UDC 634.8:631.531.1:547.56:663.21

QUALITY PARAMETERS OF WINE GRAPE VARIETIES UNDER THE INFLUENCE OF DIFFERENT VINE SPACING AND TRAINING SYSTEMS

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Abstract. Physicochemical and biochemical indices, which characterize quality of white wine grape varieties Zagrey and Aromatnyi of selection of NNC «IV&W named after V. Ye. Tairov», (harvest of 2016) were determined. The field trial which includes various variants of planting density and vine training systems, made it possible to study the influence of viticulture practices on the criteria of carbohydrate-acid and phenolic complex, oxidative enzyme system of grapes.

Low-density plantings of Aromatnyi variety (2222 vines per ha) were characterized by harvest that slightly exceeded the grapes obtained from dense plantations (4000 vines per ha) in terms of carbohydrate-acid and phenolic complexes. The most optimal in terms of the mass concentration of sugars, phenolic substances, polymer forms, macerating ability of must, activity of oxidizing enzyme system was cultivation of this variety on a 160 cm – high trunk. Growing grapes of Zagrey variety with vine spacing, corresponding to 4000 plants per ha, contributed to obtaining harvest with optimal parameters of carbohydrate-acid complex, low technological reserve and mass concentration of phenolic compounds, moderate macerating ability and activity of monophenol monooxygenase in must. Training vines of this variety on a 40 cm high trunk with vertical shoot positioning led to significant deterioration of grape quality due to increased content of phenolic substances and their polymer forms, high macerating capacity of must.

Key words: planting scheme, training system, carbohydrate-acid complex, phenolic complex, oxidative properties, grapes

ПОКАЗНИКИ ЯКОСТІ ТЕХНІЧНИХ СОРТІВ ВИНОГРАДУ ПРИ РІЗНИХ СХЕМАХ САДІННЯ ТА СИСТЕМАХ ФОРМУВАННЯ КУЩІВ

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Анотація. Визначено фізико-хімічні та біохімічні показники, що характеризують якість білих технічних сортів винограду Загрей і Ароматний селекції ННЦ «ІВіВ їм. В. Є. Таїрова» врожаю 2016 р. Польовий дослід, що включає різні варіанти схем посадки і систем формування кущів, дозволив вивчити вплив агротехнологічних прийомів на критерії вуглеводно-кислотного та фенольного комплексу, окиснювальної ферментної системи винограду.

Рідкі насадження сорту Ароматний (2222 кущів на 1 га) характеризувалися урожаєм, що перевищував за показниками вуглеводно-кислотного та фенольного комплексу виноград, отриманий на густих насадженнях (4000 кущів на га). Найбільш оптимальним за величиною масової концентрації цукрів, фенольних речовин, полімерних форм, мацеруючої здатності сусла, окиснювальної активності ферментної системи винограду виявилось вирощування кущів цього сорту на штамбі висотою 160 см. Вирощування кущів винограду сорту Загрей за схемою посадки, що відповідає 4000 рослин на 1 га, сприяло отриманню врожаю з оптимальними показниками вуглеводно-кислотного комплексу, низьким значенням технологічного запасу і масової концентрації фенольних речовин, помірною мацеруючою здатністю і активністю монофенолмонооксигенази сусла. Формування кущів даного сорту на штамбі висотою 40 см з вертикальним веденням приросту зумовлювало значне погіршення якості винограду за рахунок підвищеного вмісту фенольних речовин та їхніх полімерних форм, високої мацеруючої здатності сусла.

Ключові слова: схема садіння, система формування, вуглеводно-кислотний комплекс, фенольний комплекс, окиснювальні властивості, виноград.

DOI: http://dx.doi.org/10.15673/fst.v11i2.512

Introduction. Formulation of the problem

The main task of modern viticulture is to find the optimal balance between yields and quality of grapes. This balance, largely determined by the size of leaf area and the crop load of vines, is based on fundamental relationship between «sources» and «sinks» of energy and organic carbon [1].

