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INFLUENCE OF VITICULTURAL PRACTICES ON THE SENSORY CHARACTERISTICS OF WINE GRAPE VARIETIES

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Представлені результати дослідження впливу агротехнічних прийомів вирощування винограду – схеми садіння і висоти штамбу кущів на сенсорні характеристики ягід білих технічних сортів Ароматний і Загрей селекції ННЦ «ІВіВ ім. В. Є. Таїрова» (Україна). Статистичними методами виявлено відмінності між варіантами експерименту і показано вплив досліджуваних агротехнічних факторів окремо і в комплексі на підсумковий результат сенсорного аналізу

Ключові слова: сенсорна оцінка ягід, агротехнічні прийоми вирощування, Загрей, Ароматний

Представлены результаты исследования влияния агротехнических приемов выращивания винограда – схемы посадки и высоты штамба кустов на сенсорные характеристики ягод белых технических сортов Ароматный и Загрей селекции ННЦ «ИВиВ им. В. Е. Таирова» (Украина). Статистическими методами выявлены различия между вариантами эксперимента и показано воздействие исследуемых агротехнических факторов отдельно и в комплексе на итоговый результат сенсорного анализа

Ключевые слова: сенсорная оценка ягод, агротехнические приемы выращивания, Загрей, Ароматный

1. Introduction

Under contemporary conditions, sensory analysis finds wider and wider application in different fields of food industry due to creation of the regulating base from 28 international standards, which imposes strict requirements on all components of the procedure of analysis and makes it possible to avoid errors of final result.

The method of sensory evaluation of grapes is actively used in production in addition to standard methods of chemical analysis, carried out during monitoring the process of harvest ripening. Sensory evaluation of berry provides oenologists an efficient tool for making decisions on harvest date and further direction of usage of grapes, makes it possible to adapt the vinification procedure taking into account the quality of obtained wine [1, 2].

Scientific works in the area of sensory analysis of grape predominantly set the goal of establishing correlation between organoleptic properties of grape and corresponding characteristics of wine. In this aspect, the important direction of studies is examination of the influence of viticulture practices on sensory properties of grapes for the production of wines of the assigned style and quality.

2. Literature review and problem statement

Chemical composition of grapes is the basic factor, which predetermines the quality of wine. Sugars, acids, nitrogen, phenol and aromatic substances are accumulated in the morphological parts of the berry – skin, pulp and seeds during the process of ripening. Concentration and distribution of these substances in plant tissues depends on a degree of ripeness of grape [3, 4]. Definition of the optimum ripeness of a grape berry is the basic condition for making high-quality wines.

The results of chemical analysis make it possible to obtain only a partial information about ripeness, since they do not consider a change in the texture of tissues of a berry during ripening [5]. Implementation into practice instrumental methods of measuring concentrations of phenol and aromatic substances requires significant expenditures of time and resources; the possibility of conducting similar analyses at a winery is limited. Thus, sensory estimation of berry is an alternative method for the quantitative expression of perception of substances, which affect the quality of grapes [1, 2, 5]. Taking into account high heterogeneity of grape by the degree of maturity, observance of a strict protocol of sampling must provide objectivity of the obtained results.

It is known from literature that the most common today procedure of sensory analysis of grapes was developed by researchers from Institut Cooperatif du Vin (Montpelier, France). According to this procedure, the analysis of three fundamental component of a berry – pulp, skin and seeds – is carried out according to 20 indicators, which are assessed in the range from 1 to 4 [6]. The later studies [7], carried out in Australia, proved that evaluation of descriptors according to the category scale from 1 to 4 does not make it possible to entirely reveal the differences between samples, since ex-

perts avoid boundary assessments and, in the essence, have only two possible versions of the answer. The use of the linear rating scale (as a rule, 10–15 cm long) allows tasters to select the answer from a larger number of variants and decrease the number of errors of the "equal" parameter. The number of the used descriptors may also vary depending on a grape variety and purpose of analysis.

