

Promising sources for breeding golden currant (*Ribes aureum* Pursh)

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Abstract. The fundamental objective of this study is to comprehensively investigate the morpho-biological attributes and valuable economic traits of hybrid samples of golden black currant. These hybrid samples are the result of crossbreeding Russian and American varieties. Beyond this, the research endeavors to establish foundational insights that can be employed as primary references in the development of novel cultivars. These cultivars are envisioned to be both fecund and endowed with larger-sized fruits, an abundance of essential vitamins and minerals, as well as adaptability to local environmental conditions. Furthermore, their suitability for extended transportation distances is an essential consideration. In essence, the study aspires to unravel the potential of these hybrid golden black currant varieties, exploring their morphological and biological characteristics, economic viability, and their potential contribution to the nutritional landscape. By assessing their adaptability, nutritional richness, and commercial prospects, we lay the groundwork for the advancement of new cultivars that hold promise not only for local agricultural systems but also for broader markets where they can meet the demands of health-conscious consumers and environmentally sustainable production practices.

Keywords. Golden currant, phenological phases, selection, productivity, bud, flower, fruit size, productivity, source material.

1 Introduction

In order to meet the demand of the population for fruit and berry products in Uzbekistan, it is envisaged to increase the volume of the product, as well as to increase its quality and expand its assortment [1, 2]. Therefore, one of the main tasks before the specialists of the field is to expand the range of fruit and berry crops, to study the biology of new crop types, to create new varieties suitable for local conditions and to introduce them into production [3, 4].

The volume of berry cultivation in the world is 7.2-8.4 million. tons, of which about 662,000 tons were blackcurrants, and the average yield was 5.5 tons per hectare. According to the statistics of FAO in 2018, the Russian Federation is the leader in the cultivation of currants (*Ribes* L.) in the world, and about 400,000 tons are harvested every year [5, 6].

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Poland (170,000 tons) and Ukraine (24,000 tons) took the next places, while the share of other countries engaged in blackcurrant cultivation did not exceed 70,000 tons [7].

In 2018, a total of 1,025 tons of blackcurrant products were obtained in Uzbekistan, including the assortment of blackcurrant varieties grown in Uzbekistan, which are high-yielding, resistant to heat, cold, drought and fungal diseases, intensive, short growing season, highly marketable and universal (for processing, freezing and keeping fresh) the reason is that there are not enough varieties [8, 9]. Therefore, enriching the assortment of berry fruit crops with promising varieties, improving the technology of creating and growing mother gardens is one of the urgent issues in the development of the horticultural sector in Uzbekistan.

Large-scale studies on systematics, selection, various resource-saving technologies of cultivation, diseases and harmful insects of the currant plant were carried out in Russia, Poland, Ukraine, Germany, England, New Zealand, Denmark, Azerbaijan, Holland, USA and other countries by K. Linney, A. Berger, A. Richard, J. Berlandier, C. Ichori, G. Burgsdorf, R. E. Regel, O. V. Panfilova, T. V. Zhidekhina, E. A. Ivanova, E. A. Gnusenkova, L. S. Sankin, I.V. Michurin, N.M. Pavlova, M.G. Abdeeva, E.I. Glebova, L.A. Tokhtar, V.S. Salykova, V.N. Sorokopudov, Yu.V. It was carried out by scientists such as Burmenko, A.E. Soloveva [10-14].

In Uzbekistan, the initial research with blackcurrant was carried out by S.I. Yagudina in 1947 (study of morpho-biological characteristics, valuable economic traits of blackcurrant varieties introduced from abroad, selection and selection), then in different years M.M. Mirzaev and R.M. These studies were continued by the Abdullaevs [15-17].

However, the physiological and economic-biological characteristics of the growth of local and newly introduced varieties of golden currant in Uzbekistan, as well as the technological issues of high-quality seedling cultivation, have not been sufficiently studied.

The purpose of the study is to study the morpho-biological and valuable economic characteristics of the hybrid samples of the golden black currant obtained by crossing Russian and American varieties, in addition to extracting primary sources for the creation of new varieties that are fertile, large-fruited, rich in vitamins and minerals, adapted to local conditions, suitable for long-distance transportation.

