Market prospects for soybean seed production of the East Siberian ecotype domestic varieties

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Abstract. The article presents the research results on the domestic and foreign market of oilseeds. In the current conditions, there is a growing demand for soybean products, which determines the necessity for high-quality harvests of this legume plant, both in the segment of the industrial and consumer market of soybean products. Both domestic and large foreign companies producing oilseeds are represented in the Russian market. According to the Food Security Doctrine, the share of domestic seeds should be at least 75% and in 2019 this figure was 62.7%. The article substantiates the production of soybean seeds of the East Siberian ecotype domestic varieties which has potential sales markets. R & D conducted by the Krasnoyarsk State Agrarian University together with the advanced enterprises of the agro-industrial complex of the region have the goal of forming and developing the system of selection and seed production of the East Siberian ecotype soybeans by developing and implementing molecular genetic technologies in the selection process and industrial seed production of the crop. Selection achievements are interdependent and the characteristics of marketable agricultural products are closely related to the growing technology (with costs and productivity), which will ensure the demand for selection achievements, the university's leading position in the dissemination of innovations in the agricultural sphere of Siberia, and the advanced enterprises of the agro-industrial complex of the region to organize large-scale production of soybeans and increase the production activities profitability.

1. Introduction
The increase in the demand for soybean products can be observed all over the world, since these products are considered to have preventive and therapeutic use. The soybean market is usually divided into two segments: industrial, which accounts for about 80% of sales, and consumer, which accounts for 20% of sales [1]. Conditionally, the soybean market can be segmented as follows: the market of soybeans; the market of processed soybean products: oil, flour, texturate, concentrate, isolate, meal for livestock feed; the market of finished soybean products: soybean mayonnaise, milk, cheese, etc.

The growing volume of production of goods using soybean requires more and more high-quality harvests of this legume plant. Accordingly, producers of soybeans need high-quality seed material, since selection activities and the development of new plant varieties in Russia are developing at an insufficient pace [2]. The latter provides excellent opportunities for new players to start a popular and cost-effective production, the demand for the products of which will significantly boost the economy of the agricultural industry as a whole. The product in this case is soybean seeds of the East Siberian ecotype domestic varieties. The regional market is considered as the prospective market for soybean seed material, as part
of the project implementation of the Krasnoyarsk State Agrarian University together with the advanced enterprises of the agro-industrial complex in the region.

Selection is one of the research work priorities in the Krasnoyarsk State Agrarian University. Selection work is carried out on a number of agricultural crops, including soybeans [3]. The priority direction of research work in crop production is the selection of new varieties and original seed production of agricultural crops. In 2017, the soybean variety “Zaryanitsa” successfully passed the state variety testing [3]. It is important to note that the most "northern" territory where this high-protein crop is being selected is the experimental field of the Krasnoyarsk State Agrarian University. The variety is recommended for the steppe and forest-steppe zones of Eastern Siberia.

2. Materials and methods
The acreage under soybeans in the Russian Federation has been growing rapidly over the past 10 years and reached 3 million hectares in 2019 (figure 1).

![Figure 1. Soybean acreage in the Russian Federation, million hectares.](image)

The Siberian Federal District is characterized by an increase in acreage compared to 2015, in particular, in 2019, the area was 199.2 thousand hectares (588 % by 2019, or + 165.2 thousand tons) (table 1), with a yield of 11.2 c/ha (119% by 2019, or + 1.8 c/ha).

| Federal district | 2015 | 2016 | 2017 | 2018 | 2019 |
|------------------|------|------|------|------|------|
| Central          | 530.7| 612.8| 776.3| 909.9| 1117.4|
| North-West       | 0.0  | 0.1  | 1.3  | 2.4  | 1.1  |
| North-South      | 198.2| 182.2| 200.6| 240.6| 232.9|
| North-Caucasian  | 34.6 | 30.1 | 31.9 | 37.3 | 38.3 |
| Privolzhsky      | 79.4 | 91.4 | 113.4| 103.3| 126.5|
| Ural            | 3.1  | 2.2  | 4.9  | 5.5  | 3.2  |
| Siberian        | 33.9 | 42.8 | 85.0 | 151.1| 199.2|
| Far East        | 1250.9| 1275.7| 1422.5| 1499.1| 1360.0|

According to the "Center of Agroanalytics", there are two soybean clusters in Russia. The first cluster is a new one, located in the Central Federal District, where the main part of the grown soybeans is processed by the district's enterprises. The second cluster is a traditional one, located in the Far East, where the main part of the grown soybeans is exported to China. Over the past five years, the Far Eastern Federal District accounted for almost 87% of Russian soybean exports.