In scientific literature, there is comparatively little information about application of the method of sensory estimation of grape in studies. The interrelation between sensory characteristics of a berry and wine is studied by majority of scientists [2, 8, 9]. Existence of both positive and inverse correlations between the organoleptic properties of a berry and wine makes it possible to create the target sensory profile of grapes and on its basis to judge on quality and suitability of raw material for wine making.

The quality of the finished produce directly depends on the qualitative productivity of a vineyard. Manipulation with the architecture of the canopy of a vine for the purpose of improvement of light microclimate of leaves is one of the ways of enhancing grape quality [10].

The conclusions, obtained in Adelaide (Australia) in experiments with the grape variety Semilion, are important in this respect. A partial removal of leaves in the cluster zone made it possible to obtain the harvest with potentially more desirable qualities, such as high acidity of skin, citrus aromas, more pronounced aromas of «frying» in the seed, lower astringency of skin and presence of tannins [7]. During the study the diverse variants of crop loading of vines and light microclimate of clusters of grape variety Sira, it was established that the variant with the highest intensity of "green" tones in the aroma corresponded to the highest crop load and sun exposure of clusters of less than 50 %. More pronounced and lasting fruit aromas of the pulp of berries caused more intensive "jam" aromas and perception of «body» in obtained wines [2, 8].

Developments of scientists of the National scientific center "IVW named after V. Ye. Tairov" (Ukraine) in the area of selection of wine grape varieties within last years made it possible to supplement Ukrainian assortment with new varieties, which possess original organoleptic properties. However, the existing standard approach to viticulture and estimation of quality of grapes does not make it possible to reveal entirely its technological potential [11].

The authors of this article propose to use sensory analysis of berries for directed growing of new varieties of grape with high qualitative indicators under the agro-ecological conditions of Ukraine.

3. The aim and tasks of the studies

The purpose of present work was to study the influence of viticultural practices (planting density, trunk height of vine) on sensory characteristics of berries.

To achieve the set goal, the following tasks were to be solved:

– to conduct the sensory estimation of experimental samples of grapes;

– to carry out statistical analysis of the obtained results, to reveal differences between the experimental samples and to prove the influence of the examined viticultural practices (individually and in complex) on the final estimations of descriptors.

4. Materials and methods of studying the influence of viticultural practices on the sensory characteristics of wine grape varieties

The object of the study was grape of white wine varieties. Aromatnyiy and Zagrey of the 2016 harvest, grown under agro-ecological conditions of Odessa region, Ukraine.

The field experiment, which simulates the influence of viticultural practices on sensory characteristics of berries, was implemented on the experimental plots of the NSC "IVW named after V. Ye. Tairov" (Odessa region, Ukraine).

The sensory evaluation of the studied grape varieties was carried out in the specialized laboratory of sensory analysis of foodstuffs, which functions in Odessa national academy of food technologies (Odessa, Ukraine).

It is possible to get acquainted with the procedure of conducting this study in more detail in work [12].

5. Results of studying the influence of viticultural practices on the sensory characteristics of wine grape varieties

To define the influence of vine planting density on sensory characteristics of grape, the results of the experiment with grape varieties Aromatnyiy and Zagrey were generalized. The grapevine training system and the trunk height were established identically in all experimental variants. The value of the vine planting density varied due to an increase in both the distance between the rows and the plants in a raw. As the control sample, we selected the experimental variant, planted according to the scheme 2·1.25 m (Table 1).

Statistical processing of the obtained results made it possible to determine sensory characteristics, the average estimations of which significantly differ between the experimental variants.

Perception of descriptor of skin aroma is determined by accumulation of primary aromatic substances of grape in the free and bounded form in berry skin in the process of ripening. A decrease in the number of plants per unit of vineyard area contributed to enhancing of fruit aromas in the skin of grape berries of variety Aromatnyiy.