2 Materials and methods

During the extraction of primary data, we relied on well-established methodologies to ensure accuracy and reliability. The biochemical analysis was conducted using the method developed by A.I. Ermakov. The determination of drought resistance of varieties was carried out following the approach outlined by E.A. Goncharova. To assess heat resistance, we employed the method established by F.F. Matskov, while cold resistance of buds was determined using the method devised by M.A. Solovev [10-14].

Subsequent to data collection, we undertook meticulous mathematical and statistical processing. This critical step was executed utilizing the Microsoft Excel program, employing the guidelines recommended by B.A. Dospikhov [5]. By adhering to these recognized methodologies and protocols, we aimed to ensure the accuracy, consistency, and comprehensiveness of our research outcomes. This approach underpins the reliability and significance of the conclusions drawn from the data, providing a solid foundation for subsequent analysis and the formulation of informed recommendations.

3 Results and discussion

The golden currant *Ribes aureum* belongs to the *Ribes* family of the *Grossulariaceae* family.

Carl Linnaeus (1753) divided *Ribes* into two species, *Ribes inermia* and *Grossularia accileata*, and 120 years later, the Russian scientist and great botanist K.I. Maksimovich (1873) classified the plants belonging to *Ribes* divided into 6 species according to morphological characteristics, biological characteristics, distribution area. To date, scientists have identified about 190 species belonging to this genus.

Black and red currants differ in the location of the buds on the branches, the color of the bark, and whether the fruit is fragrant or odorless. The bark of the one-year-old branches of the black currant is yellow with a long gray stripe, and the bark turns brown as it grows. Freckle-like spots are visible on all branches. Buds, leaves, bark and fruit have a unique smell. Red currants have no smell and can be easily distinguished from black currants by the slow development of all branches. Blackcurrants have compound inflorescences, and red currants have simple inflorescences.

Golden currant differs dramatically in its vigorous growth compared to red and black currants. The bushes are tall. It is similar to the leaves of krijovnik, fragrant **and** the flowers are orange, with a sharp smell. The fruit has a unique aroma. Golden currant is a perennial shrub with a root system up to 2 meters deep. The leaves are alternate, three- to five-lobed, light and dark green in color, some are slightly, and some are branched. The appearance resembles the leaves of the gooseberry plant. In autumn, the leaves of this variety take on a dark red or yellow-red color.

In Uzbekistan, golden currant blooms from the end of March to the first ten days of April, and its fruit ripens in early spring, at the end of May, in the first ten days of June, i.e., on the same level as the fairy varieties of black currant. However, some varieties take a little longer. The fruit is black, red, orange, yellow, purple.

Golden currant fruit contains 6.29 to 13% sugar, 0.94 to 2.04% acids, 43.2 to 187 mg% vitamin C, 8.05 mg% provitamin A and 1.5% pectin. (on the basis of dry mass) has substance. Blackcurrant fruit is eaten fresh, as jam, juice and jelly (condensed fruit juice). 46 varieties of currants are in the gene pool of the research institute of horticulture, viticulture and winemaking named after Academician Makhmud Mirzaev, including 13 varieties of black currant (*Ribes nigrum* L), 6 varieties of red currant (*Ribes rubrum* L), golden currant (*Ribes aureum* Pursh) 15 varieties and 12 hybrids are kept alive.

Selection of fruit crops is fundamentally different from the selection of other agricultural crops, in some cases, several generations of scientists participate in the process of creating one variety. Scientific research completed by us was also started in 1947 by S.I. Yagudina and his followers. Between 1947 and 1979, S.I. Yagudina and a number of scientists of the institute crossed American Kronidal and Russian Michurin varieties and obtained about 274 hybrids. Later, a promising hybrid isolated from these hybrids was included in the state register under the name "Plotnomyasaya" [6].

During the period of keeping the collection alive, a group of hybrids was given the names "Uzbekistanskaya krupnoplodnaya" and "Uzbekskaya sladkaya". In 2007-2009, 140 plants were cloned from Uzbekskaya sladkaya na muna. These plants gave their first crops in 2011, and in 2013 they reached full harvest and from these plants no. 48 numbered plants were selected according to valuable economic traits.

