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Ampelographic and phenotypic bases of improvement of some grape varieties

Vugar SALIMOV[1], Movlud HUSEYNOV[2*], Azer SHUKUROV[1], Afet HUSEYNOVA[1], Hikmat NASIBOV[1], Vusala SHUKUROVA[1], Elnura MUSAYEVA[1], Khuraman ABASOVA[1], Aida Najafova[1]

[1]Scientific Research Institute of Viticulture and Winemaking, Baku, Azerbaijan, E-mail: movludh@mail.ru

[2]Azerbaijan State University of Economics (UNEC), Baku, Azerbaijan, E-mail: movlud.huseynov@unec.edu.az

*Corresponding Author

Abstract

During the research, the prospects of a number of local and introduced seedless grape varieties were evaluated on the basis of a "new model", which includes 25 ampelographic indicators of OIV, and morphometric sizes of berries and bunches, including yield indicators, were studied. It was revealed that the grape varieties differ significantly in their ampelodescriptor indicators. The overall assessment of prospects, calculated from the score which was obtained for each descriptor indicator, significantly differed by grade and changed in a wide range from 101.8 (Khyrcha kishmish) to 162.5 (Sultany kishmish) points. It was determined that 1 variety is unpromising, 3 varieties are quite promising, 14 varieties are extremely promising in comparison with the control.

Researches have shown that the studied grape varieties also differ significantly in the yield of the vine. So, this indicator ranged from 5.3 (Khyrcha kishmish) to 12.8 kg (Attica). Mathematical and statistical analysis of the significance level of the average yield of the studied varieties compared to the control (by U-factor) and the average growth compared to the control (Δ ,%) showed that only three of the local varieties (Ag oval kishmish, Ag kishmish, Gara kishmish), and six of the introduced varieties (Attica, Superior, Autumn Royal, Danuta, Centennial seedless, Sultanina) have significant reliability compared to the control variety Asgeri. Compared with the control, the average growth of the varieties of Kishmish Sogdiana, Kishmish Zarafshan, Sary kishmish, Khyrcha kishmish, Gyrmyzy kishmish was zero or negative (0 and -29.4%), while other varieties (Ag oval kishmish, Gara kishmish, Chahrayi kishmish, Attica, Superior, Danuta, etc.) had a significant positive growth (5.6-88.2%).

Keywords: ampelographic descriptors, grape variety, local variety, bunch, berry, ampelographic collection.

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Introduction

Viticulture and wine-making, being the oldest economic and industrial branch, is still one of the main directions of development of the country's economy.

Currently, in the world, including in our country, due to the need to produce high-quality food, there is a great need for seedless (suitable for the production of sultana) grape varieties with high dietary and nutritional properties. Despite the great importance of these varieties in the world viticulture, their number does not exceed 150. Despite the fact that the berries of native seedless varieties are mostly small (the exception is new seedless varieties of hybrid origin with large berries), these varieties are distinguished by a large bunch size, high yield, commercial and taste qualities and sugar content. They are characterized by instability to diseases and pests, also to frost, drought and other stress factors (Vasylyk 2008; Golodriga & Troshin 1980; Karadzhi et. al. 1977; Panahov et. al. 2010; Petrov & Talash 2015; Podvalenko 2009).

The above disadvantages (small berries, instability to diseases and pests, frost, drought and other stress factors) are also inherent in the seedless varieties of our country. With this in mind, valuable native seedless grape varieties of Azerbaijan should be comprehensively evaluated and involved in improvement programs (Gubler & Genkin 1973; Kashirina 2015; Krasokhina & Ganich 2006; Gurbanov & Salimov 2010). Due to the above disadvantages, farmers have a low interest in local seedless varieties. Therefore, large-berried seedless grape varieties are imported in Azerbaijan from abroad and grown there.

Taking into account the above-mentioned, the purpose of our research work was a comparative study of the morphological, biological and technological features of local and introduced seedless grape varieties, including selection, reproduction and recommendation to farmers of high-yield, high-quality, large-berried local seedless genotypes with high commercial qualities.

Azerbaijan has a rich genetic diversity of grapes. The genotypes of grapes are distinguished by a wide polymorphism. Their populations, being formed from various biotypes, clones, forms, variations, are hereditary carriers of economically and selectively valuable signs. For this reason, it is necessary to determine, collect, reliably preserve and transmit each grape genotype available in the gene pool to the next generations through effective use. It is important to achieve satisfaction of the needs for viticulture and wine-making products and ensure the continued development of this industry by maximizing the potential of these genotypes. From the point of view of solving this problem, clone selection of grapes, hybridization and ampelographic studies have wide opportunities.

In the process of change of a number of previously cultivated valuable grape varieties, due to the impact of various factors (anthropogenic, environmental, genetic, etc.), as a result of changes in agriculture and ecology, many valuable and selectively significant features have deteriorated or been lost. This, in turn, led to the fact that they were left out of attention when creating new farms. In addition, a number of varieties (genetically modified), being a product of the modern development of breeding and biotechnology, displace local traditional varieties from farms.

Observations have shown that during long-term cultivation for various reasons even among these varieties it were appeared forms with positive and negative signs that differ from each other. In some cases, in the populations of these varieties, plants with negative signs, such as weak growth, susceptibility to diseases and pests, small size of bunches and berries, excessive shedding of flowers and uneven color of berries, make up the majority. This generally reduces the yield and worsens the quality of the grape variety, negatively affects its biological and genetic nature. Therefore it is necessary to carry out works on the genetic improvement of varieties in the local ancient populations of grapes. To do this, it is advisable to use such methods as clone selection, approbation, individual and mass selection. Recently, these methods have been widely used in viticulture.

Due to the above, it is considered relevant to attract to the breeding improvement program traditional grapevine varieties that are highly adaptable to local conditions, are resistant to biotic and abiotic factors and have high taste qualities, but do not meet the requirements of a modern market economy for a number of biological and production-technological indicators. Based on the above-mentioned, in 1998-2020, the scientific research was carried out to study clone selection of indigenous and introduced grape varieties grown in the ampelographic collection of The Azerbaijan Research Institute of Viticulture and Wine-making.

Material and Methods

The research was carried out in 1998-2020 in the conditions of the Absheron and Jalilabad regions of Azerbaijan on the vines of a number of local and introduced seedless grape varieties involved in the improvement program; their biomorphological, technological features, mechanical and chemical composition and prospects were evaluated using traditional and modern methods. The international descriptors of International Organization of Vine and Wine (OIV) were used for digital coding of botanical signs, agrobiological, economic-technological, phenotypic features and for assessment of their prospects. The prospects of seedless grape varieties were evaluated on the basis of a "new model", which includes 25 international descriptors of OIV (Avidzba et. al. 2009; Borisenko et. al. 2015; Masyukova 1973; Guseinov et. al. 2021). The actual data obtained as a result of the research were mathematically processed, the degree of reliability of the results was

verified by a nonparametric method (U-factor) (Borisenko et. al. 2015; Kashirinova 2015; Radchevsky & Troshin 2008; Rokitsky 1973).

