

State, problems and prospects for the development of sugar beet seed production in the Krasnodar Territory

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Abstract. A retrospective analysis of the state of sugar beet seed production in the Krasnodar Territory has been carried out. The problems are reflected and the factors of intensification of the seed-growing process are named as a necessary condition for the restoration of domestic seed-growing and an increase in the proportion of seeds of the Kuban selection in the crops of sugar beet in the North-Caucasian region. The results of production testing of sugar beet hybrids selected by the FSBSI "Pervomaysky Selection and Experimental Station of Sugar Beets" in 2019-2020 are presented.

In the system of measures for growing high and stable yields of sugar beets with high sugar content, a very important role belongs to the seed production of this crop. For a long time, sugar beet seed production in southern Russia was carried out according to a three-tier scheme: the originator of the hybrids included in the State Register grew original (super-elite) seeds, the volume of which reached 800 kg; elite seed farms produced at least 47 tons of basic (elite) ones; seed farms prepared on average up to 1500 tons of hybrid (F1) seeds. In the Krasnodar Territory, there was a specialized trust "Sugar beet", which was entrusted with the task of providing beet-growing farms in southern Russia with seeds of sugar beet of the Kuban selection. 7 thousand hectares of arable land, 3.5 thousand fallows and more than 2 thousand hectares of mother plants of planting beets were allotted annually for seed-growing beets. The annual plan for the purchase of seeds was 7 thousand tons. The factory beet growing industry served the Tbilisi Seed Plant with a seed processing capacity of 13.2 thousand tons per year, taking into account that in some years the region grew seeds for other regions and the insurance carry-over stock of seeds of the Ministry of Agriculture of Russia was kept here. Seed production was carried out in two ways: planting and non-planting. Planting seed plants were located mainly in seed farms of Gulkevichsky, Novokubansky, Kurganinsky and Tbilisi districts, non-planting seed plants in farms of Novokubansky, Labinsky, Otradnensky and Mostovsky districts. From the beginning of market reforms and until 2009, out of 8 elite seed farms, only 3 experimental production farms of the State Scientific Institution "North Caucasian Research Institute of Sugar Beet and Sugar" (NCRISB&S) survived, out of 18 seed farms producing factory seeds, only 3

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enterprises. Accordingly, the sowing area and the volume of seed production decreased sharply [1,2,3].

Until 2000, local hybrids prevailed in sugar beet crops in the North Caucasus region. But then the situation changed dramatically, and the share of hybrids of the Kuban selection decreased over the period 2000-2007. from 97.3 to 13%. The greatest drop in demand for seeds of domestic hybrids occurred in 2003-2005, when the market was filled with seed products of Western European companies and this continues to this day and now the share of foreign-bred seeds reaches 97%. With a significant volume of domestic consumption of seed, the share of seeds of domestic hybrids on the market is less than 3 percent. This led to a high import dependence of the sugar beet industry on foreign seeds. The loss of the domestic seed market was not so much due to the higher genetic potential of foreign-bred hybrids, but due to the high quality of seeds provided by the best growing zones and innovative methods of seed preparation and pelleting at that time in specialized plants. All this contributed to their rapid introduction in production areas and reduced the competitiveness of domestic hybrids [4,5,6].

The high share of seeds of foreign-bred sugar beet hybrids in the domestic market is due to the following reasons:

- the absence in the period from 1998 to 2012 of the necessary organizational and economic conditions for the formation of a scientific and production base for scientific research in the field of selection and seed production of sugar beet;
- lack of a well-functioning system of seed production of domestic hybrids - seed production is a long, costly process, irrigated lands, special equipment, spatial isolation, separate reproduction of crossing components, seed production zones are required;
- lack of interest on the part of business in making investments in this sector of agricultural production;
- despite the high resistance to diseases during the growing season and post-harvest storage, high sugar content of root crops, domestic selection of sugar beet hybrids were not in demand on the domestic market.

The shortage of seeds of sugar beet hybrids in the domestic market was covered by the import of foreign seeds, since there was not a single plant in the Russian Federation that allowed the production of pelleted seeds. The existing seed factories, having lost their raw material base, ceased their economic activities (FGU "Belorechensky seed processing plant") or redesigned production for processing and storage of seed material of other agricultural crops (JSC "Tbilisi Seed Plant"). Moreover, none of the Russian seed plants was reconstructed, and they were unable to establish the production of pelleted seed material, competitive in terms of quality and technological indicators of foreign analogues. This led to the termination of the activities of all seed enterprises, since their products remained unclaimed in the market. Currently, there are 3 modern sugar beet seed factories in the Russian Federation, which are located in the Belgorod, Voronezh regions and the Krasnodar Territory, with a total nominal capacity of 1.0 million sowing units of sugar beet per year. Taking into account the organizational and technical reserves, these plants can increase the output of seeds to 1.35 million sowing units per year, which will amount to 90 percent of the total demand of the Russian Federation for seeds of sugar beet hybrids. However, all factories process a heap of beet seeds grown abroad, since in the Russian Federation sugar beet seed production is carried out in small volumes [7, 8].