In 2008-2009, as a result of studies on valuable economic characteristics of 700 seedlings grown from the seeds of the "Uzbekistanskaya krupnoplodnaya" sample, samples No. 13-27 and No. 14-7 were selected by the method of individual selection. Complex hybrids of "Uzbekistanskaya krupnoplodnaya" obtained by free crossing of golden black currant suitable for the climatic conditions of Uzbekistan were studied according to morphological and economic characteristics.

During the years 2011-2015, in the "Plotnomyasaya" variety of the golden currant, the swelling of the buds coincided with February 24, and the opening of the buds coincided with March 3. Among the studied varieties and hybrids, only the "Uzbekskaya sladkaya" variety

had the swelling of the buds at the same time as the model, and in all other varieties and hybrids, it was on the 1st Late opening was observed for 3 days. Budding was observed at the latest (on March 1) in "Alyona" variety and samples #13-2 and #13-27, while in all other varieties and hybrids this physiological process was recorded on February 25-27, and opening on March 2-6.

Among varieties and hybrids of golden currant, there are differences in the phase of flowering, including: "Plotnomyasaya" variety begins on March 24, and "Kyghos" blooms on March 29, and ends on April 21, while "Altinoy", "Dostlik", "Elixir" varieties and in the hybrids, the appearance of flowers was recorded on March 21, the beginning of flowering in the varieties "Oltinoy" and "Elixir" on April 1, and in the variety "Dostlik" on March 29. The duration of flowering in the collection nursery was 28-33 days, and the longest flowering process lasted for the "Uzbekskaya sladkaya" variety (33 days).

Among the varieties and hybrids of golden black currant, 3 varieties, Oltinoy, No. 5-11, No. 13-7 and Rukhshona, were distinguished according to their early ripening characteristics, and it was observed that they ripened 4-6 days earlier than the model Plotnomyasaya variety.

Compared to the model variety, the ripening duration of the fruits lasted 5-8 days, and the varieties No. 3, Oltinoy, No. 14-7, No. 13-7 and No. 13-27 and hybrids were isolated. The following results were obtained when the cultivars and hybrids maintained in the nursery of golden currant collection samples were studied for the productivity of one plant during the years 2011-2015 (Table 1).

Table 1. Five-year average indicators of productivity of golden currant varieties and hybrids per bush (kg).

Varieties	Productivity from 1 bush, kg					
	2012	2013	2014	2015	total	average
Plotnomyasaya (control)	0.540	0.250	1.1	1.01	2.495	0.624
Uzb planted tanskaya krupnoplodnaya	0.450	0.301	0.65	0.89	1.954	0.488
(№-3) Uzbekskaya sladkaya	0.650	0.350	0.810	0.800	2.610	0.653
Golden	0.5	0.310	0.853	0.820	2.108	0.527
Siyuma	0.250	0.180	0.450	0.910	1.603	0.401
Rukhshona	0.26	0.20	0.60	0.740	1.605	0.401
Orzu	0.3	0.24	0.74	0.68	1.735	0.434
Alyona	0.19	0.15	0.45	0.400	1.48_	0.262
No. 14-7 (Memorial)	0.571	0.474	0.82	2.16	4.10	1.024
Dustlik	0.32	0.21	0.45	0.68	1.42	0.355
Elixir	0.42	0.31	0.49	0.69	1.595	0.399
No. 15-5	0.29	0.21	0.56	0.91	1.753	0.438
No. 13-7	0.41	0.312	0.74	0.95	2.105	0.526
No. 13-2	0.31	0.24	0.39	0.785	1.493	0.373
#13-27 (Oydin)	0.454	0.362	0.882	1.69	4.048	1.012
#13-16	0.32	0.32	0.76	0.86	2.02	0.505

#13-17	0.51	0.29	0.91	0.91	2.238	0.559
No. 15-12	0.54	0.25	1.1	1.01	2.495	0.624
No. 5-11	0.45	0.301	0.65	0.89	1.954	0.488
Zolotistaya	0.25	0.25	0.51	0.8	1.623	0.406
EKF05	0.01	0.0	0.02	0.04		0.03
ECF%	3.2	2.6	3.0	4.0		4.9
V	2.3	1.9	2.2	2.9		3.6

During the years 2011-2015, the average productivity of one bush of the model variety "Plotnomyasaya" (st) is 0.624 kg. and it was found that 16 of the 19 studied varieties and hybrids had lower results from 65 to 360 grams compared to the standard variety.