Clonal selection was carried out in accordance with the generally accepted method of "Choosing of high-yielding, high-quality plants with adaptive and other positive properties by the way of individual selection and their further reproduction". Morphometric indicators (size of bunches and berries, etc.), yield indicators (coefficient of productivity of fertile shoots, number of bunches, mass of bunches, degree of shedding of berries in a bunch, number of berries in a bunch, weight of 100 berries, etc.), features of growth of plants, degree of resistance to diseases and pests, quality indicators (sugar content, index of yield of a shoot, organoleptic properties of grapes) of chosen plants were consistently studied for three years in population of each variety, then the best stable forms were selected.

The selection of economically valuable (high-yielding, high-quality, resistant to biotic and abiotic stress factors) grape plants by the step-by-step selection method proposed by I. A. Vasylyk (2008), P.Y.Golodriga and L.P.Troshin (1980), as a rule, is carried out for three years and consists of three stages. At the first stage of selection, 25% of plants with positive signs are chosen in the vineyards in autumn. At the second stage, 50% of the best plants chosen last year, or 10-12% of the total number of plants on the site, are selected. And at the third stage of selection, plants that are transgressive (most differing) in complex characteristics and plants with average indicators (which characteristic of grape varieties) are selected from the plants chosen at the first two stages. One group of plants selected at the third stage of selection is classified as a group of plants that deviate from the average indicator, the other group is classified as a group of plants with average phenotypic indicators. Grapevines that are below the average indicator at the second and third stages of breeding are excluded from the clone selection process. Plants with a complex of valuable traits that have reached the last stage of selection are evaluated as primary clones (protoclons). Then the cuttings are prepared from them and they are planted on the test site for further study (Salimov 2016; Salimov 2014; Salimov et. al. 2016; Smirnov et. al. 1996). All these processes together constitute the primary stage of clone selection. Morphometric and agrobiological indicators of the selected grapevines are studied for 3-5 years or more. Dependence of these indicators on meteorological and other random factors is also determined (Salimov et. al. 2019; Smirnov et. al. 2002; Soldatov 1984).

Results and Discussion

Until recently, when introducing grape varieties in a certain zone, numerous indicators of morphological, biochemical, economic and technological features of grape varieties were traditionally used. Currently, the evaluation of the prospects of grape varieties is carried out in

digital form using more effective, reliable and operational methods. Depending on the requirements for grape varieties, a different number of the most important breeding and economic characteristics are invested in the selection and genetic program and the digital evaluation model by means of descriptors. Since the evaluated and improved features differ in significance, a "correction coefficient" or "significance coefficient" is applied separately for each feature (Avidzba et. al. 2009; Studennikova & Kotolovets 2016; Troshin et. al. 2015; Troshin & Magradze 2013).

When assessing yield of genotypes in populations of grape varieties and analyzing correlations between yield elements and a number of biomorphological features, it was revealed that there is a direct correlation between yield of grape plants and size and weight of bunches and berries, number of bunches, average mass of a bunch, weight of 100 berries, number of berries in one bunch, load of a plant with eyes, number of fertile shoots, and when identifying high-yielding genotypes (clones) as the main quantitative indicator, i.e., a sign of a phenotypic marker, it is advisable to use such markers as loading plant with eyes, number of bunches on a vine, mass of 100 berries (Masyukova 1973).

With this in mind, morphometric indicators were studied, including indicators of yield of bunches and berries of the studied seedless varieties. It turned out that number of bunches on a plant, which directly affects the formation of yielding of grape varieties, at the studied varieties was significantly different and ranged from 17.7 (Kishmish Zarafshan) to 40 (Chahrayi kishmish). Relatively few bunches were formed on the plants of Kishmish Sogdiana (19.3 bunches), Sultany kishmish (19.7), Ag kishmish (20.3), relatively many bunches were formed on the grapevines of Centennial seedless (33.7), Khyrcha kishmish (38.3) varieties. In other varieties, this indicator ranged from 22.3-30.3 bunches.

One of factors influencing formation of actual yield of grapes is average mass of bunches. This indicator varied significantly depending on the variety (from 162.6 g. in Khyrcha kishmish to 481.3 g. in Attica) and amounted to: Khyrcha kishmish – 162.6 g, Chahrayi kishmish – 200.0 g, Sary kishmish – 234.2 g, Gyrmyzy kishmish – 237.8 g, Kishmish Hishrau – 310.0 g, Kishmish Zarafshan – 319.3 g, Girde kishmish – 317.5 g, Asgeri – 321.0 g, Centennial seedless – 346.3 g, Ag oval kishmish – 349.3 g, Gara kishmish – 350.0 g, Kishmish Sogdiana – 370.2 g, Sultany kishmish – 395.5 g, Danuta – 413.0 g, Ag kishmish – 434.8 g, Superior – 440.0 g, Sultanina – 446.0 g, Attica – 481.3 g.

Based on the number of bunches formed on the grapevine and their mass, the economic (actual) yield is determined. The high value of these indicators has a positive effect on the average yield of the plant. In the course of research, it turned out that the studied grape varieties differ significantly among themselves in the yield of the grapevine. So, this indicator fluctuated in a wide

range between 5.3 (Khyrcha kishmish) – 12.8 kg/vine (Attica). In general, the average yield of the vine, being very different, was by varieties: Khyrcha kishmish – 5.3 kg, Sary kishmish – 5.4 kg, Kishmish Zarafshan – 5.5 kg, Gyrmyzy kishmish – 6.6 kg, Asgeri – 6.8 kg, Kishmish Sogdiana – 6.8 kg, Girde kishmish – 7.1 kg, Sultany kishmish – 7.2 kg, Kishmish Hishrau – 7.4 kg, Chahrayi kishmish – 7.9 kg, Ag oval kishmish – 9.8 kg, Gara kishmish – 10.0 kg, Ag kishmish – 8.3 kg, Danuta – 9.1 kg, Superior – 9.5 kg, Autumn Royal – 9.5 kg, Sultanina – 11.0 kg, Centennial seedless – 11.2 kg, Attica – 12.8 kg.

During the research, a mathematical and statistical analysis was carried out to determine the degree of significance of the average yield indicators (according to the U-factor) and the average increase compared to the control (Δ%). It was found that three local varieties (Ag oval kishmish, Ag kishmish and Gara kishmish) and six introduced varieties (Attica, Superior, Autumn Royal, Danuta, Centennial seedless and Sultanina) had a noticeable advantage compared to the control variety Asgeri. The difference between the other varieties and the control variety was not significant. When calculating the average increase compared to the control, it turned out that this indicator was zero or negative (0 and -29.4%) at the varieties Kishmish Sogdiana, Kishmish Zarafshan, Sary kishmish, Khyrcha kishmish, Gyrmyzy kishmish. At other varieties (Ag oval kishmish, Gara kishmish, Chahrayi kishmish, Attica, Superior, Danuta, etc.) it was positive and made 5.6-88.2%. The yield per 1 ha also varied in a wide range and changed from 117.8 (Khyrcha kishmish) to 284.4 c/ha (Attica).

One of the factors affecting the mass of bunches, as well as the yield of grapevine, is the size of berries. The size of berries is characterized by a mass of 100 berries. This indicator varied in the range: 138.7 g (Girde kishmish) – 245.0 g (Sultany kishmish) for local varieties (on average 175 g) and 233.3 g (Attica) – 496.7 g (Superior) for introduced varieties (on average 379 g). As you can see, the berries of local grape varieties are significantly smaller than the berries of introduced varieties.