In connection with the critical state of seed production in 2003, the "Program for the Stabilization of Sugar Beet Seed Production in the Krasnodar Territory" was adopted. Over the course of four years, 31.8 million rubles were allocated from the regional budget, of which 13.03 million rubles. - the originator of sugar beet hybrids (NCRISB&S) for the development of breeding and primary seed production and 18.77 million rubles. - seed farms of the region to subsidize part of the costs associated with the production of elite and

reproductive (F1) seeds. But this only partially solved the problems of seed production in the region. As a result of the rapid filling of the sugar beet seed market with foreign products, the industry could not withstand competition and lost its position. As a result, for 2001-2009, 49 hybrids of foreign selection of sugar beets recommended for cultivation in our (6th) soil-climatic zone, and 8 hybrids - selection of NCRISB&S were included in the State Register of Breeding Achievements of the Russian Federation. The State Register of Breeding Achievements registered: 2017 - 427 varieties, hybrids and parent components of sugar beet, of which 65 are domestic (15%); 2018 respectively 330 and 35 (11%); 2019 344 and 37 (11); 2020 350 and 68 (19%). Every year in the Russian Federation seeds of foreign-bred sugar beet hybrids are sown in the amount of 5.7 to 5.8 billion rubles.

In recent years, the FSBSI "Pervomaysky Selection and Experimental Station of Sugar Beets" has created and zoned highly productive sugar beet hybrids based on cytoplasmic male sterility (CMS). The most optimal combination of economically valuable traits and properties is observed in hybrids: Kuban MS-95, Vector, Kulon, Uspek, Azimut, from the last generation Rubin, Karat, Pervomaysky. Since 2020, new hybrids Frigate, Corvette are undergoing State Test, from 2021 Prestige. All sugar beet hybrids of high-yielding sugar and sugary type, intended for medium and late harvesting periods, adapted to the conditions of the North Caucasian region. The advantages of these hybrids include their resistance to diseases of the leaf apparatus and root crops during the growing season, drought resistance, as well as a higher keeping quality of root crops when stored in the post-harvest period. Potential yield - 75-85 t / ha, sugar content - 19.0-20.4%, sugar collection - 10-13 t / ha. In terms of breeding, domestic sugar beet hybrids were obtained according to the same scheme as all foreign hybrids. The methods of the breeding process are the same [8, 9, 10].

A distinctive feature of the hybrids of the FSBSI "Pervomaysky Selection and Experimental Station of Sugar Beets" selection is that they were created and bred in the North Caucasian region, and are adapted to the soil and climatic conditions of the region. The selection of starting materials was carried out for resistance to pathogens of the most harmful microflora in our zone - therefore, our hybrids have the following exceptional properties:

- stability and plasticity;
- high tolerance to cercospora and root rot pathogens;
- advantage in areas with high severity of beet moth and leaf-eating scoop;
- high sugar content in root vegetables;
- high keeping quality of root crops during long-term storage

In 2018, the restoration of domestic seed production began, when, under the author's support of the originator, JSC Uspensky Sugarnik, in its structure, produced 97 tons of sugar beet seeds of hybrids Kubansky 95, Azimut, Uspek. In 2020, FGUP Urupskoye has grown 35 tons of seeds of the new hybrid Rubin, seed plots of the Pervomaysky hybrid were laid on an area of 35 hectares to obtain factory seeds in 2021. At the same time, the production of basic seeds of parental forms of new hybrids Karat, Fregat, Corvette is underway, which in the coming years will replenish the line of domestic selection of sugar beet hybrids. Despite the fact that new hybrids are still undergoing a state test, it is planned to conduct production tests in 2021 and lay demonstration sites in production conditions in order to advertise and accelerate the promotion of these hybrids into production [7, 10, 11].

In the Krasnodar Territory, on the basis of FSBSI "Pervomayskaya SES", a Sugar Beet Selection and Seed Center (SSC) was created, this made it possible to establish sugar seed production according to the following scheme: selection and primary seed production is carried out by the FSBSI "Pervomayskaya SES"; reproduction of basic (elite) seeds SPF "Kuban" - branch of the FSBSI "National Grain Center named P.P. Lukyanenko"; hybrid seeds (F1) FSUE "Urupskoe" - FSBSI "Scientific Center of Oilseeds named after P.P. Pustovoyta", under the author's control of the originator.

Modern intensive technology of sugar beet cultivation with the use of precise seeding at the final planting density provides for high requirements for the quality of the seed; seed germination should be at least 94%, germination energy at least 90%, single sprout - at least 98%, uniformity at 90%. The pelleted seeds should be packaged in one sowing unit (100 thousand seeds). The composition of seed dragees should include a complex of protective and stimulating substances that can effectively protect the seedling from pests and diseases for 25-40 days [11, 12].

In 2019, hybrids of sugar beets of the Kuban selection - Kuban MS 95, Azimut and Uspekh were grown in OJSC "Maryinskoe", LLC "Agrosakhar" Uspensky district, LLC "Agrosakhar" Izobilnensky district, LLC "Veles" Gulkevichesky district, JSC "BP Urupsky" district, FSBI "Urupskoe", APC "Collective farm named after Lenin" Novokubansky district, JSC "Maryinskoye", Tbilisi district, LLC "Agrosakhar-3" Kochubeevsky district, on a total area of about 3000 hectares (table 1).

