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DETERMINATION OF THE POSSIBILITIES FOR BIOLOGICAL PRODUCTION OF GRAPES OF "MAVRUD" CULTIVAR, GROWN IN THE REGION OF NOVI IZVOR, MUNICIPALITY OF ASSENOVGRAD

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Abstract

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Experiments related to the possibilities for biological production of grapes of "Mavrud" cultivar in the region of Novi Izvor, Municipality of Assenovgrad, were carried out in the period 2006-2008.

It was determined that the terroir of the village of Novi Izvor is favourable for production of Mavrud cultivar. No heavy metals exceeding the allowable rates were found in the soil which shows that there is no industrial pollution of the air and the soil in the region. The condition of the grapes in both cultivation technologies was good. The percentage of rotted, moth-eaten and raisin-shaped berries was insignificant. There was not a large density of the grape cloth *Lobesia botrana* in the region and no damages were allowed due to the activity of the dispensers in the plantation. The grapes obtained under the biological technology have better condition for production of high-quality red wines compared with the conventional method of cultivation. The region of the village of Novi Izvor is suitable for biological production of grapes.

Key words: wine, biological, conventional, heavy metals, fruitfulness, pheromone wiles, dispensers

Introduction

The production of ecological grapes is an integral part of the development of the biological agriculture in Europe. Biological agriculture as a method of thinking and practice dates back to the first years of XX-th century with the application of various alternative methods of agricultural production, mainly in the countries of Northern Europe.

In the beginning of the 1990s the countries from the European Union adopted a common strategy and principles for the development of the biological agriculture, reflected in Decree No: 2092, adopted on 24th June 1991, which is a main document for regulation of this production throughout the entire European Union. The mandatory character of its regulatory measures guarantees the consumers quality of the foods obtained, processed and sold as biological (Karov et al., 2001).

The production of ecological grapes and wine is a

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topical issue of great importance for the economy of the country.

A National plan for development of biological agriculture in Bulgaria for the period 2006-2013 was developed. The strategic objectives of the plan include development of the market of biological products, scientific research directed towards practice, determination of an efficient system of control and certification as well as increase by 8% of the biologically cultivated agricultural land by 2013 (Bachvarova, 2006).

In Bulgaria biological vine-growing is still practiced on a small scale (Trifonova et al., 2002; Vachevska et al., 2007).

The objective of this study is to determine the possibilities for biological cultivation of grapes of Mavrud cultivar in the region of Novi Izvor, Municipality of Assenovgrad.

Materials and Methods

The research was carried out on vines of Mavrud cultivar, engrafted on rootstock Berlandieri x Riparia SO_2.

The plantations were located in the region of the village of Novi Izvor, District of Plovdiv. The vines were planted at a distance between the rows 3.20m and within the rows – 1.20m. The formulation is modified Moser. The age of the plantation is 15 years.

At pruning of the vines of Mavrud cultivar during the experimental period loading of 26 buds (13 internodes x 2 buds) and 24 buds (12 internodes x 2 buds) was provided during 2007-2008.

The scheme of the experimental work included the following elements:

- Climatic specification of the region of Novi Izvor. The information about the climatic indices was obtained from the Climatic guide of the Republic of Bulgaria.

- Soil specifications: geology, geomorphology and mechanical composition of the soil. All these indices were examined under the methods described in the Handbook of Soil Science (Totev et al., 1987).

- Chemical composition of the soil: organic matter content; pH, salt content, the main nutrients – under the methods described in the Handbook for exercises in Agrochemistry (Tomov et al., 1999), and the content of heavy metals, iron, lead, zinc, Cd, Cu, Mn with aqua regia with atomic adsorption spectrometry. The examinations of these indices were carried out in the laboratory of Agrochemistry and Soil Science and the Central scientific research laboratory at the Agrarian University of Plovdiv. The content of residual quantities of chororganic and phosphororganic compounds was determined under MEZERU HF at the Laboratory of Agroecology at the Agrarian University of Plovdiv.

- Presence of harmful nematodes – by means of counting after dispersal of the soil and subsequent wet sifting out.

- Fertility of the vines, the yield and the quality of the grapes were assessed under the methods described in the Ampelography with foundations of wine-production (Radulov et al., 1992).