Ability to fall and compression of berries is the result of structural changes in tissues of skin and pulp in the process of ripening. Elasticity and plasticity of tissues decreases in proportion to degree of maturity; a berry becomes soft, is easily deformed at pressing, does not restore its original shape and is easily separated from the stalk [2, 3]. The conditions of the experiment did not have a positive effect on the estimation of compression of berries of grape variety Zagrey. Experimental variants were characterized by higher elasticity, in comparison with the control samples. At the same time, with decrease of vine planting density, the ability to fall of berries increased.

The adhesion of skin and pulp of berry considerably decreases and juice release at pressing is getting more difficult in proportion to maturity of grape [2]. It is evident from the data of the table that adhesion of tissues of a berry of variety Zagrey considerably weakens with an increase in the distance between rows and vines in a row.

Visual and gustatory estimation of seeds makes it possible to determine the beginning of physiological maturity of grapes. Ripe seeds are easily destroyed, they have the color with shades of brown; the "grill" notes prevail in the aroma. The sensation of tannin substances when chewing is velvety, with weak astrin-

gency [2]. For grape variety Zagrey, the experimental variants, planted according to schemes 3×1, 3×1.5 m, were characterized by green coloring of seeds with shades of grey. The seeds of the berries of the control sample had dark brown coloring and very high grades of the astringency descriptor.

The influence of the vine trunk height on sensory characteristics of berries of grape variety Aromatnyiy was studied at the planting scheme 3×1.5 m. As the control sample of comparison, we selected the variant of vine training on the trunk of 40 cm in height (Table 2).

According to the results of the analysis of variance of the obtained experimental data, it was established that the average grades of 3 out of 20 attributes, considered by tasters, significantly differed between the experimental samples.

The skin color of the berries of white varieties of grapes varies from green to the amber-yellow nuances in proportion to ripening [2–4]. With training of vines on the trunk of 120 cm in height, the berries differed by less intensive skin color ("yellow") in the place of separation of stalk in comparison with the control sample ("amber-yellow").

The level of sugar accumulation in the berry determines a change in perception of pulp sweetness. Aromatic profile also varies from predominant grassy to confiture aromas at the moment of complete maturity in proportion to ripening of berries [2–4]. The conditions of the experiment had a positive effect on sensory attributes of the pulp of berries of grape variety Aromatnyiy. The pulp of berries of the experimental variant, grown on the trunk of 160 cm in height, was characterized by more expressed sweetness ("sweet pulp") and by prevailing confiture aromas, in comparison with the control sample. The confiture notes predominated in the aromatic profile of the pulp of the berries of the experimental variant, grown on the trunk of 80 cm in height.

The evaluation of seeds was limited by the color indicator, which was characterized by nuances from yellowish-green to brown-green for all experimental variants [2].

The influence of the vine trunk height on sensory characteristics of berries of grape variety Zagrey was examined within conditions of two single-factor experiments at planting schemes 3×1 and 3×1.5 m. As the control sample of comparison, we selected the variant of vine training on the trunk of 40 cm in height (Table 3).

According to the results of analysis of variance of the obtained experimental data (planting scheme 3×1 m), it was established that the average grades of 6 out of 20 attributes significantly differed between the experimental variants.

For better understanding of given differences, the data analysis by the method of principal components was performed, which implied distribution of the mean values of the estimation of descriptors according to two factors (principal components). The first two principal components explained 92.86 % of the differences between the experimental variants (Fig. 1). Based on the example of this study, viticultural practices (height of trunk) are designated by squares and sensory attributes are represented by vectors on the calculation diagram.

The loads of the first two components are given in Table 4. From the data of Table 4, it is evident that the first component (60.19 % of general dispersion) is mainly influenced by indicators of skin color in the place of separation of stalk, intensity of the pulp aroma, intensity of tannin substances of skin and astringency of seeds. The second main component (32.67 % of general dispersion) is influenced by the descriptors of adhesion of pulp and skin, intensity of tannin substances of seeds.