Table 1. Biological yield of sugar beet hybrids of the Kuban selection in individual beet-growing farms, 2019 year

Hybrid	Productivity, t / ha	Sugar, %	Sugar yield, t / ha	Purity of cell juice,%
Azimut	57,3	17,0	9,7	88,1
Kubanskiy MS 95	63,5	17,1	10,9	88,4
Uspekh	51,2	17,2	8,8	88,3
Average for hybrids of Kuban selection	57,3	17,1	9,8	88,3
Average for the Krasnodar Territory	52,3	-	-	-

All hybrids had the following average indicators: density 107 thousand / ha, biological yield 70.3 t / ha, sugar content 17.2%, sugar collection 12.1 t / ha, purified juice quality 88.4%. The results of mechanized harvesting showed yields from 45 to 95 t / ha. The high yield of 73.5 and 65.6 t / ha in test weight was confirmed by the hybrids Kuban MS 95 and Azimut, respectively. Sugar harvest in beet-growing farms in hybrids varied from 7.8 to 14 t / ha.

Average data for the Azimuth hybrid are represented by the following indicators; density, biological yield, sugar content, sugar collection and purity of purified juice, respectively 104 thousand / ha, 70.3 t / ha, 17.4%, 12.1 t / ha and 88.3%. The yield varied by farms from 51.0 to 95.7 t / ha, sugar harvest from 9.2 to 15.9 t / ha.

The average indicators for the Kuban MS 95 hybrid were obtained as follows: density 107 thousand / ha, yield 78.7 t / ha, sugar content 16.9%, sugar collection 13.2 t / ha and juice quality 88.5%. The yield varied from 65.8 to 95.8 t / ha, sugar collection 11.0 to 15.0 t / ha.

Average indicators for the hybrid Uspekh are presented for 10 farms: density 112 thousand / ha, yield 65.2 t / ha, sugar content 17.4%, sugar collection 11.3 t / ha, juice quality 88.5%. The yield varied from 48.0 to 84.3 t / ha, sugar collection from 8.8 to 13.4 t / ha.

In 2020, in the main beet-growing districts of the Krasnodar Territory, demonstration crops of domestically bred sugar beet hybrids were laid. For comparison, the best foreign hybrids sown on the farm were used. In the difficult arid conditions of 2020, the Kuban sugar beet hybrids showed a level of productivity; yield - 45-56 t / ha, sugar content - 15 - 18%.

In some farms, the studied hybrids exceeded their foreign counterparts both in yield and in sugar content, and in some test points they were inferior in sugar collection to foreign hybrids by 5-10%. The sugar content of domestic hybrids was 0.8% higher. In most farms, with mechanized harvesting, their average productivity exceeded the average for the region and the farm [8].

In general, the results of state and industrial tests in different zones of beet growing in the Krasnodar Territory confirmed the high potential for productivity and disease resistance of domestic breeding hybrids. This allows us to say that in the beet fields of the North Caucasus region, it is possible to obtain from each hectare at least 55-60 t / ha of root crops, using hybrids of the Kuban selection. It should also be noted that the technology of growing, post-harvest and pre-sowing preparation of seeds of domestic hybrids requires bringing them to the level of world standards [12].

To stabilize and develop sugar beet seed production in the North Caucasus region, it is necessary to take the following measures:

- to create organizational and economic conditions for the formation of a system of selection and seed production of domestic sugar beet hybrids;
- to develop and master more advanced and effective methods and techniques of breeding and seed-growing processes;
- to expand work on the creation and industrial use of effective genes that determine not only resistance to cercospora, but also resistance to low temperatures, drought and herbicides;
- to increase the volume of research on the creation of initial breeding materials, to widely apply testing of the productivity and stability of breeding forms at various stages of ontogenesis;
- to apply moisture - energy-saving technologies for the production of seeds of components and hybrids of sugar beet using irrigation;
- to introduce the technology of growing root crops from freshly harvested original seeds, some of which, if necessary, can be used to obtain basic and hybrid seeds.

The implementation of these measures will reduce the time required for the introduction of new hybrids into production and increase the realization of their genetic potential.

At the same time, the most important task of the development and intensification of sugar beet production is to preserve the economically valuable traits of sugar beet hybrids, increase the share of genetic potential realization and reduce the time required for the introduction of promising hybrids into production.

To achieve this goal, scientific organizations must have a complex of technical means for conducting a complete cycle of selection and seed production in the established volumes of production of original seeds, including lines for pre-sowing preparation of seed material. At the same time, it is necessary to increase subsidies for growing seeds and provide financial support to research institutes and seed farms within the framework of the Subprogram "Development of selection and seed production of sugar beet in the Russian Federation" of the Federal Scientific and Technical Program for the Development of Agriculture for 2017-2025 and until 2030, which will increase the effectiveness of selection and seed production, to update and strengthen the material and technical base, to preserve the scientific and human potential.

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