- For determination of the availability of *Lobesia botrana* pheromone wiles were used and for the struggle against it – dispensers 1+2 BASF. Biological vine-growing was applied to part of the plantation measuring 3000 sq.m., in accordance with Decree No: 22/4th July 2001.

The other plantations were cultivated under the technology adopted by the agricultural workers.

The following treatment schemes were applied to both technologies of vine-growing (Scheme 1).

Results

The site is a terrain with slight to medium slope to the north-west. The altitude is 380 m. The soil is maroon, slightly to medium accumulated.

With respect to the climate the region belongs to the transitional-continental climatic area. The temperature regime is characterized by relatively hot summer and mild winter. The average January temperature is 1.5°C, the temperature in the hottest month July is 23°C and the average annual temperature is 12.6°C. The average maximum temperature measured in July is 38.6°C and the absolute maximum temperature is

Scheme 1
Preparations and number of treatments

Variants	Preparations	Number of treatments
	2006	
Biological	Bordolese solution 4% - only along the chains with 30 l solution per dca	1
	Bordolese solution 1% + Tiosol 0,8%	10
Conventional	Baifidan 0,01+B58 0.2+ Cosaid 0.18%	2
	Anvil 0.02% + Nurele 0.04% + Cosaid 0.18%	2
	Rubigant 0.02% + Nurele 0.04% + Champion 0.2%	1
	Anvil 0.02% + Nurele 0.04% + Champion 0.2%	2
	2007	
Biological	Bordolese solution 4% - only along the chains with 30 l solution per da	1
	Bordolese solution 1% + Tiovit 0.25%/da	7
Conventional	Baifidan 0.01 + Cosaid 0.15%/da	2
	Anvil 0.02% + Champion 0.15%/da	3
	Bordolese solution 1% + Tiovit 0.25%/da	1
	2008	
Biological	Bordolese solution 1% + Tiovit 0.18%/da	6
	Bordolese solution 1% + Tiovit 0.18% /da	1
Conventional	Baifidan 0.01% + Champion 0.20% /da	4
	Cumulus – 0.30% /da	1

*For each spraying 30 l of the relevant preparation were used for 1 000 sq.m.

Table 1
Content of some elements from the chemical composition of the soil

Indices		Values
1	Humus%	1.82%
2	Salt content %	traces
3	Reaction of the soil (pH)	7.53-7.81
4	Active carbonates, %	0.23-0.85
5	Lead, mg/kg	10.8
6	Cadmium, mg/kg	0.26
7	Zinc, mg/kg	25.8
8	Copper, mg/kg	47.3
9	Iron, mg/kg	2.52-3.25
10	Manganese, mg/kg	3.5-5.2
11	Nitrogen, totally absorbed, mg/kg	36.4
12	Phosphorus, mg/kg	96
13	Potassium, mg/kg	400

40.4°C. The lowest absolute-minimum temperature is measured in January -23.5°C. The last spring frost was formed between 11th April and 5th May and the first autumn frost – on 4th October. The temperature sum is 3931°C.

The average annual rainfall amount for many years' period is 615mm. The average annual index characterizes the region as moderately dry, dryness occurs mainly in August – September. The region belongs to the zone of the longest sunshine periods.

Typical of the region is that the soil, air and water are pure. There are not preconditions for industrial pollution anywhere in the region (Table 1).

The data from Table 1 show that the soils have slight to moderate humus content (1.82%), there is no accumulation of salts harmful to the vines. The content of the main nutrition elements nitrogen, phosphorus and potassium is insufficient. The quantity of heavy metals lead, cadmium, zinc, copper, manganese and iron is below the permissible levels. All this shows that the soils are suitable for biological vine-growing.

The content of active carbonates is below 1% and the reaction of the soil is slightly alkaline.

The Mavrud cultivar is distinguished for comparatively low content of fruitfulness (Table 2).