Growing vines on the trunk with the height of 160 cm resulted in obtaining berries with weak adhesion, but with the most intensive perception of tannin substances of skin, seeds and astringency of seeds (Fig. 1). The experimental variants, grown on trunks of 80 and 120 cm in height, by the explored indicators contrastingly differed from the control sample and the sample, grown on the trunk of the height of 160 cm.

Fruit notes prevailed in the aromatic profile of the pulp of berries of all experimental samples. However, the factor of the vine trunk height had a significant effect on intensity of pulp aroma. The experimental sample, grown on the trunk of 160 cm in height, was characterized by low grade of this descriptor ("weakly intensive" to "moderately intensive"). Intensive aromas of pulp and amber-yellow color of skin in the place of separation of stalk were noted in the berries of the control sample of the experiment.

According to the results of the variance analysis of the obtained experimental data (planting scheme 3×1.5 m), it was established that the average grades of 3 out of 20 studied attributes significantly differed between the experimental samples.

The experimental sample, grown on the trunk of 160 cm in height, differed in terms of stronger adhesion of berry tissues from other experimental samples; at the same time, in comparison with the control sample, no significant differences were established. In the berries of this sample, we noted less pronounced pulp sweetness ("slightly sweet"), in comparison with the control sample ("moderately sweet") and the experimental sample, grown on the trunks of 80...120 cm in height.

The experimental sample, grown on the trunk of 80 cm in height, was characterized by the lowest intensity of tannin substances in seeds, in comparison with the control sample and other experimental samples.

Creation of multifactor dispersion complex makes it possible to estimate statistically the action and interaction of several studied factors on changeability of resulting feature. The influence of conditions of growing vines on sensory characteristics of grape was studied within conditions of two-factor experiment. The experiment in the format of 2×4 (two variants of planting scheme – 3×1 and 3×1,5 m and four variants of the bush trunk height – 40, 80, 120, 160 cm) was implemented based on the example of the grape variety Zagrey [12]. The obtained results are given in Table 5.

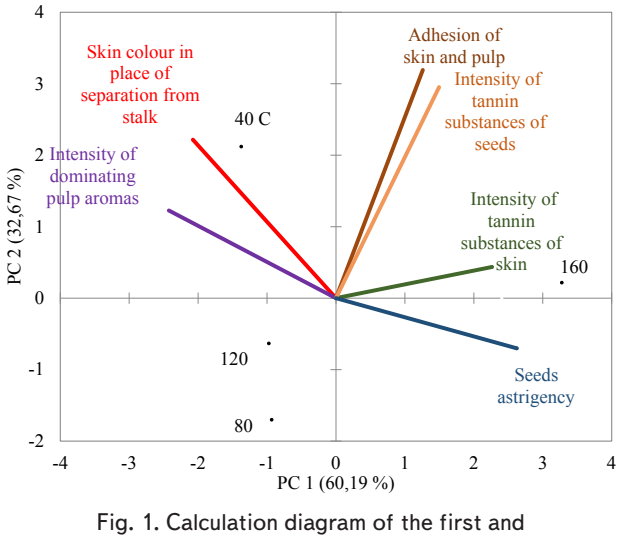

Fig. 1. Calculation diagram of the first and the second principal components

Table 1

Influence of vine planting density on the organoleptic characteristics of berries of grape varieties Aromatnyiy and Zagrey