The studied introduced grape varieties are varieties of hybrid origin, and the main goal in their breeding was to obtain varieties with a large size of berries. In order to check the degree of reliability of the difference between the weight of 100 berries in the control and in the studied varieties, mathematical and statistical analysis was carried out. It was found that the berries of local varieties do not differ too much from Asgeri variety (with the exception of Sultany kishmish – $p<0.05$). However, the berries of the introduced grape varieties are noticeably superior to the berries of the control variety and the difference between them is significantly reliable ($p<0.05$, $p<0.001$). When conducting studies the varieties with a mass of 100 berries less than 100 g were considered very small, with a mass of 110-300 g – small, with a mass of 310-500 g – medium, with a mass of

510-700 g – large, with a mass of 710-900 g or more – very large [4]. Based on this, it can be argued that by the weight of 100 berries, the studied varieties had small berries (Khyrcha kishmish – 135.3 g, Ag kishmish – 138.7 g, Sary kishmish – 153.3 g, Gyrmyzy kishmish – 158.3 g, Girde kishmish – 170.0 g, Ag oval kishmish – 163.7 g, Chahrayi kishmish – 165.0 g, Asgeri (control) – 203.3 g, Gara kishmish – 217.3 g, Attica – 233.3 g, Sultany kishmish – 245.0 g, Sultanina – 251.7 g) and medium (Kishmish Sogdiana – 332.7 g, Danuta – 339.3 g, Kishmish Hishrau – 384.0 g, Kishmish Zarafshan – 390.0 g, Autumn Royal – 492.0 g, Centennial seedless – 493.3 g, Superior – 496.7 g). There were no varieties with very small, large and very large berries among the studied grape varieties.

During the research which carried out using 25 morphobiological and technological descriptors selected from OIV ampelodescriptors and included in the "innovative perspective assessment model", the prospects of grape varieties were evaluated in points in digital format. It turned out that the grape varieties differ significantly among themselves on 25 ampelodescriptor indicators. Thus, on duration of the period from budding to berry ripening (OIV 629) 10 varieties were evaluated with 5 points (average maturity), 7 varieties – with 7 points (early ripening), and 1 variety (Gara kishmish) – with 9 points (very early ripening), on the number of fruitful shoots (OIV 153) all varieties were evaluated with 3-5 points (small or medium quantity), on the weight of one bunch (OIV 502) 10 varieties were estimated with 5 points (average: the mass of the bunch is **300-500** g), 8 varieties – with 7 points (large: the mass of the bunch is **501-700** g) (table 2). On indicator of grapevine yield (OIV 504) 3 varieties were medium-yielding (Kishmish Zarafshan, Kishmish Hishrau, Khyrcha kishmish – 5 points). Other varieties were high-yielding (7 points – 130-160 c/ha) and very high-yielding (9 points – 170 c/ha or more). This indicator significantly affects the overall assessment of the yield of grape varieties. Taking into account the share of the significance of the yield indicator in the assessment of prospects, the "level of prospects" or "correction factor" was awarded the highest coefficient - 2.5.

The studied varieties differed from each other to the greatest extent in the sugar content in berries (OIV 505). This ultimately affects the level of prospects of grape varieties. The amount of sugars in the berries is the second most important indicator among the indicators of prospects and its "correction coefficient" ("weight of the attribute") is 2.2. It was found that 3 varieties accumulate sugar in small amounts (3 points – 14-17 g/cm^3), 3 varieties – in average (5 points – 17-20 g/cm^3), 5 varieties – in high (20-23 g/cm^3), 7 varieties – in very high amounts (9 points-above 23 g/cm^3). The highest sugar content (7-9 points) was found in local seedless grape varieties. This, in turn, had a significant impact on getting them a high score when evaluating prospects. Relatively low sugar content was noted in Girde kishmish variety (5 points – 17-20 g/cm^3). Among the introduced

varieties, the varieties Kishmish Hishrau and Kishmish Sogdiana had high sugar content (7 points). The other varieties had low or medium sugar content (3-5 points).

One of the requirements for grape varieties, including seedless ones, is large size of berries. During the studies, berries less than 8 mm long were considered very small ones (1 point), 8-13 mm – small (3 points), 13-18 mm – medium (5 points), 18-23 mm – large (7 points), 23-28 mm and longer – very large (9 points) (Masyukova 1973).

In general, no varieties with very small berries were found during the studies. The berries of 3 varieties were small, the berries of 7 varieties were medium and large and the berries of 2 varieties (Autumn Royal and Centennial seedless) were very large. Among the local varieties (with the exception of Gara kishmish and Sultany kishmish), the berries were small or medium-sized. The introduced varieties (with the exception of Attica and Kishmish Sogdiana varieties – 7 points) had large and very large berries (7-9 points).

The "degree of uniformity" of berries in a bunch is one of the signs that affect the appearance and market value. Studies have shown that the grape varieties had berries similar in shape and size, with the exception of Autumn Royal, Centennial seedless, Kishmish Sogdiana. This, in turn, had a positive effect on the appearance of the bunches and berries.

Among the studied varieties there are varieties with berries of green, yellow or amber (Girde kishmish, Danuta, Superior, Centennial seedless, Sultanina, Kishmish Zarafshan, Kishmish Hishrau, Ag oval kishmish, Ag kishmish, Hyrcha kishmish, Sultany kishmish, Asgeri), red (Gyrmyzy kishmish), black (Attica, Kishmish Sogdiana, Gara kishmish, Autumn Royal) and pink (Chahrayi kishmish) color. According to the perspective model, amber and pink colors were awarded a higher rating (7-9 points).

By specific aroma (OIV 236) and taste (OIV 237), the berries of the studied grape varieties mainly had a simple, weak nutmeg or other specific taste and aroma (1,2,3,4 points).

By the effort to detach the berries from the peduncle, the varieties did not differ too much from each other and the berries came off with the application of medium (5 points) and large (7 points) degrees of effort. One of the requirements for table varieties is lack of seeds, the presence of a small number of seeds and the presence of small-sized seeds. All varieties were highly rated (9 points) by this indicator. During the research, it turned out that the studied varieties have high (7 points) and very high (9 points) growth strength (OIV 351).

Resistance to diseases and pests has a special effect on the growth and development of grape varieties, their yield and crop quality. Therefore, the resistance of grapes to the most dangerous diseases, such as mildew, oidium and gray rot, was included in the perspective assessment model (OIV 452, 455, 459). Phytopathological evaluation showed that the studied varieties were unstable

(3 points) or tolerant (5 points) to fungal diseases. Centennial seedless and Sultany kishmish were resistant to gray rot (7 points). Upon phytopathological observation, it turned out that the introduced grape varieties are slightly superior to the local ones in terms of resistance to mildew and oidium. This is due to their hybrid origin and heterotic nature. The Azerbaijan local grape varieties demonstrated instability or tolerance to fungal diseases inherent in the *V.vinifera* species.

Based on the values of 25 ampelodescriptor indicators, determined during the research, the overall prospect score for each variety was calculated. Depending on score for each indicator, the overall score of the varieties differed significantly. Thus, the overall assessment of the prospects changed within 101.8 (Khyrcha kishmish) – 162.5 points (Sultany kishmish) and amounted to the varieties: Khyrcha kishmish – 101.8 points, Girde kishmish – 104.7, Kishmish Zarafshsn – 108.1, Sultanina – 109,0 Gyrmyzy kishmish – 118.6, Kishmish Hishrau – 120.0, Centennial seedless – 121.6, Superior – 132.4, Danuta – 140.0, Attica – 141.0, Chakhrai kishmish –148.2, Asgeri – 148.0, Gara kishmish – 151.0, Ag oval kishmish – 159.4, Sultany kishmish – 162.5 points.