In each specific case, for terrains and grape varieties, the technology of growing on a trellis allows determining a certain amount of leaf surface and yield. It is possible due to changes in structure of vineyards, representing location of plants on the site and architecture of vines – the number and positioning of shoots and leaves in trellis space [1,2].

However, in Ukraine, standard approach to viticulture practices is mainly implemented without taking into account technological potential of varieties. This fact is often the reason for production of low quality wines.

Literature review

Leaves of vines provide the flow of photosynthetic reactions – the most important physiological function of plants. The grapevine uses for photosynthesis a part of the light spectrum with a wavelength of 400 – 700 nm (photosynthetically active radiation, FAR), which corresponds to the region of visible radiation. In vine canopies, synthetic processes are carried out mainly by external leaves, which absorb up to 90 % of FAR, reflecting or missing only 10 %. As the number of foliage layers inside canopy increases, the effect of mutual shading also increases. This is the reason, why quantity of FAR inside canopy space can decrease to 1 % of the surface value [3-7].

The ratio between external leaf area and area of leaves inside the canopy determines carbon balance of vines. Assimilation of carbon dioxide by shaded leaves practically does not occur; vine does not effectively consume carbohydrates to maintain vital activity of such leaves. As a result, the influx of photosynthates to clusters decreases, which negatively affects quantity and quality of yield [3,4,7].

Scientific and practical experience shows that the inhomogeneous radiation microclimate of canopies with a large number of internal foliage layers causes deterioration of grape quality. It can be described by decrease in mass concentrations of sugars, phenolic substances and anthocyanins, tartaric acid, monoterpenes, an increase of pH, mass concentrations of potassium, malic acid and the ratio of malic to tartaric acid content, methoxypyrazines. Wines, obtained from such grapes, are characterized by weak varietal characteristics of aroma and taste, predominance of «plant» and «grassy» tones in aroma texture [4,7].

One of ways to improve grape quality is the implementation of viticulture practices to provide maximum sun exposure of entire leaf area per vine, per ha and increase photosynthetic potential of vineyards.

In terms of light microclimate, training systems of vine are of prime importance, determining position of shoots and perennial wood in the trellis plane, shape and density of canopies, size of exposed leaf area [4,5,7].

On industrial vineyards of Ukraine, plants are grown mainly on 80 cm – high trunk with vertical shoot positioning in the trellis plane. The most common planting scheme involves row spacing at a distance of 3 m and vines – 1,5 m. The rationale for this configuration of plantations lies not in the biology of grape plant, but in the technical support of viticulture. In most cases, this contributes to high vigor of vines with dense canopies; there are more than 60 % of leaves in zone of permanent shading [2,10].

An increase in the number of plants per unit area makes it possible to create smaller forms, reduce crop load by the elements of fruiting. Based on calculations, presented in the work of Australian researchers, with the same shoot load per area unit, distance between them will be higher with narrower row spacing, which is the reason for lower density of the crown, better sun exposure of leaves. Lower yield per vine of high-dense plantations is compensated by higher yield per unit of planted area [7,9].

Increasing density of plantations by the number of trellis rows raises total length of the canopy and exposed leaf area. For training vines with vertical shoot positioning in a single-plane trellis, optimum distance between rows for absorbing solar radiation corresponds to the height of vine canopy. Under such conditions, the area of -foliage, exposed to the sunlight, reaches 18000 – 21000 m^2/ha. For example, in some European countries, viticulture laws regulate the ratio between canopy height and inter-row distance, that should not exceed 0,6 – 0,8. Most of Ukrainian vineyards, providing canopy height of 1,2 m and distance between rows of 3 m, are characterized by the value in range 0,4 – 0,45. Exposed leaf area does not exceed 8500 m^2/ha [2,8,11].

