

Analysis of mechanical properties, biochemical composition and technological parameters of grape (*Vitis*) raisin varieties in conditions of Uzbekistan

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Abstract. This article describes the agrobiological characteristics of grapes (*Vitis*) raisins (Hermione) grown in Uzbekistan, the mechanical and biochemical composition of the grape and the technological - raisin (Hermione) indicators of large grape varieties. The highest sugar content in Hermione was found in the Sultani variety at 70.9%, while in the Kara Djandjal variety it was also insignificant compared to control (64.6%). The highest organoleptic value of hermione product made from raisin varieties of grapes was recorded in Sultani and Hussaine nutmeg varieties. It was observed that the tasting value of hermione products made from grapes of this variety is the highest - 8.0 and 7.9 points, respectively, for varieties.

1 Introduction

Today, the world's raisin production is 1.220 million tons and Turkey (353,167 tons), the United States (332,760 tons), Iran (122,595 tons), Greece (72,861 tons), Chile (51,128 tons), and South Africa (37,049 tons) are leading in this regard. In terms of gross raisin production, Uzbekistan ranks seventh in the world (32,893 tons) and the share of germ in it is 8-10,000 tons. Increasing the production of hermione raisins in our country will increase the volume of exports of products that are competitive in foreign markets [1, 2].

In the leading countries in the production of raisins, concentrations and methods of drying grapes between rows, first drying by breaking the stalk, then drying, drying in large conveyor-type dryers with electricity and fuel, processing of raw materials with caustic soda, sulfur [1-5]. However, in these countries only seedless raisin varieties of grapes, such as Sultanina, are dried. Along with raisin varieties, large-grape varieties such as Katta Kurgan, Sultani, Kara Djandjal, and Hussaine nutmeg are dried and high-quality hermione is produced in our country. Therefore, radically increase the production of hermione, a new product for the world market. One of the urgent tasks of national economic importance is the development of efficient storage and cheap, convenient drying methods made from local raw materials, which allow achieving conditioning in accordance with the requirements of the standards [6-8].

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2 Materials and methods

The experiments were conducted in 2017-2019 on the experimental farm of Tashkent State Agrarian University and specialized farms of Surkhandarya province in Uzbekistan. In the study of agrobiological properties of raisin grape varieties were identified using the method of M.A. Lazarevsky. The mechanical composition and biochemical properties of grape bunches were determined in the method of N.N. Prostoserdov. Drying processes were carried out in accordance with the recommendations of Z.S. Iskandarov in the methodological literature "Scientific basis of regulating the thermal process of drying of high-moisture bakery products" [8-12].

The amount of soluble dry matter and sugar in grape pulp was determined in accordance with the governmental standard (GOST) 27198-87 "Fresh grapes: Methods for determining the mass concentration of sugars" [8].

Moisture of dried raisins in the method of drying to the absolute weight GOST 8756.2-82 "Products of processing of fruits and vegetables: Methods of determination of dry matter and moisture", and in accordance with GOST 6882-88 "Dried grapes: Technical environment" [9].

Statistical analysis of the results of the study was performed in computer programs "Excel 2010" and "Statistica 7.0 for Windows" with a confidence interval of 0.95% using the method of "Statistics for experimenters: an introduction to design, data analysis and model building" by Box and others [10].

All studies related to the organization of the drying process of grape varieties also used methods recommended by scientists such as A.V. Lykov and L.Ya. Auerman, and M.M. Mirzaev [11, 12].

3 Results and discussion

Analysis of the main characteristics of the studied raisin varieties of grapes showed that Katta Kurgan (Mask), Sultani, Kara Djandjal, Hussaine nutmeg, Nimrang and Guzal kara varieties are all suitable for obtaining quality hermione raisins. Because these entire grape varieties produce large clusters, their clusters vary from 21x15 mm in the Nimrang variety to 30x30 cm in the Large Kurgan (Mask) variety.

Resistance of grape varieties to common diseases is also an important economic indicator in the regions where raisin varieties of grapes are grown. In recent years, observations of grape varieties affected by oidium disease have shown that most of them have moderate resistance. Only the Katta Kurgan (Mask) and Kara Djandjal varieties were found to be intolerant to this disease.

The cold tolerance of the studied varieties was low, with 3 in most varieties, and even weaker resistance (4 points) observed in only Kara Djandjal variety.

Vine is a relatively demanding plant to soil moisture, and this has been reflected in the variation of yields relative to soil moisture over the years of research in all varieties studied.