If the total score on 25 indicators of the studied variety is inferior to the total score of the control variety by more than 15 points, the variety is considered unpromising (<15), if it coincides with the total score of the control variety or the difference is up to 15 points, then the variety is considered quite promising (± 15), if the difference is more than 15 points (>15), the variety is considered extremely promising (Karadzhi et. al. 1977; Kashirina 2015; Shukyurova et. al. 2016). During the research, it turned out that the index of the prospects of Khyrcha kishmish variety is quite low (-2.9 points) and this variety was determined as unpromising. The score on the prospects of Sultanina, Kishmish Zarafshan and Gyrmyzy kishmish varieties exceeded the indicator of the prospects of the control by 3.3-13.9 points and these varieties were considered quite promising. The remaining varieties (Kishmish Hishrau, Centennial seedless, Superior, Autumn Royal, Kishmish Sogdiana, Ag kishmish, Danuta, Attica, Chahrayi kishmish, Asgeri, Gara kishmish, Ag oval kishmish, Sultany kishmish) had a score of 15.3-57.8 points higher than the control and these varieties were identified as extremely promising.

Due to the fact that grape populations are a mixture of genotypes with various hereditary characteristics, the selection of high-yielding, high-quality, adaptive forms and groups of grape varieties does not lose its relevance. For the reason of diversity within the variety, individual selection and clone selection of grapes have been conducted since ancient times. During natural mutations of shoots and buds of grapevine, vegetative reproduction of mutated shoots and buds is carried out, which makes it possible to obtain a generation of grapes with new hereditary features. Often, within the same variety, several vines differ positively from others in one or more

quantitative and qualitative characteristics and indicators. It serves as the basis for selection and forms the basis of private selection (Rokitsky 1973; Smeonov et. al. 2016; Salimov et. al. 2017;).

As is known, the selection is based on complex hereditary (spontaneous or natural bud mutations, an increase in the overall genetic potential of an adaptive nature, etc.) and non-hereditary changes (prolonged modifications, etc.), on which the nature of individual selection depends (Avidzba et. al. 2009; Golodriga & Troshin 1980; Gubler & Genkin 1973; Kashirina 2015. Individual selection can be as follows:

- identification and selection of "bud or point mutations" that create changes in one or more qualitative indicators of grapes;

- selection of forms with genetic changes of morphological characteristics (mainly leaf characteristics), manifested in changes in biological characteristics and affecting mainly the amount of harvest;

- selection of forms that are morphologically similar to other plants in the population, but differ from them in yield, sugar accumulation, acidity, adaptive ability, resistance to biotic and abiotic environmental factors. This type of selection has quantitative and qualitative nature. These changes are mainly characteristic of ancient grape populations.

We used the method of selection of high-yielding clones in our research work,. Currently, such local seedless grape varieties as Ag oval kishmish, Asgeri, Sary kishmish, Gara kishmish, Gyrmyzy kishmish, Chahrayi kishmish, Sultany kishmish are most widely grown in small peasant farms. These varieties have been cultivated by the local population for centuries and have found wide application in household and in production. The purpose of our research was to study the local valuable grape varieties Asgeri, Gara kishmish and Sultany kishmish, whose populations have not been sufficiently studied in terms of clone variability and polymorphism. To achieve this goal, 22 plants were randomly selected from the population of each variety and for three years (2011-2013), the elements of fruiting (number of green shoots, number of bunches, average weight of the bunch, vine yield, etc.) and quality indicators (weight of 100 berries, sugar content of juice, shoot yield index, etc.) of these plants were constantly studied (tables 3-5).

As you know, the yield of vines largely depends on the number of eyes left on them during pruning. The number of left eyes is determined depending on strength of growth and development characteristics of vines, planting scheme, etc. During the researches the eye load rate for the seedless grape varieties, studied by us, was determined taking into account the above factors. So, the vine load for Asgeri variety was 35-56 eyes, for Gara kishmish variety – 36-64 eyes, for Sultany kishmish variety – 42-60 eyes. Observations and studies have shown that the grape vines in the populations of all three varieties differ significantly from each other in the number of bunches,

the average weight of one bunch, the yield of one plant, the weight of 100 berries, the sugar content of juice and the yield index of the shoot. So, the number of bunches of the vines in the population of Asgeri variety changed from 12 to 37 pcs., the average mass of the bunch ranged within 183-501 g, the yield of the vine was in the range of 2.5-14.7 kg, the mass of 100 berries ranged within 122-236 g, the sugar content of the berry was in the range of 18.3-24.0 g/100 cm^3 and the yield index of the shoot changed from 13.4 to 65.1 g×sugar. The number of bunches of the vines in the population of Gara kishmish variety was 11-38 pcs., the average mass of the bunch ranged within 158.0-560.6 g, the yield of the vine – within 2.2-14.7 kg, the weight of 100 berries – within 163-256 g, the sugar content of the berry – within 17.1-22.8 g/100 cm^3, the yield index of the shoot – within 9.2-57.0 g×sugar.

The number of bunches in the population of Sultany kishmish variety was 12-33 pcs., the average mass of the bunch – 190-457 g, the yield of the vine – 2.6-11.7 kg, the weight of 100 berries – 232-425 g, the sugar content of the berry –16.7-21.2 g/100 cm^3, the yield index of the shoot – 10.0-44.6 g×sugar. In the course of our research, we determined the index of the shoot yield separately for each variety. So, this indicator made: for Asgeri variety 13.4-65.1 g×sugar, for Gara kishmish variety 9.2-57.0 g×sugar, for Sultany kishmish variety 10.0-44.6 g×sugar. As it became known from observations, the lowest yield index (10 g×sugar) was noted only by two vines of Gara kishmish variety (No. 6/12-14 and 2/1-14). The low yield index (11-20 g×sugar) was observed on eight vines in the population of Asgeri variety, on fourteen vines of Gara kishmish variety and on thirteen vines of Sultany kishmish variety. The average yield index of the shoot (20.1-30 g×sugar) was noted on six vines in the population of Asgeri variety, on one vine of Gara kishmish variety, on three vines of Sultany kishmish variety. The high yield index (31-40 g×sugar) was not observed on the vines of Gara kishmish variety, but five vines were found (No. 5/2-14, 9/2-14, 3/1-14, 6/1-14, 17/1-14) with the very high yield index (41-50 g×sugar and more). At two plants (No. 6/3-10, 18/1-05) in the population of Sultany kishmish variety the yield index was noted as high and on three plants (No. 6/1-02, 6/3-8, 18/1-02) the yield index was noted as very high. In the population of Asgeri variety only one plant (No. 12/1-16) had the high shoot yield and four plants (No.12/1-3, 12/1-9, 12/1-12, 12/1-20) showed the very high yield index.

Thus, as a result of the three-year researches, it was found that if in the first year several vines in the populations of all three grape varieties showed high yields, in the next two years some of these vines did not give high yields. And others, both in the first year of research, and in the second and third year, demonstrated consistently low yields. In addition, grapevines in the populations of the studied varieties differed significantly from each other in terms of quality and elements of fruiting. Despite the fact that the varieties in the grape population are the same in

genetic origin, due to the influence of various factors, significant changes occur in the heritability of their signs and the realization of genetic potential.