Introduction to viticulture practices of high-trunk (120 – 160 cm) forms with free shoot positioning is promising, since it allows changing the light microclimate of vine. Free positioning of shoots excludes mutual shadowing of the leaves; there are only 25 –30 % of leaves in the zone of permanent shading. Increase of vine feeding area (3 m between rows and 1 – 1,5 m between plants) causes developing of strongly vigorous and high-yielding vines. Free shoot positioning, occupying a large volume of space, allows making increased shoot and yield load per meter of canopy length [2,10].

The notion of site-specific grape quality can be obtained from the ratio between exposed leaf area and yield. The presence of positive correlation between exposed leaf area and mass concentration of sugars, anthocyanins and phenolic, aroma substances, contained in grape berry, was established. According to literature sources, to achieve optimal maturity of 1 kg of grapes, on average of 0,7 – 1.4 m^2 of exposed leaves is needed [1,11].

The relationship between exposed leaf area and chemical composition of berries should be considered, taking into account varietal characteristics, photosynthesis and factors, determining its intensity. Training systems and high-dense plantings, providing a large area of exposed foliage, are distinguished by significant evaporation surfaces and moisture consumption for transpiration. In this case, in grapegrowing regions with hot climate, uneven moistening regime and droughts during summer months, water deficit may occur. Lack of moisture in the soil causes partial or complete closure of stomata, which reduces the intensity of synthetic processes, slows maturation of berries. In regions with a cool climate, where solar radiation and temperature are factors, limiting photosynthesis, it is necessary to increase exposed leaf area in order to ensure high level of grape quality [3,11].

Thus, the study of viticultural practices in order to obtain high-quality wine grapes in southern regions of Ukraine is actual.

The study of quality parameters of wine grape varieties under different viticultural practices

The aim of research is to study quality parameters of white wine grape varieties under various planting schemes and training systems.

To achieve the goal, following **objectives** were set:

– to evaluate white wine grape varieties (harvest of 2016) by physical–chemical and biochemical quality parameters;
– to study the influence of viticulture practices (training system, planting scheme) on the criteria of carbohydrate–acid and phenolic complex, oxidative enzyme system of grapes.

Materials of research. White wine grape varieties Zagrey and Aromatnyi (selection of NSC «IV&W named after V. Ye. Tairov», Ukraine), harvested in 2016, as well as must and mash, obtained by grape processing.

Methods of research. Standard field trial, including various variants of planting schemes and training systems, was established in 2016 on experimental sites of NNC «IV&W named after V. Ye. Tairov» (Ukraine) [12]. Grapevines of studied varieties, grafted on rootstock Riparia×Rupestris 101–14, were planted in 2013. The type of soil of experimental plots is non-irrigated, southern chernozem. Loading of vines by nodes, shoots and clusters was established in proportion to vigor of plants.

Measurement and calculation of exposed leaf area of vine were carried out according to the procedure, which was developed by *A. Carbonneau* and given in details in [13].

Time of harvest was determined, based on dynamics of accumulation of sugars, titrated acids, pH changes. Grapes, obtained from experimental vines, were collected separately according to variants for carrying out laboratory analysis. Evaluation of investigated varieties by physicochemical and biochemical parameters was carried out in accordance with procedure, described in [14]. Optimal and permissible values of indicators for monitoring quality of grapes were given in publications of Ostroukhova E.V., Tkachenko O.B. [9,14].

Results and discussion. The influence of vine planting density on agrobiological parameters of plants and quality criteria of Aromatnyi and Zagrey grape varieties was studied by changing the distance between rows and vines in a row. For all variants of the experiment, vines were formed on a 80 cm – high trunk and trained to double – armed horizontal cordon with vertical shoot positioning (Table 1,2).

As shown by the data, presented in Table 1, yields per vine were increased, as plants of studied varieties were given larger feeding area. In terms of unit area, the productivity of dense plantations of Aromatnyi variety did not differ from that of control variant. For Zagrey variety, with an increase in vineyard planting density from 2222 to 4000 vines per hectare, an increase in productivity by 58 % was noted.