The study of the biological development of grape varieties studied in the conditions of weakly saline soils of Surkhandarya province showed that all varieties were able to withstand this salinity of the soil, and this did not significantly affect the yield and quality. Exceptionally, Guzal kara was a black variety, which showed negative conditions in the growth and development of this variety in soils with low salinity, which was reflected in the fact that the plant lags behind in growth, its yield is slightly lower than in non-saline soils (see Table 1).

Table 1. Agrobiological characteristics of regionalized grape varieties in Uzbekistan, 2012-2019.

Varieties	Grape size, mm	Oidium resistance	Frost resistance (5 point scale)	Moisture requirements	Salt resistance	Sugar content, %	Acidity, g/l	Group of ripening	Duration of the growing season, days	Sum of active temperature, °C	Date of ripening
Katta Kurgan (Mask) – control	30x30	unbearable	3	+	+	24-26	4.3	Average late	150-160	3.600	Sep 15-25
Sultani	25x24	average	3	+	+	25-27	4.1	Average late	148-154	3.400	Sep 8-15
Kara Djangjal	27x24	unbearable	4	+	+	23-24	4.6	Average late	138-145	3.500	Sep 5-10
Hussaine nutmeg	32x20	average	3	+	+	26-27	4.4	Average late	140-145	3.400	Sep 4-11
Nimrang	21x15	average	3	+	+	23-24	5.1	Average late	155-162	3.300	Sep 8-14
Guzal kara	27x22	average	3	+	-	25-26	6.0	Average late	136-140	2.800	Aug 25-31

It is known that the sugar content and acidity of rye juice in grape varieties are important technological indicators. This is because the yield of the product during drying (sugar content) and its quality indicators (sugar and acid content) are directly related to the amount and ratio of these substances. Laboratory analysis of the cultivars of the studied varieties during the technical period showed that the sugar content of the cultivars of Sultani and Hussaine nutmeg varieties was 1-2% higher than the control - Katta Kurgan (Mask) cultivar. In Kara Djangjal and Nimrang, on the other hand, the sugar content of bunch juice was 1-2% lower than in the control variant. It should be noted that, although lower than the control variant, the sugar content of these varieties is sufficient condition for the preparation of raisins. The sugar content of the remaining varieties was expressed as an indicator of the control variant.

The sugar content of bunch juice was significantly higher than the control variant only in Nimrang and Guzal kara varieties. This indicator of the remaining varieties had an expression of deviation from or less than that of the control variant.

It should be noted that in viticulture farms specializing in raisin drying, the ripening time and duration of varieties is an important economic indicator. This is due to the fact that when there are varieties of grapes that ripen and are stored at different times, it allows extending the period of uninterrupted delivery to the consumption and processing

departments from the time of cutting in the vineyard. This is one of the most important technological and economic elements, especially in the cultivation, care and quality improvement of raisin grapes, which allows organizing a conveyor for the production of environmentally friendly products and raisins.

The ecological conveyor of grape cultivation is organized on the principle of ripening grapes of the same variety at different times in different regions. The variety conveyor, which is an effective way to increase the supply of grapes in the same ecological conditions of the farm, allows solving the problem of increasing the supply of grapes from the vineyard as much as possible and creating favorable organizational and economic conditions for harvesting.

In other words, early ripening, the characteristics that determine the marketability of the product grown, the density of vines, low temperatures, and disease and pest resistance are the main criteria for technological evaluation of grape varieties in the development of such conveyors.

Analysis of the data in the table above shows that the current production of grape varieties grown in the country meets modern production-biological and technological requirements - the presence of a group of varieties ripening at different times from early ripening to late maturity, the size of one grape, resistance to common diseases and pests does not fully meet other requirements. This, in turn, affects the efficiency of the raisin industry. Because all raisin varieties start to ripen after the end of the summer rainless season, and the drying period is very short. This requires that farms that specialize in grape drying organize grape drying only for a very short period of the year.

In recent years, the Research Institute of Horticulture, Viticulture and Enology named after M. Mirzaev has been creating a small number of new varieties and hybrids of grapes. The presence of the above-mentioned very early and early ripening varieties and hybrids in the production of raisins expands the ampelographic potential of raisin varieties in the country, increases gross productivity and yield quality, creates conditions for extending the drying period by 20-25 days per year compared to late varieties. development and increase of its efficiency, creation of compact ecological drying conveyors of two-three varieties of early ripening in the regions of the republic, and eight-ten-variety cultivating conveyors on farms, creation of conditions for using economically high and energy-saving methods of grape drying.

It should be noted that in farms specializing in drying grapes, the yield of raisin varieties is also one of the most important economic indicators. After all, the efficiency of each technological process is directly assessed by the output of the product and its cost. In this case, the role of high-yielding varieties of grapes is high, which, in addition to increasing production productivity, reduces the cost of production, provides the population with cheap and high-quality products.