Assessment stage	Indicator[A]	Grapes variety						
		Aromatnyiy			Zagrey			
		Scheme of planting, m		p[C]	Scheme of planting, m			p
		2×1.25[B] C	3×1.5		2×1.25 C	3×1	3×1.5	
Visual assessment	Ability to compression	2.22	2.20	n/s[D]	3.16	2.33[AE]	2.33[A]	0.022
	Ability to fall	3.18	3.00	n/s	2.33	3.00[A]	3.00[A]	0.009
	Skin color in place of separation from stalk	3.80	3.75	n/s	3.57	3.00	3.00	n/s
Pulp	Adhesion of pulp and skin	2.72	2.67	n/s	2.83[A]	2.33[A]	3.60	0.003
	Pulp sweetness	2.18	2.55	n/s	2.29	2.33	2.40	n/s
	Pulp acidity	2.00	1.67	n/s	1.43	1.43	1.83	n/s
	Pulp aroma	3.18	3.30	n/s	2.00	3.00	3.00	n/s
	Intensity of dominating pulp aromas	2.22	2.42	n/s	1.86	2.33	2.00	n/s
Skin	Ability of skin to rupture	2.45	2.17	n/s	1.67	2.33	2.00	n/s
	Intensity of tannin substances of skin	2.08	1.83	n/s	2.00	1.57	1.60	n/s
	Skin acidity	1.64	1.33	n/s	2.00	2.00	1.50	n/s
	Skin astringency	2.00	2.08	n/s	1.14	1.43	1.33	n/s
	Dryness of skin tannins	1.92	1.75	n/s	1.33	1.43	1.60	n/s
	Skin aroma	1.40	2.50	0.002	1.00	1.29	1.50	n/s
	Intensity of dominating skin aromas	2.36	2.17	n/s	1.71	1.71	1.60	n/s
Seeds	Color of seeds	1.80	1.83	n/s	3.67	2.57[A]	3.00[A]	0.003
	Aptitude of seeds to destruction	–	–	–	3.00	2.67	3.00	n/s
	Aroma of seeds	–	–	–	2.20	2.00	2.50	n/s
	Intensity of tannin substances of seeds	–	–	–	2.00	1.67	1.67	n/s
	Seeds astringency	–	–	–	2.60	1.71[A]	2.00[A]	0.009

Note: [A] – mean values (n=12); [B] – height of trunk (80 cm) and training system of vines (double-arm horizontal cordon with vertical shoot positioning) are identical in all experimental variants; [C] – levels of significance of statistical difference by results of one-way analysis of variance; [D] – n/s – statistical difference is not significant by the results of one-way analysis of variance; [E] – letters of superscript indicate existence of statistical differences between the variants at multiple paired comparison according to value LSD_{05}

Table 2

Influence of vine trunk height on the organoleptic characteristics of berries of grape variety Aromatnyiy

Assessment stage	Indicator[A]	Trunk height, cm				p[B]
		40 C	80	120	160	
Visual assessment	Ability to compression	2.17	2.20	2.08	2.55	n/s[C]
	Ability to fall	2.50	3.00	2.88	2.60	n/s
	Skin color in place of separation from stalk	3.90[AD]	3.75[A]	2.75	3.83[A]	0.002
Pulp	Adhesion of pulp and skin	2,33	2,67	2,50	2,56	n/s
	Pulp astringency	2.33	2.67	2.50	2.56	n/s
	Pulp sweetness	2.57[A]	2.55[A]	2.55[A]	3.40	0.001
	Pulp acidity	1.25	1.67	1.75	1.67	n/s
	Pulp aroma	2.63[A]	3.30[B]	2.38[A]	3.82[C]	<0.001
	Intensity of dominating pulp aromas	2.45	2.42	2.27	2.50	n/s
Skin	Ability of skin to rupture	1.83	2.17	2.08	2.17	n/s
	Intensity of tannin substances of skin	2.00	1.83	2.33	2.17	n/s
	Skin acidity	1.50	1.33	1.58	1.58	n/s
	Skin astringency	1.83	2.08	2.17	1.91	n/s
	Dryness of skin tannins	1.82	1.75	2.08	1.83	n/s
	Skin aromas	2.00	2.50	1.64	1.80	n/s
	Intensity of dominating skin aromas	2.17	2.17	1.92	2.33	n/s
Seeds	Color of seeds	1.75	1.83	1.82	1.73	n/s
	Aptitude of seeds to destruction	–	–	–	–	–
	Seeds aroma	–	–	–	–	–
	Intensity of tannin substances of seeds	–	–	–	–	–
	Seeds astringency	–	–	–	–	–