Table 1 – Agrobiological parameters of studied varieties under various schemes of vine planting

Parameter	Variety				
	Aromatnyi		Zagrey		
	Variant				
	1a (C)*	1b	2a (C)	2b	2c
Yield per vine, kg	4,36	2,4	3,87	2,35	3,4
Yield per ha, cwt	96,9	96,0	86,0	78,3	136,0
ELA per vine, m^2	2,7	3,1	2,8	2,0	3,1
ELA per ha, m^2	5,4	11,1	6,5	6,7	11,1
ELA/yield, m^2/kg	0,62	1,29	0,72	0,83	0,91

Note: *Aromatnyi variety, planting scheme, m (vines per ha): 1a (C) – 3×1,5 (2222), *control*; 1b – 2×1,25 (4000). Zagrey variety, planting scheme, m (vines per ha): 2a (C) – 3×1,5 (2222), *control*; 2b – 3×1 (3333); 2c – 2×1,25 (4000)

The value of exposed leaf area of vine varied, depending on planting scheme. With a decrease in feeding area of vines of studied varieties from 4,5 m^2 (3×1,5 m planting scheme) to 2,5 m^2 (2×1,25 m planting scheme), this parameter increased by 0,4 m^2, due to higher height of the canopy, which experimental plants developed in conditions of research. With reduction in distance between rows, exposed leaf area per unit of vineyard increased by 107 and 71 % and per unit weight of harvest – by 108 and 26 % for Aromatnyi and Zagrey varieties, respectively.

In Ukrainian practice of winemaking main indicators, that are controlled during processing of grapes for production of white table wines, are mass concentration of sugars and titrated acids. Optimum ranges of variation of these criteria are 180 – 210 and 6 – 10 g/dm^3, respectively [9,14].

According to the data, presented in Table 2, an increase in number of plants per hectare from 2222 to 4000 caused a slight decrease in sugar content of grapes, which was 3 and 10 %, respectively, for studied varieties.

pH is an important technological characteristic of wine grapes. The value of this indicator functionally determines intensity of oxidative processes and dissociation of sulfur dioxide in must and wine. pH value affects intensity of perception of such characteristic sensory descriptors, as «freshness» and «fineness» in white wines. Preservation of these descriptors is possible in the range of values of 2,8 – 3,5. However, French authors recommend an upper limit of pH value of grapes equal to 3,2 [9,14,15].

For samples of Aromatnyi variety pH value exceeded acceptable values. For samples obtained from high-dense plantations, results were 6 % higher than control values.

Calculation criteria – glucoacidimetric index (GAI) and index of technical maturity (ITM) allow obtaining aggregate evaluation of grapes based on determination of indicators given above. In works of several authors, it was shown, that these ratios are closely correlated with wine quality. Recommended ranges of values of GAI and ITM for white grape varieties are 1,9 – 2,7 and 135 – 270, respectively [9,14].

Values of glucoacidimetric index for Aromatnyi and Zagrey varieties were higher than recommended. GAI value, closest to the optimal, was noted for the grape sample of Zagrey variety, obtained from high-dense site of 4000 vines per hectare.

Table 2 – Parameters of carbohydrate–acid, phenolic complex and oxidizing properties of grapes of investigated varieties under different schemes of vine planting

Parameter	Variety				
	Aromatnyi		Zagrey		
	Variant				
	1a (C)	1b	2a (C)	2b	2c
Parameters of carbohydrate–acid complex					
Mass concentration of sugars, g/dm^3	210,0	204,0	218,0	215,0	194,0
Mass concentration of titrated acids, g/dm^3	6,2	6,0	6,7	6,7	6,6
pH	3,55	3,78	3,31	3,33	3,33
GAI*	3,4	3,4	3,2	3,2	2,9
ITM**	265	291	239	238	215
Parameters of phenolic complex and oxidizing properties					
TR PC, mg/dm^3***	696	717	664	613	575
PCin, mg/dm^3	339	342	262	230	250
MF, mg/dm^3	266	280	237	223	227
PF, mg/dm^3	73	62	26	7	23
PPF, %	22	18	10	3	9
PCmac, mg/dm^3	283	213	256	269	252
PCin/TR PC, %	49	48	40	38	43
PCmac ×100/PCin, %	84	62	98	117	101
Activity of MPMO×1000, units	44,1	50,7	91,5	89,4	68,1
Activity of MPMO/PCin , units× mg/dm^3	0,13	0,15	0,35	0,39	0,27

