identical efficacy with the one of the classical scheme (chemical treatments) at a lower cost. Thus this cost 170 euro/ha versus the 200 euro/ha of the classical scheme. The number of treatments was smaller by one, both for manna and for odium and the botrytis of the grapes was controlled through 2 partial removing of leaves at the grapes level. The main pest of the Murfatlar vineyard, grape moth, was controlled by using of 3 traps/ha achieving an efficacy close to the level of chemical treatments.

Using and evaluating efficacy of the drip irrigation system

The un-uniform distribution of precipitation in the vegetative period, the constant water deficit in the soil which registered values between 100 and 1200 mc/ha and the strong winds specific of the area make the using of irrigation in vine plantation in the Murfatlar region necessary.



Fig. 1. ATRABOT traps in Columnna experimental plot

The disease or pest controlled	Integrated control scheme				Clasic control scheme			
	Used product and the dose - l or kg/ha	No. of treat .	Efic. comp. with the witness un-treated	Cost Euro /ha	Used product and the dose- l or kg /ha	No. of treat.	Efic. comp. with the witness un-treated	Cost Euro /ha
Manna	Champion - 3,0	1	87	20	Mancozeb -2,0	1	81	20
	Ridomil gold -2,5	2	94	70	Curzate Manox -2,5	1	88	40
					Bordelese -7,5	1	77	10
					Champion-3,0	1	87	25
Oydium	Topas 0,2	2	96	30	Sulph dry -20,0	2	82	10
	Wet Sulph - 5,0	2	88	20	Sulph -5,0	2	90	20
					Karathane-0,5	1	95	15
Botrytis	Two partial leaves removing	-	89	20	Konker -1,5	1	95	30
Grape moth	3 pheromonal traps	-	85	10	Decis -0,4	2	94	10
					Larvin -1,0	2	98	20
Total			90	170			89	200

Table 3. Integrated control scheme for mains vine diseases and pests, Columnna variety, 2003 year at Murfatlar

Very important is to choose the most efficient irrigation system taking into consideration that the water quantity used for one vine hectare irrigated by sprinklers (most frequent system in the area) is between 800-1000 mc water.

An optimum solution is to choose the less water consumer system, like drip irrigation. The efficiency of utilizing water in the case of the sprinkle irrigation system is 50% compared to the 85-90% of the drip irrigation (Ranca, 2005). Once with the local application of the water in reduced quantities we can concomitantly apply the fertilization with soluble fertilizers.

The description of the drip irrigation system existing on the pilot plot

In this step the system serves a single plantation, the Columna one, but allows for the ulterior linkage of other plots. The bringing of water is realized through a PEHD 80D 50mm conduct on the distance of 230 m, fueled from a common underground network of irrigation water supply.

The first filtering is done with a main sand filter that assures a 230 mc/h debit and the second filtering is done with a small plastic filter having a filtrating surface of 527 cm², having a debit of 28.8 mc/h. The filtering is preview with two manometers on entrance and exit and evacuating cock.

The fertilization is done through an injector integrated in a circuit with a cock access that assured a medium debit on the injector of 50l /min (3 mc/hour) of fertilized solution injected in the irrigation water.

Distribution is done with tubes PEHD D50 mm respectively 40 mm for the distribution antenna water on the plant rows (figures 2 and 3). After the technological probes and the determining of the functional parameters of the installation will have introduce an automatic programming system.



Fig. 2. Dirip irrigation distribution on the plants row in the Columna experimental plot

The watering system is previewed with plastic tubes with double incorporated drippers situated at 60 cm from the other on the tubes length. Each dripper assures a 3 l/h debit at a supplied water pressure of between 0.5 and 2 atmospheres, having from the construction a pressure regulator

The functional parameters of the installation are: maximum debit assured: 34 mc/h, maximum watering intensity: 26 mc/h/ha. A standard watering of 200 mc/ha can be done

in 8-10 hours on normal functioning parameters. From this distribution center the water can be supplied to other parcels, alternatively, with the condition that it must not surpass the distance from the station as to not lose pressure.