The North-Western District, namely the Kaliningrad Region, which receives almost all imported soybeans, stands out. They are processed by the “Sodruzhestvo” group of companies, and the processed products are mainly exported. The Kaliningrad region accounts for almost 66% of soybean oil production, 92% of Russian exports of soybean meal and 87% of soybean oil [4].
Among the federal districts of the Russian Federation for the production of unrefined soybean oil in 2019, the leaders are: the North-Western District (457.3 thousand tons) and the Central District (120.7 thousand tons) (table 2). The Siberian Federal District has stable indicators in 2018 and 2019 at the level of 45.2 thousand tons, surpassing the Southern Federal District.

Table 2. Production of unrefined soybean oil in Russia, thousand tons.

| Federal district    | 2015 | 2016 | 2017 | 2018 | 2019 |
|---------------------|------|------|------|------|------|
| Federal district    | 53.0 | 78.2 | 96.7 | 98.1 | 120.7|
| Central             | 381.0| 433.8| 443.0| 480.1| 457.3|
| North-West          | 25.7 | 26.9 | 33.7 | 43.4 | 35.8 |
| South               | 0.0  | 0.1  | 0.0  | 0.0  | 0.0  |
| North-Caucasian     | 0.0  | 0.1  | 0.7  | 1.6  | 1.5  |
| Privolzhsky         | 0.1  | 0.0  | 0.0  | 0.2  | 0.1  |
| Ural                | 59.1 | 62.4 | 37.2 | 45.2 | 45.2 |
| Siberian            | 40.7 | 39.2 | 63.3 | 75.8 | 54.5 |

Among the regions of the Siberian Federal District of soybean cultivation is the Altai Territory, which is included in the top 10 regions of soybean producers in Russia and is on the 9th place in the rating.

In the Krasnoyarsk Territory, agricultural producers began to actively include oilseeds in crop rotations. The total harvesting oilseeds area increased by 62.9% in 2013-2018. In particular, for soybeans, there is a relatively stable trend in sown areas, in 2020 at the level of 1475 thousand hectares (98.7% by 2019, or 25.1 thousand hectares) (figure 2).

In 2020, the gross soybean harvest in the region amounted to 61 thousand quintals (70.8% by 2019, or 25.1 thousand tons), with a yield of 12.1 c/ha (117.4% by 2019, or +1.8 c/ha).

Reducing the share of foreign seeds is one of the main objectives of the development of domestic breeding and seed production. According to many experts, the exclusion of seeds of imported selection is currently impossible due to the need to update and replenish the seed fund with the latest foreign developments [2].

To solve the problem of import substitution, the Decree of the President of Russia No. 20 of January 21, 2020 "On the Approval of the Doctrine of Food Security of the Russian Federation" was signed which introduced a new indicator of food security in relation to seeds of the main agricultural crops of domestic selection. Their share should be at least 75%. In recent years, their ratio has been about 50/50.
In 2019, this figure was 62.7%. The share of seeds of the main agricultural crops of domestic selection is presented in table 3.

**Table 3.** Share of domestic selection seeds in the volume of sown seeds, 2019.

| Name of the agricultural crop | Volume of sown seeds, thousand tons | The share of domestic selection seeds in the volume of sown seeds, % | Threshold value of the share of domestic selection seeds in the volume sown by 2025, % |
|-------------------------------|-------------------------------------|---------------------------------------------------------------------|-----------------------------------------------|
| Soy                           | 346.2                               | 41.8                                                                | 70                                            |
| Winter wheat                  | 3330.4                              | 90.5                                                                | 92                                            |
| Spring wheat                  | 2454.4                              | 82.2                                                                | 90                                            |
| Spring barley                 | 1702.9                              | 63.2                                                                | 75                                            |
| Sugar beet                    | 3.9                                 | 0.6                                                                 | 20                                            |
| Vegetable crops               | 5.3                                 | 43.0                                                                | 60                                            |
| Sunflower seeds               | 37.2                                | 26.5                                                                | 50                                            |
| Potatoes                      | 777.3                               | 9.7                                                                 | 50                                            |
| Corn                          | 77.7                                | 45.8                                                                | 65                                            |
| Spring rapeseed               | 9.3                                 | 31.7                                                                | 50                                            |

The data in table 3 show that for the group of grain crops in Russia, there is currently a high level of availability of the high-quality domestic selection seed material with the exception of grain corn, for other crops, import dependence is high, including soybeans, with the share of domestic selection seeds in the volume of seeds sown – 40%, the threshold value of the share of seeds of domestic selection in the volume sown by 2025 is – 70% [5].

The share of foreign selection seeds in soybean crops is about 26% (figure 3).

**Figure 3.** Structure of soybean acreage by players.

In 2015-2016, Russian private selection companies became much more active in registering new varieties: the number of applications submitted by them exceeded the number of applications received from state selection institutions (figure 4).