Note: * glucoacidimetric index; ** index of technical maturity; *** TR PC – technological reserve of phenolic compounds; PCin – initial mass concentration of phenolic compounds; MF – monomeric forms of phenolic compounds; PF – polymer forms of phenolic compounds; PPF – percentage of polymer forms of phenolic compounds; PC mac – mass concentration of phenolic compounds in must after maceration of mash for 4 hours at 20 ...22 ° C; PCmac×100/ PCin – macerating ability of must; PCin/TR PC – degree of extraction of phenolic compound at pressing of whole berries; MPMO – monophenol monooxygenase

With area of feeding vines of 2,5 m^2 (planting scheme 2×1,25 m), grape samples of Aromatnyi variety were characterized by the value of ITM, exceeding (by 9 %) analogous result of the control and optimal value.

Technological reserve of phenolic compounds is a criterion, characterizing the phenolic complex of grapes. It is a part of phenolic content, which can dilute in must during processing of grapes. Recommended values of this criterion for white grape varieties are 250 – 500 mg/dm^3 [14].

High value of this parameter is a distinctive feature of varieties of generative selection. The experimental data, given in Table 2, show that for Aromatnyi and Zagrey varieties technological reserve of phenolic compounds was much higher than recommended values. Grapes with higher technological reserve, than the control, characterized high-dense plantings of Aromatnyi variety (4000 vines per hectare). For Zagrey variety, reverse trend was typical – a decrease of the value of parameter by 8 – 13 %.

Mass concentration of phenolic compounds and macerating ability of must are technological characteristics of grapes, determining the direction of its use. Phenolic compounds, represented in grapes in the form of monomers, oligomers and polymers, are actively involved in oxidation-reduction processes, occurring in must and wine.

Analysis of the data, given in Table 2, showed that mass concentration of phenolic compounds in must of Aromatnyi variety did not significantly differ between the control and experimental variants. It accounted about 49 % of technological reserve, while the proportion of oxidized polymer forms in phenolic complex did not exceed 22 %. Macerating mash, low macerating ability of must of the experimental sample in comparison with the control one was noted.

Dense planted sites of Zagrey variety (3333 vines per hectare) were characterized by yield with low content of phenolic compounds in berries (38 % of the value of technological reserve), as well as additional enrichment of must in these compounds during mash maceration. Phenolic complex of berries of control and experimental samples was represented mainly by monomers; the content of polymeric forms of these compounds was low (3 – 10 %).

The activity of monophenol monooxygenase (MPMO) and its ratio to phenolic content in must are indicators, which characterize the oxidative system of grapes. MPMO activity, exceeded optimum (70 units and 0,2 units× mg/dm^3), creates conditions for production of oxidized wines [12].

The enzymatic activity of oxidative system of grapes of Zagrey variety exceeded optimum in all variants of the experiment. The increase in number of vines per ha promoted decrease of the MPMO activity by 26 % and relative value of this parameter by 23 %.

The influence of vine training system on agrobiological parameters, quality criteria of Aromatnyi and Zagrey grape varieties was studied, considering the same planting density for all variants of the experiment – 2222 vines per hectare (Tables 3, 4, Figures 1, 2).