The benefit of implementing drip irrigation system in vineyards

There are multiple direct and indirect advantages in using drip irrigation system on the vineyards located in dry or half-dry areas.

The *direct advantages* are:

- The *water quantity is reduced* mainly in the areas with a continental semiarid climate with lack of water resources
- Need of *labor force is lowered*
- Small and controlled *fertilizers can be applied* (fertigation) increasing the efficiency of these and reducing pollution risks
- The *intervention of the soil* level was *diminished*, being protected the chemical and physical soil proprieties
- Slope areas can be cultivated without the danger of washing of fertile level of soil
- The risk of phreatic water contamination with fertilizers is extremely reduced.



Fig. 3. The watering surface in drip irrigation system

Between the *indirect advantages* are:

- Unfavourish the weeds growth, the interval between plants is dry
- The cryptogammic diseases risk is lower and the costs of treatments is diminished
- There is the possibility for underground irrigation by using herbicides in this system

- This system permits applying of different breeding technologies, which lead to increase the grapes quality (table 4).

The wine quality was studied in comparison with a witness obtained on a classical breeding technology.

The Columnna wine has a constant quality on the experimental period assured by the new technology: water supply on necessary time and of appropriate quantity, a rational fertilization, preserving a good status health of plant, respectively grapes. In opposition the wines obtained on a witness Columnna plot has hard influences due to the lack of water at the principal developing moments of plants (flourishing, shoots growing, berry forming) and of the main physiological processes (photosynthesis rate, transpiration, stomata conductance). So, the witness vines are in all this years (exception 2006 year), below the quality of witnes obtained by the integrated technology (figure 4).

Un-irrigated plot			Sprinkler irrigation			Drip irrigation		
Tones/ha	Sugar g/l	Acidit.g/l H ₂ SO ₄	Tones /ha	Sugar g/l	Acidit. g/l H ₂ SO ₄	Tones /ha	Sugar g/l	Acidit. g/l H ₂ SO ₄
6,4	183,6	4,1	8,2	181,6	5,2	8,0	190,08	4,8

Table 4. Characterisation of harvest - Columnna - average data 2001-2006

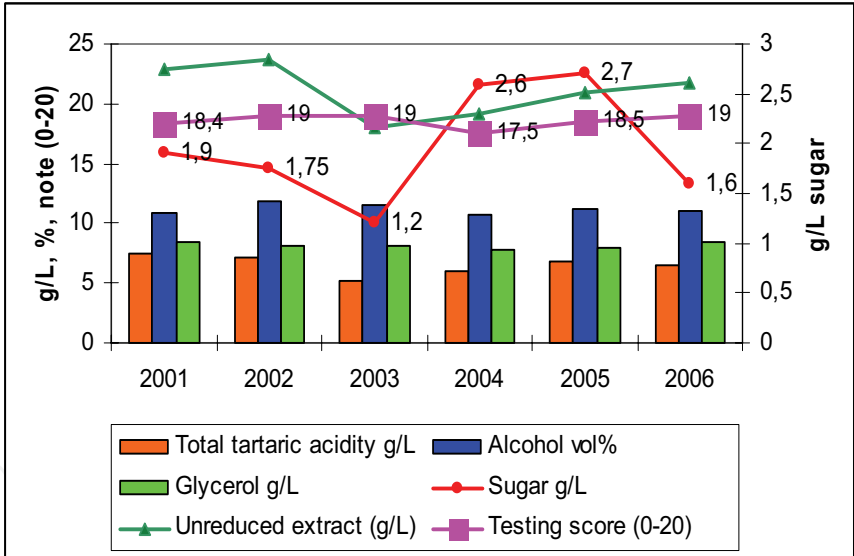


Fig. 4. The oenological potential of the wines obtained from Columnna variety

5. Conclusions

The yearly climatic condition represented mainly by thermal, lightening and hydro parameters specific for the vineyard biotope are directly related with growing and developing rate of plants, changing the active period of the these influencing the achievement of a constant and qualitative harvest (Jones, 2005, Stock, 2005).