These varieties and samples are effective in the early spring changing climate of Uzbekistan compared to the model "Plotnomyasaya" (st) variety, and the productivity was significantly higher in years with warm spring months, as a result of many years of observations. For example, the yield of one bush in the variety "Siyuma" was 250-180 g in 2012-2013, and 0.450 and 910 g in 2014-2015 (years with even spring days). The lowest productivity was observed in "Alyona" (0.262 kg), #13-2 (0.373 kg), "Dostlik" (0.355 kg), "Elixir" (0.399 kg) varieties and hybrids.

When analyzing the research conducted with golden currant varieties and hybrids, the 4-year average yield indicators were shown as follows. It is known that the climatic conditions of Uzbekistan change rapidly, and spring months sometimes come early and sometimes late. In most cases, the air temperature rises from the end of February to the beginning of March and decreases in the end of March or the beginning of April. This situation leads to the loss of part of the crop. Sometimes, when the air temperature rises at the same time (as a result of the frost not hitting the flowers), it is observed that the yield is high. We made a conclusion based on the average indicators of the results obtained during the 4 years of research due to the different arrivals of the spring months.

"Plotnomyasaya" (st) variety of golden black currant has an average yield of 19.27 q/ha, the lowest indicator is "Siyuma" (11.4 q/ha), No. 5-11 (11.4 q/ha), "Alyona" (11.8 q/ha), No. 13-2 (12.4 q/ha), "Dostlik" (13.2 q/ha), "Rukhshona" (14.6 q/ha), "Elixir" (14.9 q/ha), "Zolotistaya" (15.1 q/ha), No. 15-5 (15.3 q/ha), "Uzbekistanskaya krupnoplodnaya" (15.9 q/ha) samples, average indicators "Oltinoy" (16.2 q/ha), "Iroda" (16.8 q/ha), No. 13-7 (16.8 q/ha), No. 13-16 (17.1 q/ha), No. 15-12 (17.9 q/ha) were observed, relatively high results were observed in No. 13-27 ("Oydin") (20.7 q/ha), "Uzbekskaya sladkaya" (21.5 q/ha) and No. 14-7 ("Yadgor") (34.0 q/ha) were observed (Table 2).

Table 2. Four-year average yield indicators of golden currant varieties and hybrids (q/ha).

Varieties	2012	2013	2014	2015	Average
Plotnomyasaya (control)	17.82	9.93	36.30	26.40	19.27
Uzb ekistanskaya krupnoplodnaya	14.85	11.55	21.45	27.06	15.94
Uzbekskaya sladkaya	21.45	10.23	26.73	30.03	21.55
Golden	16.50	10.23	28.14	22.44	16.23
Siyuma	8.25	5.94	14.85	22.77	11.41
Rukhshona	8.58	6.60	19.80	30.03	14.64
Will	9.90	7.92	24.42	31.35	16.54
Alyona	6.27	4.95	14.85	25.90	11.82

No. 14-7 (Memorial)	18.84	15.64	27.06	88.77	34.05
Dustlik	10.56	6.93	14.85	28.38	13.20
Elixir	13.86	10.23	16.17	30.03	14.97
No. 15-5	9.57	6.93	18.48	33.33	15.28
No. 13-7	13.53	10.30	24.42	29.37	16.87
No. 13-2	10.23	7.92	12.87	26.40	12.44
No. 13-27 (Oydin)	14.98	11.95	29.1	27.06	20.77
No. 13-16	10.56	10.56	2508	30.03	17.08
No. 13-17	16.83	9.57	3003	22.44	16.56
No. 15-12	17.82	8.25	36.30	22.77	17.94
No. 5-11	14.85	9.93	2.145	30.03	11.45
Zolotistaya	8.25	8.25	16.80	33.5	15.15

No. 13-27 ("Oydin"), "Uzbekskaya sladkaya" and No. 14-7 ("Yadgor"), the average yield compared to the variety "Plotnomyasaya" (st) is from 1.5 to 14.7 q/ha or, 7, 3-44.6% higher results were noted (Figure 1).