Analysis of the yield characteristics of the studied varieties showed that the highest number of single-vine branches was observed in Sultani and Nimrang varieties. In them, this biological indicator was 2.1-2.2% higher than the control - Katta Kurgan (Mask) variety (22.1). Although insignificant, the number of single-bunched vines compared to the control variant was also recorded in the Guzal kara variety. The remaining varieties had control options and slightly lower rates.

The same trend was observed in the number of two-vine branches as in one-vine branches. Consequently, a higher rate of control of the two vine branches was recorded in the Sultani and Nimrang varieties. In all other varieties, the amount of double-stemmed twigs was less than the control variant.

Depending on the amount of one- and two-vine branches, the total number of harvested branches had a higher expression than the control in the Sultani and Nimrang varieties. The

number of fruiting branches of the remaining varieties was at or slightly below the level of the control variant.

In the studied raisin grape varieties, the number of grape bunches corresponding to one yielding twig and one developed twig was almost in close range. With the exception of Kara Djandjal, Nussaine nutmeg and Guzal kara varieties, the number of grape bunches per plant (1.18-1.21), as well as each developed branch (0.22-0.24) is lower than the control variant in the indicators (see Table 2).

Table 2. Fertility indicators of grape raisin varieties, 2012-2019 (load 120 buds).

Varieties	Yield fertility of branches, %			Number of grape bunches, pcs	
	One grape bunch	Two grape bunches	Total	On one fruitful branch	On one advanced branch
Katta Kurgan (Mask) – control	22.1±1.1	4.3±0.8	26.4	1.31±0.6	0.30±0.05
Sultani	24.3±1.6	5.2±0.9	29.5	1.34±0.8	0.33±0.08
Kara Djandjal	20.8±1.4	3.7±0.7	24.5	1.18±0.8	0.22±0.07
Hussaine nutmeg	21.3±1.5	4.1±0.6	25.4	1.20±0.7	0.24±0.06
Nimrang	24.2±1.3	5.1±0.5	29.3	1.30±0.6	0.31±0.05
Guzal kara	22.4±1.2	3.8±0.4	26.2	1.21±0.5	0.22±0.06

It should be noted that the average weight of grape bunches is a feature of the variety, and in all the studied varieties formed large vines, typical of large-fruited varieties. In this control, the largest grape bunches were recorded in the Sultani variety compared to the Katta Kurgan (Mask) variety (407.5 g). The average weight of grape bunches of this variety reached about 725.2 g. In other varieties, close to control, but significantly lower - about 350.5–405.3 g of grape bunches were formed.

Our observations show that, depending on the average weight of the grape bunches, the average yield per unit area corresponding to a single-stemmed branch varied. In this case, the highest average yield of a single-fruited branch, as a rule, was observed in the Sultani variety. The average yield per unit area of this variety was 971.8 g. This is 438 g higher than this figure of the control variant. In all other raisin grape varieties, this figure was lower than the control variant and varied around 424.1–495.2 g by variety (see Fig. 1).

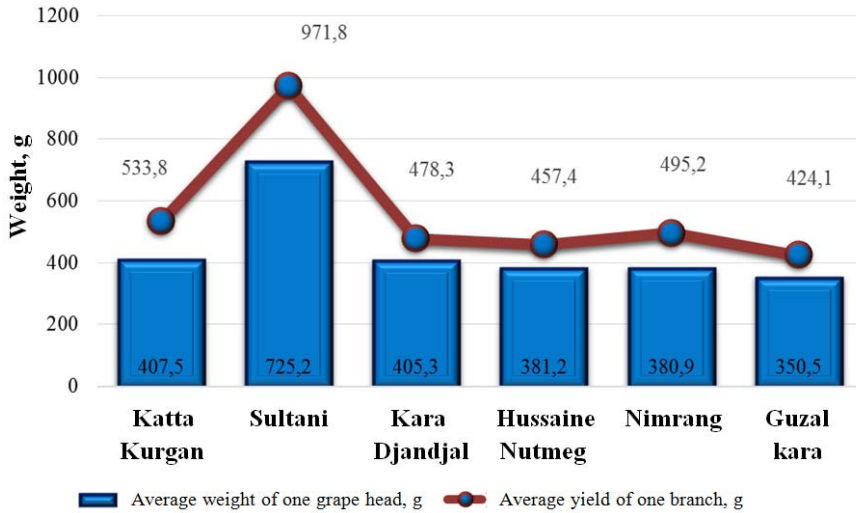


Fig. 1. Average weight of the vine and the productivity of the twigs of grape raisin varieties.