The average number of grapes on one cane for the period 2006 – 2008 is 0.72-0.73 for the biological and conventional plantations respectively. When 12-13 internodes were loaded on two buds 14.68 to 15.00 clusters per vine on average were obtained

Table 2

Quantitative modifications of the index values, characterizing the actual fertility of the vines of Mavrud cultivar

Variations	Years	Q Fruitfulness	Q / one fruit-bearing shoot	Developed buds, %	Fruitful shoots, %	Average number of inflorescences per vine
1. Mavrud-biological	2006	0.85	1.4	71.8	60.5	14.24
	2007	0.74	1.26	65.4	50.2	14.3
	2008	0.57	1.4	70.6	55.4	15.5
	Average	0.72	1.35	69.3	55.4	14.68
2. Mavrud-conventional	2006	0.87	1.5	66.4	59.5	14.24
	2007	0.78	1.28	65.5	60.7	15.9
	2008	0.54	1.28	71.8	52.2	14.8
	Average	0.73	1.35	67.9	57.5	15

Table 3

Research on the size of the cluster, the mass and largeness of the berries

Variations	Year	Cluster size, cm		Average mass per 100 berries, g	Size of the berries, mm	
		Length, cm	Width, cm		Length, cm	Width, cm
Mavrud-biological	2006	16.3	11.5	166.81	15.5	14.2
	2007	17.8	12.3	169.41	13.5	12.3
	2008	16.4	10.7	180	15.2	14.4
	Average	16.8	11.5	172	14.7	13.6
Mavrud-conventional	2006	17.1	10.9	165.5	15.2	14.5
	2007	17.5	12.5	159.4	12.4	12.1
	2008	16.6	10.9	177	15.2	14.5
	Average	17.1	11.4	167.3	14.3	13.7

Table 4
Mechanical analysis of the grapes

Variants	Year	Clusters %	Berries %	Rotted %	Damaged %	Raisin-shaped %	Hails-torm %	Moth %	Flesh %	Skin %	Seeds %
Mavrud-biological	2006	4.05	86.7	7	1.84	0.01	0	0.4	88	8.2	3.8
	2007	3.53	88.92	6.72	0.67	0.16	0	0	89.14	7.09	3.77
	2008	3.46	92.71	0.7	0.35	2.78	0	0	88.84	7.65	3.51
	Average	3.68	89.45	4.81	0.95	0.98	0	0.13	88.7	7.6	3.7
Mavrud-conventional	2006	4.31	88.25	1.47	0.6	0	0	5.37	87.9	8.8	3.3
	2007	3.32	89.83	5.38	0.63	0.84	0	0	88.18	7.45	4.37
	2008	3.6	88.15	2.6	0.1	5.55	0	0	89.18	7.42	3.4
	Average	3.74	88.75	3.15	0.44	2.13	0	1.79	88.4	7.9	3.7

Table 5
Quantitative modifications in the yield and quality of the grapes

Variants	Year	Number of clusters per vine	Average mass per 1 cluster, kg	Yield from 1 vine, kg	Yield from 1da, kg	Yield from 1 ha, kg	Sugars, %	Titratable acids, g/dm^3
	2006	13.2	0.361	4.765	1115	11150	22.6	7.1
	2007	12.9	0.351	4.528	1059	10590	22.2	6.75
Biological	2008	15.5	0.299	4.653	1085	10850	23.8	6.62
	Average	13.9a	0.337a	4.642a	1086a	10863a	22.8a	6.82a
	2006	14.8	0.366	5.461	1267	12670	22.9	7.9
	2007	15.9	0.356	5.660	1324	13240	22.6	7.4
Conventional	2008	14.8	0.31	4.588	1074	10740	22.8	6.54
	Average	15.1a	0.344a	5.221a	1221a	12216a	22.2a	7.28a
GD-95%		4.64	0.009	1.47	344.7	3446	2.11	1.16
GD-99%		10.7	0.02	3.39	795.1	7950	4.87	2.69
GD-99.9%		34.08	0.063	10.81	931.2	9312	15.51	8.58

*a,b,c – Burden of proof under Fisher's method

during the three-year experimental period.

The output of grapes is influenced not only by the number of clusters but also by the average mass of the cluster and berries (Tables 3 and 4).

The data in Table 3 shows that there is not a significant difference in the size of the clusters and berries between the two technologies of cultivation (Table 3).