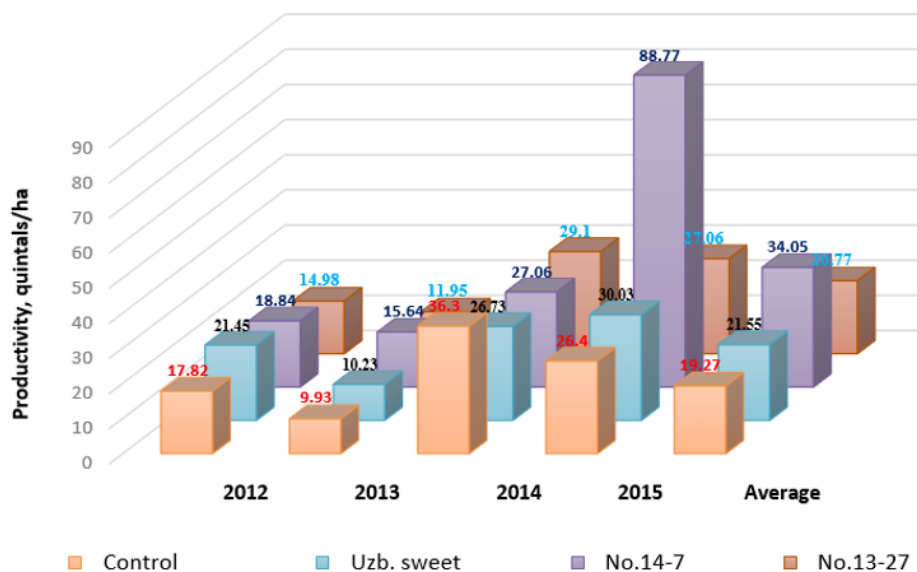


Figure 1. Productivity indicators of fruit varieties

No. 3, No. 14-7 and No. 13-27 were selected according to the complex economic characteristics. "Uzbekskaya sladkaya", "Yadgor" and "Oydin" were given the names "Uzbekskaya sladkaya", "Yadgor" and "Oydin" to the selected hybrids of golden currant.

The newly created varieties "Uzbekskaya sladkaya", "Yadgor" and "Oydin" were studied for four years (2012-2015) in comparison with the model variety "Plotnomyasaya" and the following results were obtained.

The average productivity of "Oydin" variety is 20.77 tons/ha, "Uzbekskayasladkaya" variety is 21.55 tons/ha, and "Yadgor" variety is 34.05 tons/ha, and "Oydin" variety is 1.5 It was noted that the "Uzbekskayasladkaya" variety has a high yield of 2.28 tons/ha, and the "Yadgor" variety has a high yield of up to 14.77 tons/ha (Table 3).

Table 3. Four-year average productivity indicators of golden currant varieties and hybrids (q/ha).

Varieties	2012	2013	2014	2015	Average	Difference
Plotnomyasaya (control)	17.82	9.93	36.30	26.40	19.27	0
No. 13-27 (Oydin)	14.98	11.95	29.1	27.06	20.77	1.5
No. 3 Uzb. sweet	21.45	10.23	26.73	30.03	21.55	2.28
No.14-7 (Memorial)	18.84	15.64	27.06	88.77	34.05	14.77

Another valuable economic characteristic of the golden currant is its large fruit size. The sample "Plotnomyasaya" (st) variety is 1.6 grams, and the largest one is 2 grams. Almost all of the studied varieties and hybrids are lower in average weight of one fruit (0.67-1.5 g) compared to the sample variety. got results. However, according to the weight of the largest fruit, 12 varieties and hybrids are 1.5 compared to the standard variety ("Siyuma", "Rukhshona", "Dostlik", "Elixir" varieties, No. 13-7, No. 13-2, No. 13- 27, "Oydin", "Yadgor") and 2 times (Uzbekistanskaya krupnoplodnaya, "Iroda" varieties, hybrids #13-16, No. 15-12) were noted in the research (Figure 2).