As a result of the final comprehensive assessment, five primary clones were selected from the populations of Asgeri, Gara kishmish and Sultany kishmish varieties, exceeding other plants in the population in terms of quantity and quality. Vegetative reproduction of the selected clones was carried out and the stability of quantitative and qualitative indicators in the vegetative generation was studied.

The heritability of signs by the vegetative generation is checked in various ways. In the process of clone selection conducted by several researchers on the Crystal grape variety characteristic of the North Caucasus, seven clone forms were identified (No. 07/12, 12/07, 14/18, 15/29, 17/04, 22/16, 25/24), differing from each other in many signs. The evaluation of these clone forms was carried out by them in stages. First, the primary clones (protoclones), then the vines grown from the cuttings of protoclones (vegetative generation) were evaluated. The evaluation of the protoclones was carried out for five years (2008-2012), and the primary clones grown from the cuttings prepared in 2013 were evaluated for three years (2015-2017) (Petrov & Talash 2015; Radchevsky & Troshin 2008).

All over the world, including in our republic, to determine the heredity in the vegetative generation of clonal forms selected from populations of various grape varieties, such methods as mathematical-statistical and comparative analysis, evaluation of plants in various environmental conditions, determination of the stability of indicators of the quantity and quality of protoclones (primary clones) and their vegetative generation (new clonal forms) are widely used (Kashirina 2015; Krasokhina & Ganich 2006).

Taking into account the above, during the research we conducted the comparative analysis of yield and quality indicators of the parent forms of high-yielding, large-berried, qualitative variations selected from the populations of the studied local seedless grape varieties and of the plants of the vegetative generation reproduced by their cuttings (after their entry into the fruiting stage). Four years after planting (in 2017), the cuttings of the primary clones began to yield. In the period from 2017 to 2019 these clones were constantly monitored, as a result of which the average score was derived for all their indicators. In addition, the comparative study of the indicators of fruiting and quality of the new clone forms and their parents was carried out in order to establish the presence or absence of a difference between them.

In the course of researches, it was conducted the comparative study of such indicators as the number of green shoots, the number of bunches, the average weight of the bunch, the yield of the

grapevine, the weight of 100 berries, the yield per hectare, the sugar content of the berry, the yield index of the shoot in the parent plants and their vegetative generation (table 6).

As can be seen from table 6, the yield indicators of most vines of the vegetative generation are inferior to the parent forms due to their young age. So, if the yield of the vine in the primary clone 12/1-9 for Asgeri variety was 14.7 kg and in the primary clone 3/1-14 for Gara kishmish variety was 14.6 kg, then in the new clone forms it decreased and, respectively, amounted to 10.8 and 8.4 kg. Some plants in the vegetative generation (variation 12/1-20 of Asgeri variety, variation 16/1-14 of Gara kishmish variety, variation 6/1-02 of Sultany kishmish variety) had higher yields than their parent forms. And only one new clone form (variation 17/1-14 of Gara kishmish variety) was significantly inferior to the parent forms in terms of yield and did not demonstrate stability over the years.

In general, other clone forms, although slightly inferior to the parent forms in terms of yield, showed stability in this indicator during the years of observation.

In terms of the sugar content of berry juice, there was no significant difference between the clone and parent forms. For Asgeri variety this indicator changed in the range of 20.3-24 g/100 cm^3, for Gara kishmish variety it varied between 18.8 and 23.0 g/100 cm^3 and for Sultany kishmish variety it changed within 18.6-21.2 g/100 cm^3.

Index of shoot productivity for the clone forms of the studied varieties was at a satisfactory level and amounted to: for Asgeri variety – 31.6-56.8 g×sugar, for Gara kishmish variety (except for one form – No.17/1-14) – 29.0-57.4 g×sugar, for Sultany kishmish variety – 29.6-43.0 g×sugar.

Based on the results of the carried out comparative analysis, it can be concluded that all six of the six selected clone forms of Asgeri variety, five of the six selected clone forms of Gara kishmish variety and all five of the five selected clone forms of Sultany kishmish variety inherited the yield and quality indicators from their parent forms, which manifested in their vegetative generation.

During the years of research, the indicators of yield and quality of the clonal forms of grapes, selected in the course of the experiments and demonstrated stable yields, were studied and their comparative analysis was carried out with the average indicators of the plants in the population of each grapevine variety (table 7).

As can be seen from the table 7, in the clone forms of Asgeri variety, the number of green shoots made 40-54 pieces (in the control – 47 pieces), the number of bunches – 22-32 pieces (in the control – 23 pcs.), the weight of bunches – 268.0-468.6 g (in the control – 270.7 g), the weight of 100 berries – 178-230 g (in the control – 167 g), the sugar content of berries – 20.3-22.8 g/100 cm^3 (in the control – 21.0 g/100 cm^3), the yield index of shoots – 35.0-56.8 g×sugar (in the control –

26.8 g×sugar), the yield of vine – 7.2-11.5 kg (in the control – 6.0 kg). The increase in the average yield of the vine in the clone forms of Asgeri variety made 20.0-91.7% compared to the control. The difference is mathematically reliable ($p<0.05$ and $p<0.001$).

In the clonal forms of Gara kishmish variety, the number of green shoots was 37-58 pieces (in the control – 47 pieces), the number of bunches made 22-29 pieces (in the control – 20 pcs.), the weight of bunches – 216.4-432.6 g (in the control – 264.8 g), the weight of 100 berries – 206-204 g (in the control – 203.8 g), the sugar content of berries – 18.8-23.0 g/100 cm^3 (in the control – 19.1 g/100 cm^3), the yield index of shoots – 21.0-57.4 g×sugar (in the control – 26.8 g×sugar), the yield of one plant – 4.6-10.4 kg (in the control – 5.4 kg). The increase in the average yield of the plant in the clonal forms of Gara kishmish variety was 42.6-91.7% compared to the control. The difference is mathematically reliable ($p<0.05$ and $p<0.001$). But one clone form of Gara kishmish variety (No. 17/1-14) did not demonstrate stable yield and turned out to be less productive compared to the control.

In the clone forms of Sultany kishmish variety, the number of green shoots was 45-57 pieces (in the control – 51 pieces), the number of bunches made 18-29 pieces (in the control – 19 pcs.), the weigh of bunches – 306.0-444.0 g (in the control – 292.7 g), the weight of 100 berries – 228-412 g (in the control – 313.1 g), the sugar content of berries – 19.4-21.0 g/100 cm^3 (in the control – 18.5 g/100 cm^3), the yield index of shoots – 29.6-43.0 g×sugar (in the control – 20.8 g×sugar), the yield of the plant – 6.8-11.5 kg (in the control – 5.5 kg). Compared with the control, the increase in the average yield of the plant in clonal forms of Sultany kishmish variety was 23.6-109.1%. The difference is mathematically reliable ($p<0.05$ and $p<0.001$).