Table 3 – **Agrobiological parameters of studied varieties under various vine training systems**

Parameter	Variety							
	Aromatnyi				Zagrey			
	Variant							
	I (C)*	II	III	IV	I (C)	II	III	IV
Yield per vine, kg	4,36	3,59	4,57	1,93	3,87	2,04	2,78	2,09
Yield per ha, cwt	96,9	79,8	101,5	42,9	85,9	45,3	61,8	46,4
ELA per vine, m^2	2,7	2,9	2,0	1,4	2,8	3,2	2,1	2,1
ELA per ha, m^2	5,4	5,8	4,1	2,8	5,5	6,5	4,2	4,2
ELA/yield, m^2/kg	0,62	0,81	0,45	0,72	0,72	1,59	0,75	1,01

Note: ***Vine training system: I (C) – double–armed horizontal cordon/vertical shoot positioning/trunk height 80 cm, *control*; II – double–armed horizontal cordon/vertical shoot positioning/trunk height 40 cm; III – double–armed horizontal cordon/free shoot positioning/trunk height 120 cm; IV – double–armed horizontal cordon/free shoot positioning/trunk height 160 cm

According to the data, presented in Table 3, for Aromatnyi variety the highest yield per vine and unit of area (105 % of the control) was obtained, when training vines on a 120 cm – high stem with free shoot positioning.

Exposed leaf area of vines varied, depending on the training system. Comparing the control and experimental variants according to this parameter, it was found that the low–trunk training system of vines (40 cm) was characterized by the largest area of the assimilation apparatus per plant, hectare and yield weight unit, which was 108 and 131 %, respectively, of control values.

For Zagrey variety, in all variants of the experiment the productivity per vine and unit of area was 26 – 46 % lower than that of the control.

The low-trunk training of plants (40 cm) provided the largest area of the assimilation apparatus per vine, hectare and yield weight unit, which amounted to 114, 118 and 220 %, respectively, of the control values.

Table 4 – Parameters of carbohydrate–acid complex of grapes of investigated varieties under different vine training systems

Parameter	Variety							
	Aromatnyi				Zagrey			
	Variant							
	I (C)	II	III	IV	I (C)	II	III	IV
Mass concentration of sugars, g/dm^3	210,0	188,0	196,0	215,0	21,8	19,9	21,0	21,0
Mass concentration of titrated acids, g/dm^3	6,2	6,5	6,2	6,1	6,7	7,0	6,9	7,0
pH	3,55	3,62	3,53	3,53	3,31	3,2	3,21	3,32
GAI*	3,4	2,9	3,2	3,5	3,2	3,1	3,0	2,9
ITM**	265	246	244	268	239	204	216	231

With changing medium-trunk (80 cm) to low- and high-trunk training systems (40 and 120 cm) of vines of Aromatnyi variety, sugar content of grapes decreased by 11 and 7 %, respectively.

The active acidity of grapes of all variants of the experiment slightly exceeded recommended ranges. The highest pH was observed for sample, which was obtained from low–trunkated vines.

The value of GAI of investigated samples of grapes exceeded recommended ranges. The value of GAI, the closest to recommended ones, was observed for samples of grapes, which was obtained from low–truncated vines.

With changing medium-trunk (80 cm) to low- and high-trunk training systems (40 and 120 cm) of vines of Zagrey variety, the sugar content of grapes decreased by 4 and 9 %, respectively.

The value of the calculated glucoacidimetric index of grape samples of the control and experimental variants exceeded the recommended ranges. The value of GAI, the closest to recommended, was observed for samples of grapes, which was obtained from high-trunkated vines.

The results of investigations of the phenolic complex of Aromatnyi grapes, shown in Fig. 1, confirm that samples of grapes were characterized by value of technological reserve of phenolic compounds, which exceeded recommended ranges. Comparing high-trunk training system of vines (120 cm) and control (medium-trunk, 80 cm), a decrease of technological reserve by 5 % was observed. Changing medium-trunk (80 cm) to low- and high-trunk training systems (40 and 160 cm) of vines, an increase of the value of the parameter by 3 and 16 %, respectively, was observed.