Note: [A] – mean values (n=12); [B] – levels of significance of statistical difference by results of one-way analysis of variance; [C] – n/s – statistical difference is not significant by the results of one-way analysis of variance; [D] – letters of superscript indicate existence of statistical differences between the variants at multiple paired comparison according to value LSD_{05}

Table 3

Influence of vine trunk height on organoleptic characteristics of the berries of grape variety Zagrey

Parameter[A]	Height of trunk, cm				p[B]
	40 C	80	120	160	
Planting scheme 3·1 m					
Skin color in place of separation from stalk	3.80	3.00[AC]	3.00[A]	2.5[A]	0.004
Adhesion of pulp and skin	3.00[B]	2.33[A]	2.60[AB]	3.00[B]	0.040
Intensity of dominating pulp aromas	2.67[A]	2.33[A]	2.17[AB]	1.67[B]	0.017
Intensity of tannin substances of skin	1.50[AB]	1.57[AB]	1.17[A]	2.0[B]	0.048
Intensity of tannin substances of seeds	2.33[B]	1.67[A]	2.00[AB]	2.43[B]	0.037
Seeds astrigency	1.43[A]	1.71[A]	1.57[A]	2.33	0.026
Planting scheme 3·1.5 m					
Adhesion of pulp and skin	3.00[AB]	3.60[A]	3.40[A]	2.60[B]	0.036
Pulp sweetness	2.33[A]	2.40[A]	2.40[A]	1.40	0.022
Intensity of tannin substances of seeds	3.0[A]	1.67	2.50[A]	3.0[A]	0.001

Note: [A] – mean values (n=12); [B] – levels of significance of statistical difference by results of one-way analysis of variance; [C] – letters of superscript indicate existence of statistical differences between the variants at multiple paired comparison according to value LSD_{05}

Table 4

Loads of the first and the second main components

Parameter	PC 1	PC 2
Skin color in place of separation from stalk	–0.773	0.609
Adhesion of pulp and skin	0.469	0.876
Intensity of dominating pulp aromas	–0.904	0.337
Intensity of tannin substances of skin	0.843	0.120
Intensity of tannin substances of seeds	0.557	0.810
Seeds astrigency	0.977	–0.193

During procedure of two-way analysis of variance for quantitative assessment of influence of the studied conditions on the resulting feature, we used calculation index η^2. This index is expressed as a portion of sum of squares of deviations, determined by the studied factor, of the total sum of squares. Value η^2 makes it possible to establish which factors have the greatest contribution to the result of evaluation of a certain descriptor.

The factor of the trunk height had the most significant influence on final estimations of ability of skin to rupture, skin color, ability to fall, sweetness, aroma and intensity of dominating aromas of pulp, color and intensity of the tannin substances of seeds.

The influence of the planting scheme of vines to the greatest degree is noted for the descriptors of pulp acidity, intensity of dominating aromas of skin and aptitude of seeds to destruction. Interaction of two studied factors of influence was least pronounced and determined the indicators of adhesion of pulp and skin and skin acidity.

Table 5

Influence of the vine planting density and trunk height on organoleptic characteristics of berries of grape variety Zagrey