The improved technology applied in the Columna plantation at Murfatlar proves to be not only ecologic, diminishing the number of interventions, putting the accent on a integrate scheme of the control of the health plants but also is economically profitable, the total annual costs being with 15-20% smaller.

Drip irrigation system is usefull mostly in the spring and early summer months for to supply the water needs of the vine plants in the intensive growth processes flourish, berry formation and growing).

6. References

- Baicu T., Savescu A. – *Sisteme de combatere integrata a bolilor si daunatorilor pe culturi*. Ed. Ceres, 1986.
- Baicu T. – *Principles of intedrated pest and disease management*. Ed. Ceres, Bucuresti, 1996.
- Condei G., Ciolacu, M., et.all. – L'approche ecologique du systeme entegre d'entretien du sol en plantations viticoles intensives. *III Symp. intern. sur la non-culture de la vigne et les autres techniques d'entretien des dols viticoles*, Montpellier, 1991, 289-296.
- Cotea V, Cotea V. – *Viticultura, ampelografie si oenologie*. Ed. Did. si Ped. Bucuresti, 1996.
- Davidescu D., Davidescu V. – *Agricultura biologica – o varianta pentru exploatarele mici si mijlocii*. Ed. Ceres, 1994.
- Dejeu L., Petrescu C., Chira A. – *Horticultura si protectia mediului*, Ed. Didactic si Pedagogica Bucuresti, 1997.
- Filip I. – Realizari ale combaterii moliei strugurilor in acord cu natura. *Combaterea integrata a buruienilor*, p/ 270-277, Constanta, 1994.
- Jones G. V., With M. A., Cooper O.R., Storchmann K., 2005 – Climate change and global wine quality. *Climatic Change* 73, 319-343.
- Olteanu I. si colab. – Influence of the integrated technological system under ecological control on some physiological and biochemical processes with impact on the viticultura yield. *Analele Univ. Bucuresti*, 2000.
- Ranca A. – Studii preliminare in modelarea dezvoltarii moliei strugurilor la Murfatlar, *Analele ICVV*, vol. XVI, 1998.
- Ranca A. - Key concerning vine breeding in the dryness conditions at the Murfatlar vineyard, *Analele Univ. Ovidius Constanta Seria Geografie Vol. II*, Univ. Ovidius Press., 2005
- Stock M., Gherstengarbe F. W., Karstschall T., Werner P. C., 2005 – Reliability of ClimateChange Impact Assessments for Viticulture. *Acta Horticulture*, 689, ISHS, 29-39.
- Tardea C, Dejeu L., 1995, *Viticultura*, Ed. Didactica si Pedagogica Bucuresti, 120-126.
- XXX, Production integree. *Bull. OILB*, 16, p.41-61, 1993.
- XXX, *Bull. IOBC* 23, 2000



Environmental Technologies

Edited by E. Burcu Ozkaraova Gungor

ISBN 978-3-902613-10-3

Hard cover, 268 pages

Publisher I-Tech Education and Publishing

Published online 01, January, 2008

Published in print edition January, 2008

This book on Environmental Technology takes a look at issues such as air, soil and noise pollution problems, environmental quality assessment, monitoring, modelling and risk assessment, environmental health impact assessment, environmental management and environmental technology development. It represents institutional arrangements, financial mechanisms and some sustainable technologies. The user can always count on finding both introductory material and more specific material based on national interests and problems. The user will also find ample references at the end of each chapter, if additional information is required. For additional questions or comments the user is encouraged to contact the author.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Aurora Ranca (2008). Improving the Grapevine Technology by Optimising the Utilisation of the Environmental Resources in the Murfatlar Vineyard, *Environmental Technologies*, E. Burcu Ozkaraova Gungor (Ed.), ISBN: 978-3-902613-10-3, InTech, Available from:
http://www.intechopen.com/books/environmental_technologies/improving_the_grapevine_technology_by_optimising_the_utilisation_of_the_environmental_resources_in_

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