It is known that productivity is the most important economic indicator of any agricultural crop. This is especially important in raisin grapes grown on farms that specialize in grape drying. Analysis of the yield of grape varieties studied showed that the highest yield was recorded in the Sultani variety compared to the control - Katta Kurgan (Mask) variety. The yield of this variety was 5.7 tons/ha higher than the control variant. High yields were also recorded in the control variant, as well as in Kara Djandjal, Nimrang and Guzal kara varieties. Only the productivity of the Hussaine nutmeg variety was at the level of the control variant, but significantly lower (see Fig. 2).

From the data in this figure, it can be noted that all of the studied raisin grape varieties are highly productive and can be grown on farms specializing in the production of dried grape products as a control option and even higher yields. After all, the output of more raw materials per unit area is an important economic indicator that allows increasing labor and production productivity.

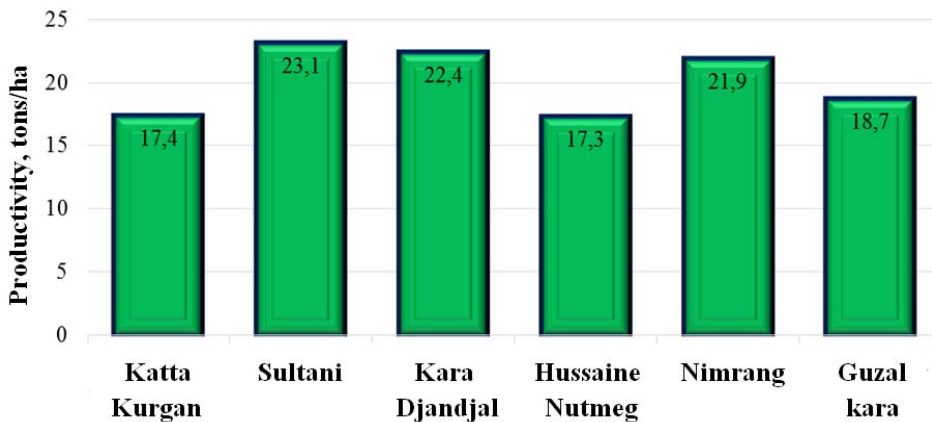


Fig. 2. Yield indicators of raisin varieties of grapes, quintals/ha (2012-2019).

The mechanical properties and biochemical composition of the varieties of grapes used in the production of raisins from dried grapes are of great importance. After all, the yield of raisins from grapes and its quality depends directly on the mechanical properties and

biochemical composition of the vine. Consequently, the higher the solubility of dry substances such as sugar in grape pulp, the higher the yield of the finished product.

In the case of low-sugar grape raw materials, not only the percentage of finished product is reduced, but also a strong decrease in product volume due to the lack of dry matter, which is negatively reflected in the overall appearance and consistency of raisins.

The better the grape bunch is developed, the larger, the looser the clusters at the beginning of the vine, the higher the quality of the raisin output. In addition, the high content of dry matter in the grape pulp, including its high sugar content, softness and high texture of the skin, ensures the abundance of high-quality raisins from this grape variety.

Mechanical analysis of the vines of the studied raisin varieties of grapes showed that the highest number of bunches on the bunch of grapes was recorded in the Sultani variety. The number of clusters in the grape of this variety increased to 101, which is 30 more than the control variant. An indicator close to the control variant was recorded in the Kara Djandjal variety. In the remaining varieties, the number of clusters per vine varied around 54.6–61.4 (see Table 3).

Table 3. Analysis of the mechanical composition of grape bunches and bunches of grape varieties (2012-2019).

Varieties	Average weight of grape bunch, g	Average number of clusters on the bunch of grapes, pcs	Mechanical composition of grape bunch, %			
			Juice	Stem	Hard part of the skin and flesh	Seeds
Katta Kurgan (Mask) – control	407.5±5.5	70.0±2.5	76.3	3.1	18.5	2.1
Sultani	725.2±6.8	101.1±4.1	73.1	3.6	19.7	3.6
Kara Djandjal	405.3±5.8	70.2±3.2	75.5	2.5	18.8	3.2
Hussaine nutmeg	381.2±4.2	54.6±3.5	76.5	2.4	18.1	3.0
Nimrang	380.9	58.5	71.8	3.0	21.4	3.8
Guzal kara	350.5	61.4	75.7	2.5	18.3	3.5
<i>LSD₀₅</i>	22.0	4.3				
<i>Sx</i>	3.65	0.72				

Analyses showed that the seeds were higher than this indicator of the control variant in all varieties. This situation is explained by the fact that the control - Katta Kurgan (Mask) variety is not well pollinated and less seeds are formed in it.