Conclusion

Studies have shown that seedless grape varieties studied under the conditions of Apsheron, according to the ripening period, belong to 3 groups: 2 varieties - early ripening (duration of the growing season 122-125 days), 12 varieties – medium early-ripening (126-144 days), and 4 varieties – medium late-ripening (145-150 days). The studied grape varieties also considerably differ from each other by the productivity of the plant; this indicator hesitates between 5,3 kg (Khyrcha kishmishi) and 12,8 kg (Attica) and makes (by varieties): Khyrcha kishmishi – 5,3 kg, Sary kishmishi – 5,4 kg, Kishmish of Zarafshan – 5,5 kg, Gyrmyzy kishmishi – 6,6 kg, Askeri – 6,8 kg, Kishmsish of Sogdiana – 6,8 kg, Girde kishmishi – 7,1 kg, Sultany kishmishi – 7,2 kg, Kishmish Khishrau – 7,4 kg, Chahrayi kishmishi – 7,9, Ag oval kishmishi – 9,8 kg, Gara kishmishi – 10,0 kg, Ag kishmishi – 8,3 kg, Danuta – 9,1 kg, Superior – 9,5 kg, Autumn royal – 9,5 kg, Sultanina – 11,0 kg, Centennial seedless – 11,2 kg, Attica – 12,8 kg. The size of berries is characterized by a mass of 100 berries and ranges from 98,7 g (Girde kishmishi) to 245,0 g (Sultany kishmishi) in local varieties and from 233,3 g (Attica) to 496,7 g (Superior) in introduced ones. According to mathematical and statistical analysis, the berries of local varieties are much smaller than those of the introduced varieties and

compared with the control, this difference is significantly reliable ($p < 0,05$, $p < 0,001$). During the evaluation of clonal variability in the populations of the local seedless varieties (Askeri, Sultany kishmishi, Gara kishmishi) for the first time, there were chosen 17 clonal forms by the traits of their productivity, quality, berries` largeness, relative tolerance, trade and organoleptic characteristics and so on. In these forms, the yield index of the shoot was 29,0-54,7 g x sugar, which is satisfactory and highly satisfactory. The studies seedless grape varieties were infected by the fungal diseases (mildew, powdery mildew, grey rot) at a different level; the introduced varieties and chosen clonal forms showed comparatively high resistance and tolerance. It became known from the organoleptic evaluation that the fruits of 11 seedless grape varieties (of them 8 introduced, 3 local ones) and 17 clonal forms received high testing indices (9,5-10 points), and possessing the attractive appearance of the bunches, the harmonic flavour and aroma of the berries, have high trade prospects. During digital descriptors` based evaluation of the prospects 3 varieties were found to be at the satisfactory level (Sultanina, Kishmish of Zarafshan and Gyrmyzy kishmishi, with increase of 3,3-13,9 points comparing the control), and 14 varieties – highly prospective (Kishmishi Khishrau, Centennial seedless, Superior, Autumn royal, Kishmish of Sogdiana, Ag kishmishi, Danuta, Attica, Chahrayi kishmishi, Askeri, Gara kishmishi, Ag oval kishmishi, Sultany kishmishi, with increase of 15,3-57,8 points comparing the control).

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Table 1
Yield indicators of local and introduced seedless grape varieties

Varieties and clones	Number of bunches, pcs.	Average mass of bunches, g.	Vine yield, kg		$\Delta \overline{X}$ %	Yield from 1 ha, c	Weight of 100 berries, g	*P	Number of berries in a bunch, pcs
			$\bar{X} \pm S_{\bar{x}}$	*P					
The local grape varieties									
Asgeri (control)	22,3	321,0	6,8±0,76	-	-	151,1	170,0	-	188
Ag oval kishmish	30,3	349,3	9,8±0,66	p<0,05	+44,1	217,8	165,0	p>0,05	242
Ag kishmish	20,3	434,8	8,3±0,48	p<0,05	+22,0	184,4	158,3	p>0,05	275
Gara kishmish	28,7	350,5	10,0±0,72	p<0,05	+47.1	222,2	217,3	p>0,05	171
Gyrmyzy kishmish	28,3	237,8	6,6±0,21	p>0,05	-29,4	146,7	203,3	p>0,05	135
Chahrayi kishmish	40,0	200,0	7,9±0,24	p>0,05	+16,2	175,5	163,7	p>0,05	132
Girde kishmish	23,7	317,5	7,1±0,38	p>0,05	+4,4	157,8	138,7	p>0,05	253
Khyrcha kishmish	38,3	162,6	5,3±0,14	p>0,05	-22,1	117,8	135,3	p>0,05	166
Sultany kishmish	19,7	395,5	7,2±0,45	p>0,05	+5,6	160,0	245,0	p<0,05	176
Sary kishmish	26,3	234,2	5,4±0,42	p>0,05	-22,6	120,0	153,3	p>0,05	183
The introduced grape varieties									
Attica	27,7	481,3	12,8±0,82	p<0,001	+88,2	284,4	233,3	p<0,05	224
Superior	22,3	440,4	9,5±0,56	p<0,05	+45,6	211,0	496,7	p<0,001	116
Autumn Royal	23,0	454,9	9,5±0,52	p<0,05	+45,6	211,0	492,0	p<0,001	118
Danuta	24,7	413,0	9,1±0,44	p<0,05	+33,8	202,2	339,3	p<0,001	146
Centennial seedless	33,7	346,3	11,2±0,86	p<0,001	+64,7	248,8	493,3	p<0,001	96
Sultanina	24,7	446,0	11,0±0,92	p<0,001	+61,8	244,4	251,7	p<0,05	203
Kishmish Sogdiana	19,3	370,2	6,8±0,30	p>0,05	0	151,1	332,7	p<0,001	136
Kishmish Zarafshan	17,7	319,3	5,5±0,16	p>0,05	-20,2	122,2	390,0	p<0,001	114
Kishmish Hishrau	24,3	310,0	7,4±0,18	p>0,05	+8,8	164,4	384,0	p<0,001	106

Note: ** p<0,05; **p<0,001; ***p>0,05; P – reliability of the difference in relation to control (by U-factor);*

