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Original Article

Influence of preparations Biolan and Vympel for the crop and quality of grapes and wine from varieties Aligote and Rkatsiteli

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Abstract

High-quality white wines with better sensory and physicochemical attributes can be produced from grapes treated by Biolan and Vympel preparations. The yield of grapes was increased by 18-25%. Using the preparation Biolan, which has an endogenous origin, the mass concentration of sugars in the juice of berries of grape varieties Aligote and Rkatsiteli increased by 10.2-15.2%, respectively, and were higher than the control. During the analysis of the physicochemical composition of the must, it was found that the grapes processed with Biolan and Vympel preparations differed in the indices necessary for the production of high-quality white table wines. The sensory evaluation showed that the wine materials from the grapes treated with the endogenous preparation Biolan were characterized by higher quality characteristics; score of the tasting was 7.8 and 7.9 against 7.6 of the control, respectively, according to the Aligote and Rkatsiteli varieties.

Keywords: wine, Biolan, Vympel, Aligote, Rkatsiteli, quality

1. Introduction

Ukraine has a great potential for wine production, which can reflect a special unique style of wine. Statistics of consumption of wine is a clear indicator of the trend, because they are a key segment of the modern world wine market (Cantín, Fidelibus, & Crisosto, 2007). The market moves to diversity, because it is the main factor in determining the scope of consumer preferences in varieties and styles of wine. The world production of grapes has continued to increase, despite the reduction of areas occupied by vineyards. Ukraine is one of the few countries that are between the 46th and 47th degree of northern latitude, that is, on one par with the most famous wine regions in France. Therefore, it is possible to produce high quality wines from Ukrainian grapes, which might be appreciated all over the world.

Currently, about 40% of agricultural products are polluted by toxic substances in Ukraine (Dubinina, 2012). The task of modern production is obtaining high-quality food with less anthropogenic impact on the environment. One of the ways to increase the production of eco-friendly goods is the use of biologically active substances. In recent years, plant growth regulators in the world have a real boom. It is forecasted that by 2018 the growth of the biostimulator market will reach 2,241 million USA dollars (Шаповал, Можарова, & Коршунов, 2014). Their use is associated with a real revolution in biology, chemistry, biotechnology, which allowed creating fundamentally new highly effective plant growth regulators, as well as their organic origin and ecological compatibility (Tuchy, Chowańska, & Chojnacka, 2013). Numerous studies indicate that the use of growth regulators contributes to higher yields, quality and plant resistance to the effects of extreme environmental conditions (Cantín *et al.*, 2007; Poudel, Kataoka, & Mochioka, 2008; Symons, 2005; Zoffoli, Latorre, & Naranjo, 2009).

The list of chemical preparations that can change the intensity of the physiological processes of plants in the direction of improving the economic valuable traits or obtaining the characteristics desired by the practice is constantly being replenished (Jeong, Kong, Seon, & Kee, 2006). In

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addition, the intensive development of organic farming requires the use of the new effective drugs that, first of all, will agree with safety requirements. The advantages of the new generation products are ecological cleanliness, safety for humans, high degree of decay for a short period (Jeong *et al.*, 2006). In this connection, ecologically harmless physiologically active compounds, possessing a wide range of positive properties deserve attention. The main aim of current study was to determine influence of endogenous growth regulators Biolan and Vympel of the domestic producer on the quality of grapes and wine materials of classic white varieties Aligote and Rkatsiteli.

2. Materials and Methods

2.1 Materials

In order to protect the crop from undesirable results associated with influencing of different pests preparations of Ukrainian production Biolan and Vympel were used at the vine plantations of Aligote and Rkatsiteli in the Artsz district of the Odessa region in 2015. These cultivars are typical grape varieties, which are used mainly for making white table wines in Ukraine, ones of the best in the Commonwealth of Independent States (CIS). Biostimulator Biolan is a product of biotechnological cultivation on the root system of ginseng fungi-micromycetes. It includes a balanced mixture of free fatty acids, chitosan, oligosaccharides, phytohormones, amino acids, biogenic microelements (Na, Mg, Ca, K, Cu, Fe) and vitamins. Biolan provides the accelerated cell division, the development of the root system, the increase in the leaf surface and the chlorophyll content, reduces the phytotoxic effect of pesticides, and has an antimutagenic effect. The preparation Biolan also actively reduces the phytotoxic effect of pesticides, significantly improves the quality of the products obtained, increases resistance to stress factors (natural or anthropogenic), increases the effect of pesticides, activates immunity and the "resistance gene," protects plants from phytophagous and phytonematode insects, from diseases associated with fungi-phytopathogens, will increase yield. Biolan was awarded the "Organik" certificate as a preparation of organic origin. Producer is ISTC Agrobiotech, Kiev, Ukraine.