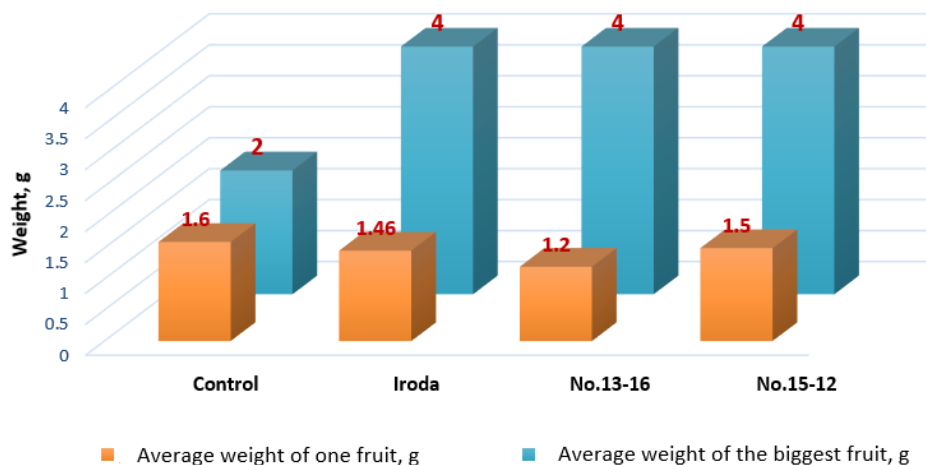


Figure 2. Varieties and hybrids selected by the size of the fruits of the black currant.

These selected specimens are the primary rare resource for the development of new large-fruited market varieties of golden currant.

One of the most valuable economic characteristics of golden currant is evaluated by its chemical composition. The fruit can be black or brown in color, round, elongated, pear-shaped or flat. According to the sources, the fruit is valuable because it contains valuable vitamins S, V, V9, A, R, K, sugar, organic acid, aromatic substances. In our research, we analyzed the content of acid, dry matter and sugar in the fruits of 9 varieties and hybrids of golden currant (Table 4). Of the sample "Plotnomyasaya" (control) variety was 1.24% acid, 14% dry matter, and 13.4% sugar.

Table 4. Analysis of chemical active substances in golden currant fruits (2022).

Varieties name	Acid %	Dry matter	Carbohydrates
Plotnomyasaya	1.24	14.0	13.4
Uzbekistanskaya krupnoplodnaya	1.79	16.0	17.0
(№-3) Uzbekskaya sladkaya	1.08	18.0	18.3
Golden	1.72	20.0	16.9
Elixir	1.66	16.0	15.1
No. 13-27 (Oydin)	1.66	18.0	18.2
No. 14-7 (Memorial)	1.24	17.0	15.2
No. 13-2	1.60	14.0	14.5

In 6 out of 8 collection varieties and hybrids whose chemical composition was analyzed, including: "Uzbekistanskaya krupnoplodnaya", "Uzbekskaya sladkaya", "Oltinoy", "Elixir" varieties and the fruits of hybrids No. 13-27 and No. 14-7, the dry matter content was 16 up to -20%, with 2-6% higher results compared to the model. Sample No. 13-2 showed a low result compared to the model variety (Figure 3).

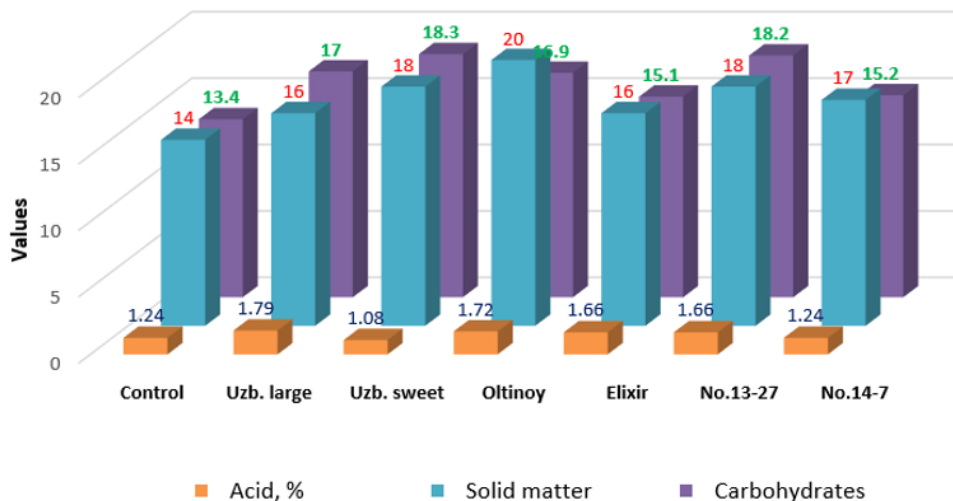


Figure 3. Analysis of chemical active substances in golden currant fruits.