$\Delta \overline{X}$ *% – average increase relative to control, %.*

Table 2

Indicators of prospects of grape varieties

Ampelodescriptor codes of OIV	The introduced grape varieties										The local grape varieties									
	Correction coefficient	Attica	Danuta	Superior	Autumn Royal	Centennial seedless	Sultanina	Kishmish Sogdiana	Kishmish Zarafshan	Kishmish Hishrau	Ag oval kishmish	Ag kishmish	Gara kishmish	Gymyzgy kishmish	Chahnoyi kishmish	Asgari	Khyrcha kishmish	Sultany kishmish	Girde kishmish (control)	**The "ideal variety" model**
301	0,5	5	5	5	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	**9**
629	2,5	7	7	7	5	5	5	7	5	5	7	5	9	5	7	7	5	5	5	**9**
305	0,4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	**9**
604-1	0,2	9	7	7	7	7	7	9	7	9	9	9	9	9	9	9	9	9	9	**9**
630	1,5	7	7	5	5	7	5	7	7	7	7	7	7	7	7	7	7	7	7	**9**
153	0,7	5	5	5	5	3	3	5	3	3	3	5	5	3	5	5	3	5	3	**7**
502	1,0	5	5	7	7	7	7	7	5	5	7	5	5	5	5	5	5	7	7	**9**
504	2,5	9	9	9	9	7	7	7	5	5	9	7	9	7	9	7	5	9	7	**9**
505	2,2	3	5	3	3	5	5	7	5	7	9	9	9	7	7	9	7	9	5	**9**
204	0,7	7	3	7	5	9	7	9	7	5	7	7	7	7	7	7	3	7	3	**9**
206	0,2	5	5	5	5	5	5	7	5	5	5	5	3	5	5	7	5	7	5	**9**
220	1,0	7	5	7	9	9	5	7	7	7	5	5	7	5	5	5	3	7	3	**9**
222	2,0	2	2	2	1	1	2	1	2	2	2	2	2	2	2	2	2	2	2	**2**
223	1,0	9	4	6	9	9	5	5	4	4	9	4	4	4	5	9	3	9	3	**9**
225	1,8	5	7	1	5	1	1	5	1	1	7	7	5	3	9	7	1	9	1	**9**
228	0,4	7	5	7	7	5	3	5	5	5	7	5	7	7	7	7	5	7	5	**9**
236	1,5	4	4	4	4	4	1	1	1	1	4	4	4	1	1	4	1	4	1	**5**
237	1,3	2	3	2	2	3	1	2	2	2	2	1	1	1	1	1	1	1	1	**7**
238	0,2	5	3	5	5	7	5	7	5	5	5	3	5	3	5	5	3	7	3	**9**
240	0,5	5	5	5	5	5	5	5	5	5	7	5	7	5	7	7	5	7	5	**9**
242	0,2	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	**9**
351	0,5	7	7	7	7	9	7	9	7	7	9	9	9	7	9	7	7	9	7	**9**
452	1,0	5	5	5	5	5	3	3	3	5	5	3	5	3	5	3	3	5	3	**9**
455	1,0	5	5	5	5	5	3	3	3	3	5	3	5	3	5	3	3	5	3	**9**
459	0,8	5	5	5	5	7	5	5	5	5	5	5	5	5	5	5	3	7	3	**9**
Total score		141,0	140,0	132,4	133,3	131,6	109,0	135,7	108,1	120,0	159,4	136,3	151,0	118,6	148,2	148,0	101,8	162,5	104,7	**206,4**
The difference compared to the control		+36,3	+35,3	+27,7	28,6	+26,9	+3,3	+31,0	+3,4	+15,3	+54,3	+31,6	+46,3	+13,9	+43,5	+43,7	-2,9	+57,8	-	-

Table 3

Indicators of yield and quality of plants in the population of the grape variety Asgeri (on average for 2011-2013)

Serial number of plant	Number of green shoots, pcs.	Number of bunches, pcs.	Average mass of bunches, gr.	Yield, kg/vine	Weight of 100 berries, gr.	Sugar content of berry juice, g/100 cm^3	Yield index of shoot by sugar content, gr.×sug.
12/1-1	39	18	305,3	4,8	124	22,7	28,6
12/1-2	39	17	198,3	2,6	123	22,7	15,2
12/1-3	51	38	275,0	10,1	204	21,5	42,6
12/1-4	43	12	240,0	2,7	122	22,7	14,3
12/1-5	42	13	284,0	3,5	139	21,8	18,2
12/1-6	52	21	300,0	6,3	131	20,0	24,2
12/1-7	49	16	273,0	4,1	130	22,4	18,7
12/1-8	53	24	299,3	6,5	143	20,5	25,2
12/1-9	49	36	416,6	14,7	201	21,7	65,1
12/1-10	54	22	223,6	5,0	184	22,5	21,0
12/1-11	39	16	197,6	2,6	125	21,0	14,0
12/1-12	52	36	368,0	12,3	236	21,5	50,8
12/1-13	45	20	217,0	3,8	160	20,2	17,0
12/1-14	53	37	183,0	6,9	176	18,6	24,2
12/1-15	43	34	266,0	8,5	226	24,0	41,4
12/1-16	47	20	337,0	7,0	172	21,2	31,6
12/1-17	56	20	220,0	4,2	140	18,3	13,4

12/1-18	50	22	204,0	4,2	141	20,1	15,4
12/1-19	45	26	223,0	5,5	224	19,1	23,3
12/1-20	40	22	501,0	9,8	175	21,5	52,7
12/1-21	46	23	214,0	4,5	173	21,1	20,6
12/1-22	35	13	209,0	2,5	226	19,0	13,6
Average rating	47	23	270,7	6,0	167,0	21,0	26,8

Table 4

Indicators of yield and quality of plants in the population of the grape variety Gara kishmish (on average for 2011-2013)

Serial number of plant	Number of green shoots, pcs.	Number of bunches, pcs.	Average mass of bunches, gr.	Yield, kg/vine	Weight of 100 berries, gr.	Sugar content of berry juice, g/100 cm^3	Yield index of shoot by sugar content, gr.×sug.
5/2-14	40	26	412,4	10,7	210,4	19,6	53,8
6/2-14	51	15	158,0	2,3	209,0	20,6	9,2
7/2-14	59	27	218,0	5,2	186,0	17,1	15,1
8/2-14	56	21	163,0	3,0	194,0	18,9	10,1
9/2-14	42	18	560,6	10,0	210,4	22,8	57,0
1/1-14	55	20	173,0	3,1	243,0	19,0	10,7
2/1-14	49	11	285,0	2,8	186,0	17,2	9,8
3/1-14	64	38	250,0	14,6	234,0	19,3	44,0
4/1-14	45	23	202,0	4,5	190,0	18,3	18,3
5/1-14	37	17	205,0	3,2	206,0	17,5	15,2
6/1-14	43	23	360,0	8,9	254,0	19,8	41,0
7/1-14	36	11	256,0	2,2	219,0	20,4	12,5
8/1-14	41	19	175,0	3,3	236,0	20	16,0
9/1-14	46	10	329,0	2,9	167,0	18,6	11,7
10/1-14	39	12	274,0	3,4	240,0	18,4	16,0
11/1-14	39	11	273,0	3,7	168,0	17,6	16,7
12/1-14	36	33	256,0	2,2	220,0	20	12,2
13/1-14	45	13	212,0	2,7	148,0	17,9	10,7
14/1-14	56	19	217,0	4,0	168,0	18,4	13,2
15/1-14	45	15	269,0	3,7	163,0	18,8	15,6
16/1-14	51	22	307,0	6,7	238,0	19,3	29,0
17/1-14	52	38	270,0	9,9	195,0	21,6	41,2
Average rating	47	20,0	264,8	5,1	203,8	19,1	21,8

Table 5

Indicators of yield and quality of plants in the population of the grape variety Sultany kishmish (on average for 2011-2013)

Serial number of plant	Number of green shoots, pcs.	Number of bunches, pcs.	Average mass of bunches, gr.	Yield, kg/vine	Weight of 100 berries, gr.	Sugar content of berry juice, g/100 cm^3	Yield index of shoot by sugar content, gr.×sug.
6/1-01	53	12	410	5,1	261	21,1	20,3
6/1-02	49	24	363	8,7	240	19,8	41,0
6/2-03	53	18	313	5,2	236	18,4	18,0
6/2-04	48	15	190	2,7	345	18,8	10,6
6/2-05	48	23	191	4,0	320	17,4	14,5
6/2-06	51	12	336	4,1	261	19,4	15,6
6/3-07	42	19	288	5,3	302	19,9	25,2
6/3-08	47	26	401	11,0	333	19,0	44,6
6/3-09	48	15	189	2,6	336	19,4	10,5
6/3-10	50	26	344	8,9	405	18,6	33,1