A very good idea about the quality of the grapes is obtained from the data in Table 4. They show that there is not a considerable difference in the condition of the grapes obtained under the biological or the conventional technology. The data in Table 4 are also very indicative for presence of damages caused by *Lobesia botrana*. On average for the three-year period 0.13% damages were discovered in the biologically cultivated vines and 1.79% in the conventionally cultivated vines. These damages were ascertained in 2005 prior to

Table 6
Content of heavy metals in the grapes, mg/kg

Cultivar	Year	Copper	Zinc	Iron	Manganese	Cadmium	Lead
Mavrud biological	2006	2.88	0.57	1.93	0.68	Below 0.01	0.13
	2007	2.4	0.39	1.72	0.69	Below 0.01	0.072
	2008	2	0.52	1.6	0.55	Below 0.01	0.2
Mavrud conventional	2006	2.68	0.6	2	0.78	Below 0.01	0.135
	2007	1.6	1	1.68	0.72	Below 0.01	0.1
	2008	1.1	0.47	0.95	0.37	Below 0.01	0.2

Table 7
Content of the residual quantities of pesticides in the grapes

Cultivar	Year	Phenarimol	Chlorpy-riphos	Ziper-metrin	Triadi-mephon	Σά,β,γ,δ,ε – HCH	Σ2,4'-DDD; 4.4' – DDD; 2.4'-DDE; 4.4'-DDE; 2.4'-DDT; 4.4'-DDT; Aldrin; Dieldrin
Biological	2006	0.151 ±0.019	0.012± 0.002	Below 0.01	0.028 ±0.004	Below 0.01	Below 0.01
	2007	0.071 ±0.009	Below 0.01	Below 0.01	Below 0.01	Below 0.01	Below 0.01
	2008	Below 0.01	Below 0.01	Below 0.01	Below 0.01	Below 0.01	Below 0.01
Conventional	2006	0.056± 0.007	0.017± 0.002	Below 0.01	Below 0.01	Below 0.01	Below 0.01
	2007	0.34 ±0.004	Below 0.01	Below 0.01	0.012± 0.002	Below 0.01	Below 0.01
	2008	Below 0.01	Below 0.01	Below 0.01	Below 0.01	Below 0.01	Below 0.01

positioning dispensers. The percentages of berries damaged by mildew and such turned into raisins were insignificant. It is worth noting that the condition of the grapes was comparatively good (Table 5).

The yield from one vine and per 1000 m^2 was 12.3% higher in the conventionally cultivated vines, compared with the biologically cultivated ones. In 2008 this resulted from the applied fertilizers to the vines with nitrogen and phosphorus fertilizers – 40 kg super phosphate, 20 kg potassium sulfate and 10 kg magnesium sulfate.

As for the content of sugars and acids in the grapes, there is a tendency to increase in the sugar content and reduction of the acids in the biologically cultivated vines, compared with the conventionally grown ones. In both technologies the condition of the grapes is favorable for the production of high quality red wines. But neither of the indices in Table 5 has proven differences between both technologies of vine-growing.

The heavy metal content in the grapes is below the allowable levels (Table 6) and the grapes are pure and suitable for wine production.

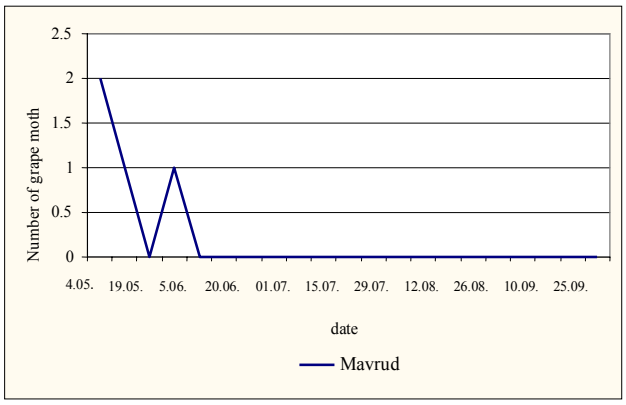

Fig.1a. Population dynamic of *Lobesia botrana* in the region of Novi Izvor in 2006

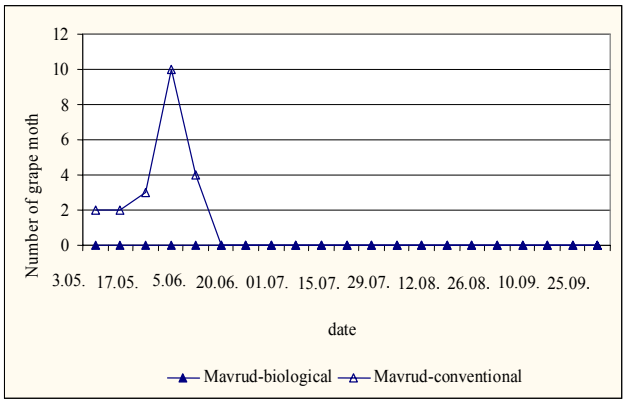

Fig. 1b. Population dynamic of *Lobesia botrana* in the region of Novi Izvor in 2007