Low ability for extraction of phenolic compounds in must during pressing was noted for the control and experimental samples of grapes, which amounted to 36 – 49 % of technological reserve. Training vines on high trunks (160 cm), yield was characterized by the lowest content of phenolic compounds in berries – 86 % of the analogous value of the control sample. The proportion of oxidized polymeric forms of compounds of the phenolic complex of grape sample, obtained from high–trunkated (120 cm) vines, significantly (by 34 %) exceeded control values.

Macerating mash, additional enrichment of must of the control and experimental samples with phenolic compounds was not observed, which indicates about low macerating ability. The sample of grapes, obtained from high–trunkated vines (120 cm), was characterized by the lowest value of this parameter.

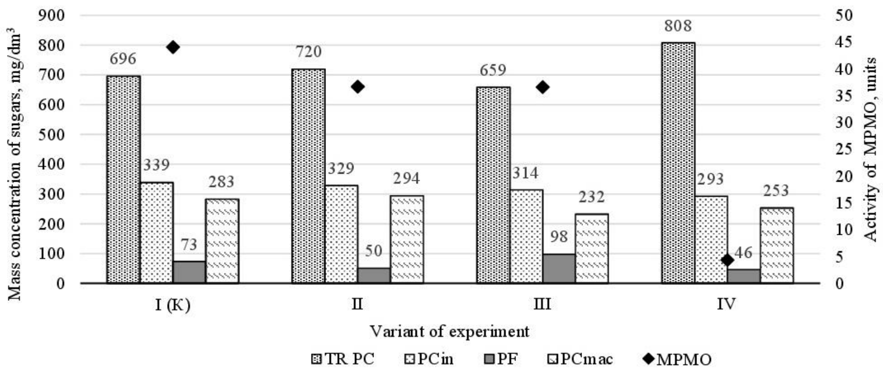

Fig. 1. Parameters of phenolic complex and oxidizing properties of grapes of Aromatnyi grape variety under various vine training systems

According to results of studies of phenolic complex of Zagrey grapes, shown in Fig. 2, it was established, that technological reserve of phenolic compounds of experimental samples exceeded recommended values. It was observed, that the value of technological reserve of low- (40 cm) and high-trunkated vines (160 cm) decreased by 14 and 10 %, respectively.

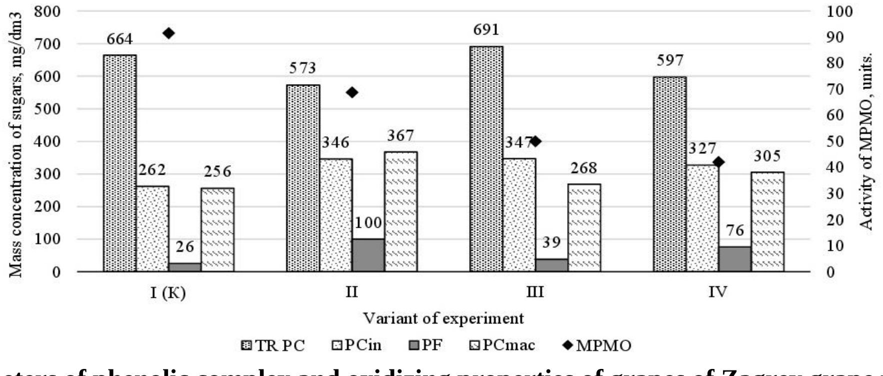

Fig. 2. Parameters of phenolic complex and oxidizing properties of grapes of Zagrey grape variety under various vine training systems

Mass concentration of phenolic compounds in must of the control and experimental samples ranged from 40 to 60 % of the value of technological reserve. According to the figure, it can be seen, that samples of grapes, obtained from low-trunkated vines (40 cm), were distinguished by the highest accumulation of phenolic compounds (32 % higher than the control value). With prolonged maceration of mash, additional enrichment of must with these compounds was noted. Phenolic complex of the experimental sample was characterized by high degree of oxidation, as evidenced by the ratio of polymer forms (30 %). It was three times higher than the control value.