In grape varieties, the size of the bunch is an important technological indicator. Observations showed that the weight of 100 bunches varied from variety to variety depending on the characteristics of the variety, i.e. the size of one bunch. The highest rate of control was recorded in the Sultan variety. It was observed that the weight of 100 bunches in this variety was 134.8 g heavier than in the control - Katta Kurgan (Mask)

variety. High performance compared to the control variant was also observed in the Hussaine nutmeg and Nimrang varieties. The weight of 100 units of the remaining varieties was at the level of the control option or slightly less (see Fig. 3).

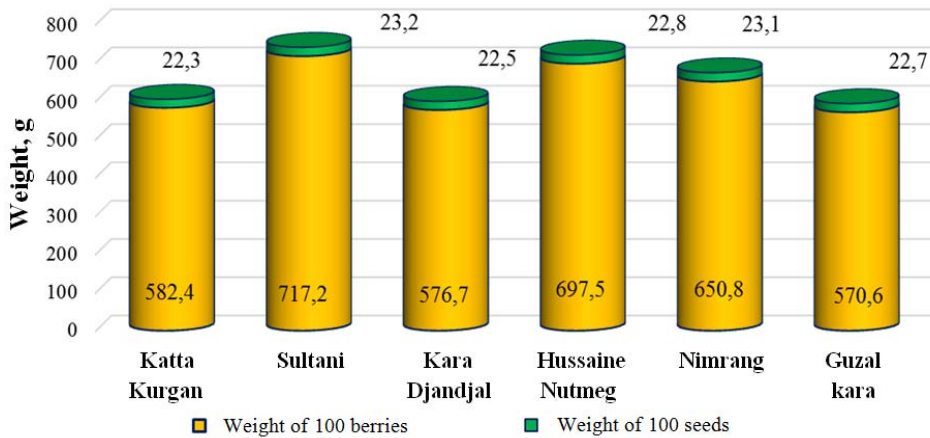


Fig. 3. Raisin grape varieties have an average weight of 100 berries and seeds (2012-2019).

Analysis of the weight of 100 seeds of raisin grape varieties showed that this agrobiological index did not differ significantly by variety and varied around 22.3-23.2 g. In this case, the control - slightly larger seeds than the seeds of the Katta Kurgan (Mask) variety were recorded in the Sultani and Nimrang varieties.

It is known that when drying raisin varieties of grapes often have to lift them from the band. These actions are carried out during the cutting and transportation of grape bunches, pre-treatment before drying of grape bunches (washing, blanching in boiling alkaline solution, smoking, placing on trays, and regular turning during drying). At this time in the brittle grape varieties can be observed a large shedding of bunches. Therefore, the transportability of raisin varieties is also one of the important production indicators.

The transportability values of the grape bunch are determined by the weight that falls from the bunch of grapes and the weight that is expended for its crushing. Analysis of these transportability indices of grape-studied varieties of grapes showed that the highest weight used to crush the bunch was recorded in the Nimrang variety. This figure was 386 g higher than that of the control variant for crushing, indicating that its transportability was the highest. The weight used for the crushing of the husk was also higher than this figure of the control variant in the remaining varieties and varied around 1,804-1,920 g, respectively, according to the varieties.

The weight required to break the bunch of grapes also differed by variety. In this case, the highest weight required to break the attack was recorded in the Nimrang variety. This variety required a weight of 301 g to break from the band, and this figure was 45 g higher than that of the control variant (see Fig. 4).

Picture data show that the smallest weight required to break the attack was recorded in the Sultani variety. It took 256 g of weight to break off the band of this variety, and this figure is 30 g less than this figure of the control variant. In the raisin-rich varieties of grapes, the weight required to break the bunch was at the level of the control variant, in particular at the level of differentiation in one way or another, and varied around 278-289 g by variety. It can be seen that the transportability of all studied varieties is at the level of the control option or even higher in some varieties, which ensures a significantly higher quality of the organization of pre-processing of grapes before harvesting, transportation, drying.