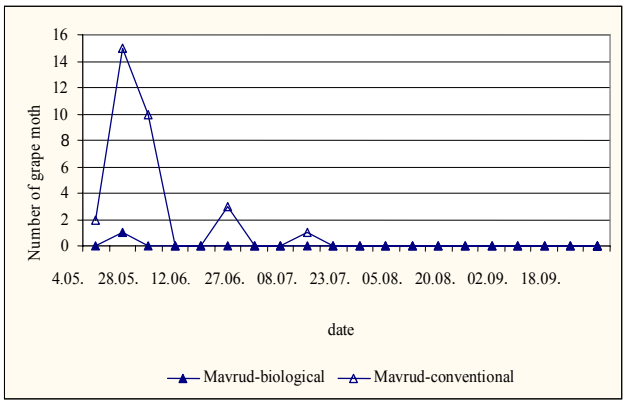

Fig. 1c. Population dynamic of *Lobesia botrana* in the region of Novi Izvor in 2008

The content of the residual pesticides in the grapes is also below the permissible levels (Table 7).

The good condition of the grapes in both technologies of cultivation is also due to the effective action of the dispensers, RAC 1+2 of BASF (Figure 1 a, b, c).

Conclusions

The obtained results from the experiments for the possibility for biological cultivation of grape of Mavrud cultivar in the region of Novi Izvor, Municipality of Assenovgrad, allow drawing of the following main conclusions:

- The terroir of the village of Novi Izvor is favourable for the cultivation of Mavrud cultivar.
- No heavy metals were found in quantities exceeding the permissible levels, which show that there is no industrial pollution of the air and the soil in the region.
- The condition of the grapes in both technologies of cultivation is good. The percentage of rotted, moth-damaged and raisin-like berries is insignificant. There is not big density of *Lobesia botrana* and damages are avoided due to the positioned dispensers.
- The grapes obtained under the biological technology are better for production of high-quality red wines in comparison to the conventional cultivation.
- The region of Novi Izvor is suitable for biological cultivation of grapes.

References

Bachvarova, Sv., 2006. The share of bioproduction will increase by 8% for 8 years. Newspaper "*Thracian agronews*", 28.09-4.10.

Decree No 22 of 4th July of the Ministry of Agriculture and Forestry(2001). About the biological production of plants, plant products and foods of vegetable origin and its designation upon them. *Official Journal* No: 68; Sofia, (Bg).

Karov, St., V. Popov and P. Paraskevov, 2001. Introduction to biological agriculture and opportunities for development in Bulgaria. A collection of lectures, Agrarian University – Plovdiv, Bulgaria, (Bg).

Mokreva, T. and G. Murgova, 1998. Programme for dispersion analysis for data processing from field experiments. Higher Institute of Agriculture – Plovdiv, Research work, XXIII, Book 1, pp. 135-139 (Bg).

National Plan for Development of the Biological Agriculture in Bulgaria for the Period 2006-2013; Sofia 2006, (Bg).

Tomov, T., G. Rachovski, Tsv. Kostadinova and Iv. Manolov, 1999. Guidelines for Exercises in Agrochemistry. Agrarian Institute of the Agrarian University – Plovdiv, (Bg).

Trifonova, H., M. Todorova, T. Yoncheva and P. Atanasov, 2002. First results from the study of the opportunities for production of ecologically pure grapes and wine. Collection "Jubilee scientific session – 100 years of the Institute of Vine-Growing and Wine-Production", SPS PRINT, Sofia, pp. 344-349 (Bg).

Totev, T., P. Gribachev, Hr. Nechev and N. Artinova, 1991. Guidelines for Exercises in Soil Science, *Zemizdat,* Sofia, 124 pp. (Bg).

Vachevska, D., V. Dimitrov and I. Simeonov, 2007. Biological Production of Grapes and Wine–Condition, Tendencies, Possibility for Development in Bulgaria. A Collection of Reports Read in a Scientific Conference, 29-30th August, Pleven, pp. 256-264 (Bg).

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