Vympel is a complex synthetic preparation of contact-system action. It consists of polyethylene oxides (PEO - 1500 - 54% and PEO - 400 - 23%) and salts of humic acids. Low-molecular-weight polyethylene oxides easily penetrate into tissues, performing the function of a transport agent, they structure free intracellular water, increase its biological activity, accelerate growth processes and photosynthesis; Regulate transpiration and the intensity of mineral nutrition. The combined effect of the two polymers increases the osmotic pressure directed inside the cell; changes protein metabolism, expressed in the synthesis of stress proteins, as well as in increasing the amount of sugars in the plant. These changes make the plant organism more resistant to unfavorable environmental factors, plants better tolerate elevated and lower temperatures, as well as stress after treatment with pesticides. Decomposition products of polyethylene oxides - ethanolamines are elements of plant cell nutrition. Producer is Agromir, Krivoi Rog, Ukraine.

2.2 Preparing of preparations

The scheme of research provided the following options: 1 - control (water treatment); 2 - treatment with Biolan (usage rate is 15 ml per 10 liters of water); 3 - treatment with Vympel (usage rate is 20 ml per 10 liters of water). The treatment was studied in three terms: before flowering, during the growth of berries, and at the beginning of ripening of berries. Formation of shrubs is single-sided cordon and planting scheme is 3.00 x 1.25 m.

2.3 Terms

Processing for the Aligote variety was carried out: I – 06.06.2015, II – 14.07.2015, III-07.08.2015; for the variety Rkatsiteli - I – 22.05. 2015, II - 26.06. 2015, III - 24.08. 2015. Harvesting of the Aligote variety was carried out on 10.09.2015 and Rkatsiteli – 02.10.2015. The aforementioned dates were chosen according to stages of variety growing in Ukrainian vineyards:

I. Bloom that is characterized by scarce energy and plastic substances, which at the same time should be used to lay embryonic inflorescences.

II. In the third phase, the grape plant consumes the greatest amount of nutrients necessary for the continued growth of shoots, leaves, antennae, kidneys and roots, and especially for flowering, fertilization and development of berries.

III. During the fifth phase, which is characterized by the beginning of the ripening of berries in leaves, organic substances are most intensively produced, which go to ripening berries and partly to maturation of shoots and the structure of the upper young leaves, the increase in the size of the year is mainly due to the stretching of cells, the sugar content in berries begins to increase rapidly, and the amount of acid decreases. At this time, other chemical changes are observed in berries and the amount of tannins decreases and the amount of coloring substances increases, the content of nitrogenous substances increases, and the content of starch increases in the crests and legs of berries.

2.4 Chemical methods

Methods of determining parameters of grapes and wines were used such as the leaf surface and one-year increment, weighting method of counting the crop with counting grapes; mass concentration of sugars (State Standard 27198-97, 1987) and titratable acids in juice of berries and as well as chemical and organoleptic analyzes of wine materials.

2.5 Sensory analysis

On January 20, 2016, in the production laboratory of the Izmaili Winery's, wine tasting was conducted on a 10-point wine quality system with the following maximum scores: transparency - 0.5; Color - 0,5; Aroma - 3.0; Taste - 5,0; Typicality is 1.0. The tasting commission consisted of seven judges, including the chief winemaker of the winery and the leading specialists of the enterprise - the technologist of the 1st category, the head of the primary processing shop, the laboratory manager, the chemist, and the microbiologist.

2.6 Statistical data

The final statistical indicator in the methodology of variance analysis is the least significant difference (LSD). With the help of the LSD, the essentiality of the differences between the variants of the experiment was calculated.

3. Results and Discussion

The carried out experiments on the vine plantations of the Aligote and Rkatsiteli varieties shown a significant influence of the endogenous preparations Biolan and Vympel on the yield and quality of grapes and wine. The increase of the mass of bunches under the influence of the use of preparations led to a higher yield of the experimental variants, and the qualitative indicators of grapes and wine also were improved that are agree with another investigations Pasqua *et al.* (2005).