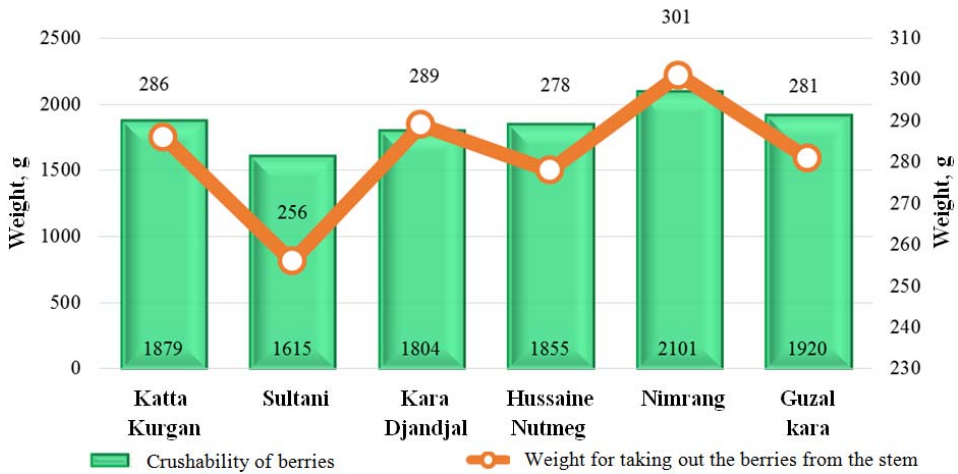


Fig. 4. Indicators of transportability of grape bunches and bunches of grape varieties (2012-2019).

In the production of raisins from grapes is an important indicator of water-soluble dry matter, in particular the amount of sugar and the concentration of organic acids. The high content of dry matter dissolved in such water in the composition of the bunch of grapes increases the yield of quality raisins.

Our laboratory analysis of the chemical composition of raisin grape varieties showed that the refractometric index of soluble dry matter in raisin juice was highest in Sultani and Kara Djandjal varieties, which were 26.7 and 26.1 °Brix, respectively. This is 1.5 and 0.8 °Brix higher than this value of the control variant. The lowest value of soluble dry matter - 23.2 °Brix was observed in Guzal kara variety. The remaining varieties took an intermediate place among these varieties in terms of the amount of soluble dry matter, and in them this figure ranged from 24.1 to 24.6 ° Brix.

Analysis of the total sugar content of the bulk showed that its amount varied in direct proportion to the soluble dry matter by variety. Consequently, the highest value of sugarcane was recorded, as a rule, in the Sultani and Kara Djandjal varieties. The sugar content of these varieties reached 25.1-25.3% during the period of technical ripening. This means that the control - Katta Kurgan (Mask) variety is 1.0-1.2% higher than this figure (see Table 4).

The lowest sugar content of bunch juice was observed in Guzal kara variety, which had a sugar content of 22.9%. The sugar content of the remaining varieties ranged from 23.0 to 23.3%, respectively, and took an intermediate place among the above varieties. The data in the table show that the acidity of the buckwheat juice varied across varieties regardless of sugar content. The highest acidity was recorded in Kara Djandjal variety. The acidity of this variety was 1.0% higher (4.8%) than that of the control-Katta Kurgan (Mask) variety (3.8%).

High acidity was also observed in the Guzal kara variety compared to the control variant and differed from the control by 0.5% accordingly. Low levels of acidity compared to controls were noted in Sultani, Hussaine nutmeg and Nimrang varieties. The acidity of these varieties averaged around 3.2–3.7%, which is 0.1–0.6% lower than the acidity of the control variant.

The data in the table again made it possible to note that the difference in acidity in one way or another depended more on the color of the batch, rather than on the amount of sugar. At the same time, high acidity was observed in black varieties, and low in white varieties.

Table 4. Chemical composition of grape juice of raisin varieties of grapes (2012-2019).

Varieties	Soluble dry matter, °Brix	Total carbohydrates, %	Acidity, %
Katta Kurgan (Mask) – control	25.2±1.3	24.1±0.9	3.8±0.2
Sultani	26.7±1.6	25.3±1.0	3.5±0.3
Kara Djandjal	26.1±1.5	25.1±0.9	4.8±0.3
Hussaine nutmeg	24.6±1.4	23.3±0.8	3.2±0.2
Nimrang	24.1±1.4	23.0±0.7	3.7±0.2
Guzal kara	23.2±1.3	22.9±0.8	4.3±0.4
<i>LSD₀₅</i>	<i>1.1</i>		
<i>Sx</i>	<i>0.19</i>		

Experiments on the drying of raisin varieties of grapes showed that the duration of drying, the time elapsed before the release of the finished product, did not differ significantly by variety and included an average of 9-12 days. It should be noted that the duration of the construction period depended more on the structure than on the chemical composition of the attack. Consequently, it was observed that the construction period was prolonged in varieties with spherical inflorescences (Sultani, Katta Kurgan (Mask)), while in elongated and cylindrical infested varieties (Hussaine nutmeg), on the contrary, it reached the appropriate condition in a shorter period (18%). For example, the drying time of the Sultani variety before reaching the required condition was 12 days, while in the Hussaine nutmeg variety the duration of this period did not exceed 9 days.