Changing medium-trunk (80 cm) to low- (40 cm) and high-trunk training systems (120 cm and 160 cm) of vines, the absolute and relative activity of MPMO decreased by 25 – 54 and 43 – 63 %. Grapes, obtained from high-trunkated vines (160 cm), were characterized by the lowest values of parameters of the oxidative enzyme system.

Approbation of research results

Scientific study of vine agrotechnology in conditions of Odessa region is a long-term research project, which will be continued in 2017 – 2018. The obtained results will allow developing and scientifically proving a complex of viticultural practices, that will ensure optimal quantitative and qualitative productivity of plantations of investigated grape varieties. This set of techniques will be recommended for implementation on an industrial scale.

Conclusions

1. Physicochemical and biochemical parameters, characterizing quality of grapes of white wine varieties Zagrey and Aromatnyi (harvest of 2016) were determined.

2. Study of the influence of viticulture practices (planting scheme, training system) on criteria of carbohydrate–acid, phenolic complex and oxidative system of grapes made it possible to establish following patterns:

– the planting scheme of vines influenced parameters of mass concentration of sugars and GAI of grapes of both varieties; for Aromatnyi variety, the dependence of pH and ITM on the studied factor was additionally noted;

– the training system of vines of both varieties caused differences in the value of mass concentration of sugars and GAI; for Aromatnyi variety, the dependence of pH value on the studied factor was additionally noted;

– density of vine planting influenced parameters of technological reserve of phenolic compounds and macerating ability of grape must of studied varieties; the effect of experimental conditions on the content of phenolic compounds and the activity of monophenol monooxygenase was additionally noted for Zagrey variety;

– training vines of studied grape varieties at different trunk heights and ways of shoot positioning caused differences in the value of technological reserve and mass concentration of phenolic compounds, degree of polymerization, macerating ability and the activity of monophenol monooxygenase of must.

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ПОКАЗАТЕЛИ КАЧЕСТВА ТЕХНИЧЕСКИХ СОРТОВ ВИНОГРАДА ПРИ РАЗЛИЧНЫХ СХЕМАХ ПОСАДКИ И СИСТЕМАХ ФОРМИРОВАНИЯ КУСТОВ

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Аннотация. Определены физико-химические и биохимические показатели, характеризующие качество белых технических сортов винограда Загрей и Ароматный селекции ННЦ «ИВиВ им. В. Е. Таирова» урожая 2016 г. Полевой опыт, включающий различные варианты схем посадки и систем формирования кустов, позволил изучить влияние агротехнологических приемов на критерии углеводно-кислотного и фенольного комплекса, окислительной ферментной системы винограда.

Редкие посадки сорта Ароматный (2222 куста на 1 га) характеризовались урожаем, который незначительно превосходил по показателям углеводно-кислотного и фенольного комплекса виноград, полученный на густых насаждениях (4000 кустов на га). Наиболее оптимальным по величине массовой концентрации сахаров, фенольных веществ, полимерных форм, мацерирующей способности сусла, активности окислительной ферментной системы являлось выращивание данного сорта на штамбе высотой 160 см. Выращивание винограда сорта Загрей по схеме посадки, соответствующей 4000 растений на 1 га, способствовало получению урожая с оптимальными показателями углеводно-кислотного комплекса, низким значением технологического запаса и массовой концентрации фенольных веществ, умеренной мацерирующей способностью и активностью монофенолмонооксигеназы сусла. Формирование кустов данного сорта на штамбе высотой 40 см с вертикальным ведением прироста обусловливало значительное ухудшение качества винограда за счет повышенного содержания фенольных веществ и их полимерных форм, высокой мацерирующей способности сусла.

Ключевые слова: схема посадки, система формирования, углеводно-кислотный комплекс, фенольний комплекс, окислительные свойства, виноград

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Отримано в редакцію 19.04.2017 | Received 19.04.2017
Прийнято до друку 25.05. 2017 | Approved 25.05. 2017