During the analysis of the physicochemical composition of musts, it was found that the grape treated with Biolan and Vympel preparations differed in the parameters that are necessary for the production of high-quality white table wines.

The highest yield from the grape bush of Aligote variety was obtained with the use of the Biolan preparation. Productivity, in this version increased by 1.4 tons or by 22% more control. When using the Vympel preparation, the harvest from the bush was 2.83 kg, which are 0.44 kg/bush more compared to the control. The yield was 7.56 ton/ha, which is 1.19 ton or 18.7% more than control sample (Table 1). The yield from the bush of Rkatsiteli when using the Biolan preparation was 4.07 kg, which is 0.85 kg more and the yield increased by 26.3% more than control variant. When using Vympel, the yield from the bush increased by 0.82 kg/bush more than in the control; the yield increased by 25.5% more control (Table 1).

The accumulation of sugars in grapes has great technological importance. According to this indicator, as a rule, the timing of the collection of grapes is determined, and also the volume fraction of alcohol in the future wine materials is predicted. The minimum sugar content in accordance with State standard of Ukraine (Ukrainian Scientific-Research and Training Center of Issues of Standardization, Certification and Quality, 2009) for white grape varieties should be at least 16.0 g/100 cm3. The obtained prototypes corresponded to the requirements of this normative document.

The mass concentration of sugars in the juice of Aligote berries when using Biolan and Vympel preparations increased, by 18.8 and 12.7 g/dm3, respectively, that was higher than the control sample. The difference in the variants of the experiment is mathematically proved by LSD05 = 8.6 g/dm3 (Table 1). The biggest mass concentration of sugars in the juice of Rkatsiteli berries was noted with the use of Biolan, counting 29.5 g/dm3 that were more than control variant. When using Vympel, the mass concentration of sugars increased to 18.7 g/dm3. The difference in the variants of the experiment is mathematically proven by LSD05 = 9.4 g/dm3 (Table 1).

The optimal concentration of titrated acidity for white grape varieties is in the range of 6.0-10.0 g/dm3. Later, during the wine material processing, the concentration of acids affects the composition of the flavor and taste of the finished product. The acidity of Aligote variety in the experimental variants was 7.8 g/dm3 using the Biolan preparation, which is 1.4 g/dm3 below than control and 8.0 g/dm3, which is 0.9 g/dm3 below than control using of Vympel (Table 1).

The process of alcoholic fermentation is accompanied by many biochemical reactions, as a result of which various substances are formed. The specificity of these reactions is due to the presence in the enzyme systems, which determine the course and direction of biochemical processes during fermentation. An important role in the formation of the quality of wine belongs to the main fermentation product - ethyl alcohol, as well as secondary and by-products of fermentation.

The volume fraction of ethyl alcohol of Aligote wine in the version using Biolan was 11.78%, which is 1.07% more than control. Using Vympel, the volume fraction of ethyl alcohol was 11.44%, which is 0.73% more control (Table 2). The content of ethyl alcohol of the Rkatsiteli wine was within the limits of 12.83 and 12.21%, which is 1.71 and 1.09% more than the control sample in the experimental variants, using of Biolan and Vympel preparations respectively. The volume fraction of ethyl alcohol of wine control variant was 11.12% v/v. For white table wines, oxidation tones and roughness in taste are unacceptable. They should have a straw-yellow or straw-green color, well-pronounced varietal or floral fragrance and a tender taste with pleasant acidity.

The experimental samples of Aligote wine material were characterized by a lower index of active acidity. Using Biolan, the pH was 3.2, while pH of wine made from grapes treated by Vympel showed 3.3. Compared with the control sample, this indicator is higher by almost 8%. Wines obtained from processed grapes are potentially less susceptible to

Table 1. Harvest and quality of grape varieties Aligote and Rkatsiteli under the influence of the use of preparations Vympel and Biolan.

Sample	Varieties	Bunch mass, g	harvest from a bush, kg	Yield		Sugar content of grape berries, g/l	Titratable acidity of grape berries, g/l
				ton/ha	%		
Control	Aligote	110.5	2.39	6.37	100.0	184.6	8.9
	Rkatsiteli	142.6	3.22	8.59	100.0	191.8	8.5
Biolan	Aligote	132.4	2.91	7.77	122.0	203.4	7.8
	Rkatsiteli	176.3	4.07	10.85	126.3	221.3	7.3
Vympel	Aligote	129.7	2.83	7.56	118.7	197.3	8.0
	Rkatsiteli	167.1	4.04	10.78	125.5	210.5	7.8
LSD_{05}		8.3				8.6	

Table 2. Chemical indicators of white table wine materials from Aligote and Rkatsiteli grape varieties.