Assessment stage	Indicator*	Evaluation of factor influence					
		Planting scheme		Trunk height		S×H	
		p**	η^2, %	P	η^2, %	p	η^2, %
Visual assessment	Ability to fall	n/s	–	0.002	31	0.009	23
	Skin color in place of separation from stalk	n/s	–	0.003	38	n/s***	–
Pulp	Adhesion of pulp and skin	0.010	13	n/s	–	0.002	33
	Pulp sweetness	n/s	–	0.023	19	n/s	–
	Pulp acidity	0.008	15	n/s	–	n/s	–
	Pulp aroma	0.005	12	0.006	20	0.006	20
	Intensity of dominating pulp aromas	n/s	–	0.009	23	n/s	–
Skin	Ability of skin to rupture	n/s	–	0.008	22	0.005	24
	Skin acidity	n/s	–	n/s	–	0.018	26
	Intensity of dominating skin aromas	0.004	21	n/s	–	n/s	–
Seeds	Color of seeds	n/s	–	0.003	31	n/s	–
	Aptitude of seeds to destruction	0.002	25	n/s	–	n/s	–
	Intensity of tannin substances of seeds	0.005	11	≤0.001	45	n/s	–

*Note: * – mean values (n=12); ** – levels of significance of statistical difference by the results of two-way analysis of variance; *** – n/s – statistical difference is not significant according to the results of two-way analysis of variance*

6. Discussion of results of studying the influence of viticultural practices on the sensory characteristics of wine grape varieties

An analysis of the obtained results makes it possible to establish that viticultural practices of wine growing under conditions of 2016 had different influence on sensory characteristics of berries in the section of the studied varieties.

The decrease in the number of plants from 4000 to 2222 per 1 ha contributed to enhancement of fruit aromas in the skin of berries of Aromatnyiy variety. Growing vines of the explored variety on the trunk of 160 cm in height made it possible to obtain harvest with the most preferable characteristics of sweetness and pulp aroma.

The low-dense planting of grape variety Zagrey (3333, 2222 plants per 1 ha) was distinguished from dense planting (4000 plants per 1 ha) by the harvest with higher elasticity of berries. Ability to fall and weak adhesion of tissues of berries were also characteristic for the plots, planted according to 3×1 and 3×1.5 m schemes.

At planting vines by the scheme 3×1, the most intensive aromas of pulp were noted at growing vines on the trunk of 40 cm in height. In the experimental variants, where the vines were trained on a high trunk, the harvest with high intensity of tannins of skin and seeds and astringency of seeds was obtained.

At planting vines by the scheme 3×1.5 m, growing grapes on the trunk of 80 cm in height was optimum by indicators of adhesion of pulp and skin, pulp sweetness and intensity of tannin substances of seeds.

Based on the example of grape variety Zagrey during studying the interaction of factors of planting scheme and vine trunk height, it was established that the factor of vine trunk height had the greatest influence on the resulting feature.

The search for dependences between sensory attributes of berries, indicators of chemical composition of must and organoleptic estimation of wine is the direction of our future studies. This will make it possible to use sensory analysis of grape as an effective tool in the oenological practice during planning of viticultural complex in the vineyard for obtaining wine of specific style and quality.

7. Conclusions

1. In the course of work, we defined sensory descriptors, which characterize the quality of grape variety Zagrey and Aromatnyiy of the NSC "IVW named after V. Ye. Tairov" (Ukraine).

2. Mathematical processing of the obtained results made it possible to establish the interrelation between the viticultural practices of growing vines and sensory descriptors of the berries of studied varieties.

The factor of planting scheme influenced skin aroma of grape variety Aromatnyiy and parameters of compression, ability of berries to fall, adhesion of tissues of pulp and skin, color and astringency of seeds of grape variety Zagrey.

The factor of trunk height influenced color indicators of skin, sweetness and aroma of pulp of grape variety Aromatnyiy. For the variety Zagrey, growing vines on trunks of different height caused differences by color indicators of skin, adhesion of tissues of pulp and skin, intensity of pulp aroma, pulp sweetness, intensity of tannin substances of skin and seeds, astringency of seeds.

During examination of the influence of the complex of the studied factors on the sensory profile of berries of grape variety Zagrey, it was established that the factor of the trunk height has a most pronounced influence, determining the final grades of ability of berries to fall, ability of skin to rupture, color of skin, sweetness, aroma and intensity of dominating pulp aromas, color and intensity of tannin substances of seeds.

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