In production conditions, along with the duration of the drying period of grapes, the yield of the finished product is the most important economic indicator. Comparison of raisin varieties of grapes according to the output of the finished product allowed determining a certain difference. Consequently, the highest hermine yield from the studied varieties was recorded in the Sultani variety. The yield of the finished product of this variety was 25.6%, which is 0.8% higher than this indicator (24.8%) of the control - Katta Kurgan (Mask) variety. The lowest dried yields in the studied grape varieties were recorded in Hussaine nutmeg and Guzal kara varieties - 23.9 and 23.8%, respectively. In the remaining raisin-rich varieties of grapes, the yield of the dried product was intermediate and varied by an average of 24.1–24.2% (see Table 5).

Analysis of the sugar content of the dried product showed that this figure was directly related to the amount of sugar in the raw material. As a rule, the highest sugar content in the hermine variety was 70.9% in the Sultani variety. This is 6.3% higher than the control variant (64.6%).

The table data show that the sugar content of the finished product was also insignificantly higher in the Kara Djanjal variety than in the control, and the difference was 3.2%. Of the remaining grape varieties studied, the sugar content of the hermine product was at or slightly below the control variant level and ranged around 61.2–64.1%.

Table 5. Drying times of grape varieties and yield of dried product (2011-2013).

Varieties	Drying time, days	Output of dried products, %	Carbohydrates, %	Acidity, %
Katta Kurgan (Mask) – control	11±1.4	24.8±1.3	64.6±2.2	1.4±0.2
Sultani	12±1.5	25.6±1.5	70.9±2.8	1.3±0.1
Kara Djandjal	12±1.3	24.2±1.3	67.8±2.5	1.9±0.3
Hussaine nutmeg	9±1.1	23.9±1.2	64.1±2.3	1.1±0.2
Nimrang	10±1.3	24.1±1.2	62.4±2.2	1.4±0.3
Guzal kara	10±1.2	23.8±1.1	61.2±2.0	1.7±0.2

Analysis of the acidity of the hermione product obtained from raisin varieties of grapes also made it possible to observe a similar trend in sugar. Consequently, the highest acidity in hermione was recorded in Kara Djandjal and Guzal kara varieties. The average acidity of the hermione product prepared from these varieties was 0.3-0.5% higher than this indicator of the control variant and was 1.9% and 1.7%, respectively, for the varieties. The lowest acidity was recorded in Hussaine nutmeg (1.1%). The acidity of the hermione product of the remaining varieties was at the control variant level and varied around 1.3–1.4% (see Table 6).

Table 6. Weight and volume of hermione product made from raisin varieties of grapes (2012-2019).

Varieties	Weight of 100 raisins, g	Relative to the control, g	Volume of 100 raisins, cm ³	Relative to the control, cm ³
Katta Kurgan (Mask) – control	144.4±3.8	-	113.2±2.9	-
Sultani	183.6±5.6	39.2	133.1±3.1	19.9
Kara Djandjal	139.6±3.4	- 4.8	99.4±1.9	- 13.8
Hussaine nutmeg	166.7±4.1	22.3	116.5±2.1	3.3
Nimrang	156.8±4.0	12.4	106.3±2.0	- 6.9
Guzal kara	135.8±3.2	- 8.6	93.5±1.7	- 19.7
<i>LSD₀₅</i>	8.8		4.7	
<i>Sx</i>	1.47		0.79	

According to sources in the literature on food production technology, not only the chemical composition, but also the size and weight of raisins are important indicators for

their use in confectionery and cooking. A study of the weight and volume of the finished product of the studied varieties - 100 pieces of hermione - showed that the control was recorded in the largest raisin Sultani variety compared to the Katta Kurgan (Mask) navigator.

The weight of 100 hermione products of this variety reached 183.6 g, which is 39.2 g higher than the control variant. Compared to the control variant, large raisins were also recorded in Hussaine nutmeg and Nimrang varieties. The weight of the raisins obtained from them was 22.3 and 12.4 g heavier than the control, respectively.

The data in the table above show that the size of the germs also varied depending on the size of the invasion of the varieties. The largest volume of raisins compared to the control variant was recorded in the Sultani and Hussaine nutmeg varieties, as a rule. The volume weight of 100 hermione products of these varieties was 133.1 and 116.5 cm³, respectively. This is 19.9 and 3.3 cm³ higher than the control variant (113.2 cm³), respectively. The volume of hermione products of the remaining varieties was at the level of the control variant, only at slightly lower rates.

Organoleptic (tasting) evaluation of hermione product made from raisin varieties of grapes showed that raisins rated higher in appearance than the control were recorded in Sultani and Hussaine nutmeg varieties (see Table 7).

Table 7. Tasting price of hermione product made from raisin varieties of grapes.