6/4-11	52	33	215	6,6	300	16,7	21,2
18/1-01	55	13	341	4,4	270	17,8	14,2
18/1-02	49	18	457	8,2	232	21,2	42,4
18/1-03	54	17	316	5,0	232	18,1	16,8
18/1-04	50	21	246	5,4	361	17,9	19,3
18/1-05	60	32	355	11,7	261	18,8	36,7
18/2-06	54	16	209	3,3	425	17,6	10,8
18/2-07	51	20	246	4,9	353	17,1	16,4
18/2-08	42	12	281	3,6	348	17,1	14,7
18/2-09	56	16	212	3,2	385	17,5	10,0
18/2-10	60	13	322	4,0	358	16,7	11,3
18/2-11	56	17	215	3,4	325	17,6	10,7
Average rating	51,3	19	292,7	5,5	313,1	18,5	20,8

Table 6

Indicators of yield and quality of primary clones (protoclones) and their vegetative generation (clones) in the population of local seedless grape varieties

Serial number of plant	Number of green shoots, pcs.	Number of bunches, pcs.	Average mass of bunches, gr.	Yield, kg/vine	Weight of 100 berries, gr.	Sugar content of berry juice, g/100 cm^3	Yield index of the shoot by sugar content, g×sugar	Yield per hectare, c/ha
Fruiting vines (protoclones and clones) of Asgeri variety								
12/1-3*	51	38	275,0	10,1	204	21,5	42,6	222,2
12/1-3**	50	32	268,0	9,2	198	21,8	40,1	204,4
12/1-9*	49	36	416,6	14,7	201	21,7	65,1	326,6
12/1-9**	52	30	398,0	10,8	208	22,4	46,5	224,4
12/1-12*	52	36	368,0	12,3	236	21,5	50,8	273,3
12/1-12**	54	31	372	11,5	230	22,0	46,8	255,6
12/1-15*	43	34	266,0	8,5	226	24,0	41,4	188,8
12/1-15**	40	29	288,5	8,6	230	22,8	49,2	191,6
12/1-16*	47	20	337,0	7,0	172	21,2	31,6	158,0
12/1-16**	44	22	328,6	7,2	178	21,4	35,0	161,5
12/1-20*	40	22	501,0	9,8	175	21,5	52,7	217,8
12/1-20**	40	24	468,6	11,2	178	20,3	56,8	284,8
Fruiting vines (protoclones and clones) of Gara kishmish variety								
5/2-14*	40	26	412,4	10,7	210	19,6	53,8	237,7
5/2-14**	37	24	432,6	10,3	204	20,6	57,4	224,6
9/2-14*	42	18	560,6	10,0	210	22,8	57,0	222,2
9/2-14**	39	22	428,6	9,2	216,0	23,0	54,3	204,4
3/1-14*	64	38	250,0	14,6	234	19,3	44,0	324,4
3/1-14**	58	29	282,4	8,4	230	21,4	31,0	186,6
6/1-14*	43	23	360,0	8,9	254	19,8	41,0	197,8
6/1-14**	45	29	392,6	10,4	246	19,2	44,4	231,0
16/1-14*	51	22	307,0	6,7	238	19,3	29,0	148,8
16/1-14**	49	28	320,5	8,7	240	18,8	33,7	193,3
17/1-14*	52	38	270,0	9,9	195	21,6	41,2	212,4
17/1-14**	49	23	216,4	4,6	206	22,4	21,0	102,2
Fruiting vines (protoclones and clones) of Sultany kishmish variety								
6/1-02*	49	24	363	8,7	240	19,8	41,0	193,3
6/1-02**	45	26	382	9,8	238	19,6	42,7	217,8
6/3-8*	47	26	401	11,0	333	19,0	44,6	244,4
6/3-8**	45	30	328	9,2	328	21,0	43,0	204,4
6/3-10*	50	26	344	8,9	405	18,6	33,1	197,8

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6/3-10**	48	18	306	6,8	412	20,4	29,6	151,0
18/1-02*	49	18	457	8,2	232	21,2	42,4	182,2
18/1-02**	51	21	444	8,8	228	21,0	36,2	195,5
18/1-05*	60	32	355	11,7	261	18,8	36,7	260,0
18/1-05**	57	29	382	11,5	258	19,4	39,2	255,5

Note: * – parent form (primary clone, protoclone);
** – vegetative generation (new clone).

Table 7
Productivity and quality indicators of selected new high-yielding clone forms (on average for 2017-2019)

Serial number of plant	Number of green shoots, pcs.	Number of bunches, pcs.	Average mass of bunches, gr.	Weight of 100 berries, gr.	Sugar content of berry juice, g/100 cm^3	Yield index of the shoot by sugar content, g×sugar	Yield, kg/vine			Yield per hectare, c/ha
							$\bar{X} \pm S_{\bar{X}}$	*P	$\Delta \bar{X}$ %	
For Asgeri variety										
12/1-3	50	32	268,0	198	21,8	40,1	9,2±0,08	p<0,05	+53,3	204,4
12/1-9	52	30	398,0	208	22,4	46,5	10,8±0,12	p<0,001	+80,0	224,4
12/1-12	54	31	372	230	22,0	46,8	11,5±0,16	p<0,001	+91,7	255,6
12/1-15	40	29	288,5	230	22,8	49,2	8,6±0,09	p<0,001	+43,3	191,6
12/1-16	44	22	328,6	178	21,4	35,0	7,2±0,07	p>0,05	+20,0	161,5
12/1-20	40	24	468,6	178	20,3	56,8	11,2±0,14	p<0,001	+86,7	284,8
Control*	**47**	**23**	**270,7**	**167,0**	**21,0**	**26,8**	**6,0±0,79**	-	-	**133,3**
For Gara kishmish variety										
5/2-14	37	24	432,6	204	20,6	57,4	10,3±**0,12**	p<0,001	+90,7	224,6
9/2-14	39	22	428,6	216	23,0	54,3	9,2±**0,11**	p<0,001	+88,8	204,4
3/1-14	58	29	282,4	230	21,4	31,0	8,4±**0,10**	p<0,001	+55,6	186,6
6/1-14	45	29	392,6	246	19,2	44,4	10,4±**0,14**	p<0,001	+92,6	231,0
16/1-14	49	28	320,5	240	18,8	33,7	8,7±**0,08**	p<0,001	+42,6	193,3
17/1-14	49	23	216,4	206	22,4	21,0	*4,6±**0,04**	p>0,05	-14,8	102,2
Control*	**47**	**20**	**264,8**	**203,8**	**19,1**	**21,8**	**5,4±0,74**	-	-	**113,2**
For Sultany kishmish variety										
6/1-02	45	26	382	238	19,6	42,7	9,8±**0,07**	p<0,001	+78,2	217,8
6/3-8	45	30	328	328	21,0	43,0	9,2±**0,06**	p<0,001	+67,3	204,4
6/3-10	48	18	306	412	20,4	29,6	6,8±**0,02**	p>0,05	+23,6	151,0
18/1-02	51	21	444	228	21,0	36,2	8,8±**0,09**	p<0,05	+60,0	195,5
18/1-05	57	29	382	258	19,4	39,2	11,5±**0,13**	p<0,001	+109,1	255,5
Control*	**51**	**19**	**292,7**	**313,1**	**18,5**	**20,8**	**5,5±0,55**	-	-	**122,2**

Note: **Control*** is the average indicator for plants in the population of each grape variety