Variant	Variety	Alcohol , % v/v	Mass concentration						pH
			Sugar content, g/dm³	Titratableacidity, g/dm³	Volatile acidity, g/dm³	Iron content, mg/dm³	Total sulfur content , mg/dm³	Phenolic compounds, mg/dm³	
Control	Aligote	10.71	2.0	9.0	0.56	7.2	89.5	256	3.5
	Rkatsiteli	11.12	2.2	8.6	0.47	8.5	86.9	305	3.7
Biolan	Aligote	11.78	1.6	8.1	0.48	6.5	88.6	384	3.2
	Rkatsiteli	12.83	1.5	7.5	0.36	8.0	83.4	396	3.4
Vympel	Aligote	11.44	1.8	8.3	0.52	7.0	88.9	371	3.3
	Rkatsiteli	12.21	1.7	7.9	0.42	8.2	85.7	368	3.5

oxidation and are resistant to opacity (Table 2). A similar tendency was observed in wine-materials according to the Rkatsiteli cultivar: when using Biolan and Vympel preparations, the pH was in the range 3,4-4,5 versus the control sample had pH =3.7 (Table 2).

The quantity of volatile acids, the main representative of which is acetic acid, was at the same level in all wine materials, which indicates the correct passage of the technological process for the preparation of wines. The content of iron in white table wines according to State standard of Ukraine 4806 (2007) should not exceed 15 mg/dm3. This indicator in all variants of the experiment was within the regulatory limits (Table 2). Phenolic compounds form the sensory qualities of grapes and wines. They as well as the products of their transformation, affect the taste, color and transparency of the wine. Phenolic compounds are actively involved in processes occurring at all stages of wine production, in particular in oxidation-reduction reactions, with nitrogenous substances, aldehydes. The total content of phenolic substances of Aligote grapes during the use of the Biolan preparation was the highest; it increased by 128 mg/dm3 and by 115 mg/dm3using Vympelcompared to the control sample (Table 2). The highest total content of phenolic substances of Rkatsiteli was noted with the Biolan preparation, it was 396 mg/dm3, which is 91 mg/dm3 and by 63 mg/dm3 using Vympel that are more than the control sample (Table 2).

One of the first basic characteristics in sensory analysis is wine color. The color of wine is characterized by the content and ratio of mono- and polymeric forms of phenolic substances, the amount of which depends on the stage of maturity of the grapes and the conditions for its processing. We can assume that the color saturation and the reduction of its shades are largely due to climatic factors of the research period, which is connected with the redistribution of the phenolic complex towards to the accumulation of oxidized forms that cause an increase of the color intensity. Samples of Aligote wine materials differed in saturated light straw color. Wine samples of Rkatsiteli variety had a more golden color.

The aroma of wine is a complex of substances, consisting of essential oils of grapes, and compounds arising during fermentation and aging of wine. The sample of wine material from Aligote variety, where the processing of grapes by preparation Biolan was used was distinguished by a pleasant delicate varietal aroma with floral tones, the taste is light, pleasant, and varietal with light bitter taste. This sample received the highest tasting score – 7.9 points against 7.6 of the control sample. With the use of Vympel, the sample is rated at 7.8 points, characterized by clear, well-expressed herbaceous-floral varietal flavor, but the taste was light tannin and it had short aftertaste. The highest tasting evaluation of Rkatsiteli was also observed in a sample where the treatment of grapes with using Biolan. The wine had a harmonious light floral fragrance with notes of apricot, the taste was pleasant. With the use of the Vympel preparation for grapes, the sample had a slight smell of moist wood, which did not spoil the overall good impression, taste with piquant sourness, light astringency. The sample was estimated at 7.8 points. The control sample had score of 7.6 points.

4. Conclusions

Using preparations Biolan and Vympel for Aligote and Rkatsiteli the high quality of grapes and obtained wines were reached. Also better scores of tastings were marked for white wines which have been produced from grapes with growth regulators. Data analysis especially the LSD showed the essentiality of the differences between the variants of the experiment that have been occurred in Ukrainian vineyards.

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