Varieties	Appearance			Taste (3.0-4.0)	Consistency (0.5-1.0)	Seed separation (0.5-1.0)	Overall price
	Size (1.5-2.0)	Smoothness (0.5-1.0)	Color (0.5-1.0)				
Katta Kurgan (Mask) – control	1.5	0.6	0.7	3.5	0.8	0.7	7.6
Sultani	1.7	0.7	0.6	3.2	0.5	0.5	8.0
Kara Djandjal	1.6	0.8	0.7	3.5	0.8	0.7	7.6
Hussaine nutmeg	1.8	0.7	0.7	3.7	0.8	0.7	7.9
Nimrang	1.5	0.7	0.7	3.4	0.8	0.7	7.6
Guzal kara	1.5	0.8	0.7	3.5	0.8	0.7	7.5

The tasting price of hermione product made from grapes of this variety was the highest - 8.0 and 7.9 points, respectively, for varieties.

A low rating for control was given only to the hermione product made from the Guzal kara variety. The price of this variety was 7.5 points. The dried product of the remaining varieties was evaluated at the control variant level and the total score was 7.6 points

It should be noted that the taste of hermione products made from Hussaine nutmeg was the highest. This situation is explained by the presence of a specific nutmeg taste in the varieties.

4 Conclusions

1. All the studied raisin varieties of grapes, such as Katta Kurgan (Mask), Sultani, Kara Djandjal, Hussaine nutmeg, Nimrang and Guzal kara, allow you to get quality hermione raisins. Because all of these varieties form large clusters, their clusters vary from 21x15 mm in the Nimrang variety to 30x30 cm in the Katta Kurgan (Mask) variety.

2. In viticulture farms specializing in raisin drying, the ripening time and duration of varieties is an important economic indicator. In Uzbekistan, the majority of regional grape varieties ripen in late August to September, which means that they form an average group of late varieties.

3. The average weight of grape bunches is a feature of the variety, and in all the studied varieties formed large vines typical of large-fruited varieties. In this case, the largest grape bunches were recorded in the Sultani variety in comparison with the control (407.5 g) of the Katta Kurgan (Mask) variety. The average weight of grape bunches of this variety reached about 725.2 g. In other varieties, close to control, but significantly lower - about 350.5–405.3 g of grape bunches were formed.

4. The highest yield was recorded in the Sultani variety (23.1 tons/ha). The yield of this variety was 5.7 tons/ha higher than the control variant. High yields were also recorded in the control variant, as well as in Kara Djandjal, Nimrang and Guzal kara varieties (22.4; 21.9 and 18.7 tons/ha, respectively). Only the productivity of the Hussaine nutmeg variety was at the level of the control variant, but significantly lower.

5. The highest number of bunches on the vine was recorded in the Sultani variety. The number of clusters in the grape of this variety has increased to 101, which is 30 more than the control variant. An indicator close to the control variant was recorded in the Kara Djandjal variety. In the remaining varieties, the number of clusters per vine ranged from 54.6 to 61.4.

6. Nimrang variety had the highest transportability. It required 2,101 g of weight to crush its bundles and 301 g to break its bundle. The lowest transportability was recorded in the Sultani variety – 1,615 and 256 g, respectively. In the remaining varieties, the transportability was at the level of the control option and varied around 1,804–1,920 and 278–289 g, respectively.

7. Sultani and Kara Djanjal varieties were distinguished by high sugar content (25.1–25.3%). The lowest sugar content of bunch juice was observed in Guzal kara variety, which was 22.9%. The sugar content of the remaining varieties ranged from 23.0 to 23.3%, respectively, and took an intermediate place among the above varieties.

8. The highest hermione output was recorded in the Sultani variety - 25.6%. The yield of the finished product in this variety was 0.8% higher than in the control - Katta Kurgan (Mask) variety (24.8%). The lowest yields in the studied grape varieties were recorded in Hussaine nutmeg and Guzal kara varieties - 23.9 and 23.8%, respectively. In the remaining grape varieties, the yield of the dried product was intermediate and varied by an average of 24.1–24.2%.

9. The highest sugar content in hermione was 70.9% in the Sultani variety. In the Kara Djanjal variety, it was also insignificantly higher than the control (64.6%) and the difference was 3.2%. The sugar content of the remaining grape varieties was at or slightly below the level of the control variant and ranged around 61.2–64.1%.

10. The highest organoleptic value of hermione product made from raisin varieties of grapes was recorded in Sultani and Hussaine nutmeg varieties. The tasting price of hermione product made from grapes of this variety was the highest - 8.0 and 7.9 points, respectively, for varieties. The lowest grade compared to the control was given only to the hermione product made from the Guzal kara variety (7.5 points). The dried product of the remaining varieties was evaluated at the level of the control variant (7.6 points).

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