**Figure 4.** Number of applications for inclusion in the register of varieties approved for use.
The Russian market is represented by both domestic and large foreign companies—producers of oilseeds (table 4). The main companies whose seeds were sown by agronomists in 2019 are the Soybean Research Institute and Semences Prograin.

**Table 4.** Oilseed producers.

| Sunflower seeds | Soy | Rapeseed |
|-----------------|-----|----------|
| LLC «Sun Flower»| «All-Russian Research Institute of Soy» | «Bayer Cropschiencev ROPSCIENCE AG» |
|                 | LLC «Kazachka», Rassvet village | |
| LLC «Russian Hybrid Industry» | LLC «Soybean Complex Company» | «KWS Saat SE» |
| LLC Research and production enterprise «Galaxy» | «Semences Prograin Inc.», LLC«PROGRAIN RU» | «Syngenta France SAS» |
| «Syngenta Group» | «Armsort Spolka Z Organikzona» | «Deutsche Saatverdelung AG» |
| «Protection AG» | «Odpowiedzialnocia»/ LLC«APROSEED RU» | |
| «Euralis Semences» | «Saatbau Lincengen»/ LLC «SAATBAU RUS» | «Norddeutsche Pflanzenzucht Hans- Georg Lembke KG» |
| «Maisadour Semences SA» | Huron «Commodites Inc.»/LLC «EKONIVA-SEEDS and others |

The data in table 4 show that the Russian market of oilseeds is dominated by international producers. There are 56 enterprises and organizations in the register of seed farms in Russia that have licenses for oilseed varieties with the right to produce original seeds. Many of them produce seeds of foreign selection. In 2019, the share of domestic selection seeds in the total volume of sown seeds was 41.8% for soybeans. The doctrine of food security in general for seeds sets the indicator at a rate of at least 75%.

Import dependence on seeds and hybrids of agricultural crops is caused by a number of factors: low competitive potential of newly registered varieties and hybrids, poor seed quality, shortcomings of the variety renewal incentive system, underdeveloped infrastructure, outdated material and technical base, lack of highly qualified specialists in genetics, selection and seed production [6, 7]. Due to inefficient links in the genetics – selection – seed production – agricultural producer chain, new varieties and hybrids registered with the State Export Commission are difficult to reach consumers.

At the moment, there is uncertainty about the export positions of seed products of the Russian Federation due to the need for the procedure for granting the status of equivalence to the system of state variety tests of the EU by the Russian Federation [8].

The above-mentioned circumstances emphasize the special relevance of the project for the creation of selection and seed production of soybeans of the East Siberian ecotype domestic varieties.

3. **Results and discussion**

Russia has not developed a culture of soybean consumption in its pure form, but as a processed product, the range of demand for it is large both in the domestic and foreign markets. Modern high-tech feed production is impossible without soy. In order to achieve the necessary indicators from soybeans, selection must constantly move forward, anticipating the future demands of agricultural producers.

The market of soybean seed material in the Krasnoyarsk Territory is partially provided by local producers, most of it is imported from other regions, or the material of foreign selection. The increase in the share of seed production will allow to saturate the market of the Krasnoyarsk Territory with high-quality soybean seed material to a greater extent.

The main sales market will be the Krasnoyarsk Territory, and the surrounding regions of the Siberian Federal District.
The main target segments are agricultural enterprises and peasant farms, with which there are already contracts for the future supply of seeds.

To expand the sales market, it is planned to participate in the regional agricultural exhibitions "Agro-Industrial Forum Siberia" and in the field days. In accordance with this, the central place among the complex of planned marketing activities at the first stage will be occupied by actions to position products in the selected market segments and ensure their competitive position [9, 10].

4. Summary
The final consumers of selection achievements are agricultural organizations, since they are the ones who make the decision in favor of growing a particular variety. In this case, in terms of individual properties of the selection achievement that determine the commodity characteristics of the corresponding agricultural products (and not the growing process, yield, etc.), the final consumer is not an agricultural organization, but the food industry, livestock, export markets. But since all the properties of the selection achievement are interdependent and the characteristics of commercial agricultural products are closely related to the growing technology (with costs and productivity), it is the agricultural organizations that are the link that assesses all the properties of the selection achievement in the aggregate and makes a decision in favor of a particular variety.

Agricultural organizations choose the most competitive (economically attractive) crops and varieties on the seed market (and, accordingly, selection achievements) for their placement in the crop rotation on the available acreage in accordance with the accepted agricultural technology.

The results of selection and conducting original seed production, obtaining healthy planting material through biotechnologies and agro-technologies for the industrial production of soybean seed material of competitive domestic varieties will ensure the demand for selection achievements, the university's leading position in the dissemination of innovations in the agricultural sphere of Siberia, and the advanced enterprises of the agro-industrial complex of the region to organize large-scale production of soybeans and increase the profitability of production activities.

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