It was found that all the varieties and hybrids selected for the amount of sugar in the fruit have higher results compared to the "Plotnomyasaya" variety, "Uzbekistanskaya krupnoplodnaya" variety has 17%, "Uzbekskaya sladkaya" variety has 18.3%, "Oltinoy" variety has 16.9%, 15.1% in "Elixir" variety, 18.2% in "Oydin" variety, 15.2% in "Yadgor" variety and 15.5% in No. 13-2, i.e. 1.1% to 3.9% higher than the sample was recorded.

As a result of research carried out in the nursery of the collection, 3 varieties, including No. 3 ("Uzbekskaya sladkaya"), No. 14-7 ("Yadgor"), No. 13-27 ("Oydin"), were selected

for valuable farm characteristics, and to continue the selection work the control was transferred to the cultivar trial nursery.

4 Conclusions

During the years 2011-2015, compared to the "Plotnomyasaya" variety of the golden black currant (budding of buds on February 24, bud opening on March 3), only the "Uzbekskaya sladkaya" variety of the studied varieties and hybrids is the same as the model, and all other varieties and hybrids are delayed by 1-3 days observed. Budding was observed at the latest (on March 1) in "Alyona" variety and samples No. 13-2 and No. 13-27. In all other varieties and hybrids, this physiological process was recorded on February 25-27, and opening on March 2-6.

Among varieties and hybrids of golden currant, differences were also observed in the phase of entry into the flower. In the variety "Plotnomyasaya" the beginning of the pattern was on March 24, the flowering of marigolds was on March 29, and the end was on April 21, while in the varieties and hybrids "Altinoy", "Dostlik", "Elixir" the appearance of flowers was on March 21, the flowering of marigolds was on "Oltinoy" and " It was recorded in Elixir varieties on April 1, and in Dostlik varieties on March 29.

The duration of flowering in the collection nursery was 28-33 days, and the longest flowering process lasted for the "Uzbekskaya sladkaya" variety (33 days).

From the varieties and hybrids of the studied golden currant, 3 varieties, Oltinoy, No. 5-11, No. 13-7 and Rukhshona, were selected according to their early ripening characteristics, and it was found that they ripened 4-6 days earlier than the model Plotnomyasaya variety.

The hybrids of No. 3, Oltinoy, No. 14-7, No. 13-7 and No. 13-27 varieties were selected according to the duration of fruit ripening, and it was noted that the duration of fruit ripening in these hybrids was 5-8 days longer than the standard variety.

The productivity of one bush of the studied 20 varieties and hybrids is lower than the model (65-360 g) in 16 samples, the same as the model in 1 sample, only in 3 samples (No.-3 Uzbekskaya sladkaya- 0.653 kg, No. 14- 7 Yadgor - 1,024 kg and No. 13-27 Aydin - 1,012 kg) a high result was observed.

It was found that the average productivity of varieties and hybrids of No. 3, No. 14-7 and No. 13-27 was 105-164 percent higher than the standard variety.

According to the results of research carried out for four years in the nursery of the collection, varieties and hybrids No. 3, No. 14-7 and No. 13-27 were selected, and on their basis, the golden currant varieties " Uzbekskaya sladkaya", "Yadgor" and "Oydin" were created.

The average productivity of " Oydin" variety is 20.7 tons/ha, " Uzbekskaya sladkaya" variety is 21.5 tons/ha, and " Yadgor" variety is 34.0 tons/ha. "Oydin" variety is 1.5 compared to the model variety. q/ha, " Uzbekskaya sladkaya" variety - 2.28 q/ha, and "Yadgor" variety - 14.77 q/ha were noted to have high productivity.

The varieties "Uzbekistanskaya krupnoplodnaya", "Iroda" and hybrids No. 13-16, No. 15-12 were distinguished according to the sign of fruit size. These samples will serve as a unique primary source for the creation of new large-fruited, exportable cultivars of golden currant.

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