

Development of Russian selection and seed production under the Federal scientific and technical program for agricultural development

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Abstract. The paper analyzes the preparation and status of draft of subprograms of the Federal scientific and technical program for agricultural development for 2017-2025 (FSTP) on selection and seed production in crop production. The measures taken by the subjects of the Russian Federation for the purpose of implementing the FSTP subprograms, as well as a well-founded method for selecting potential customers for complex scientific and technical projects (CSTP), are presented. Recommendations have been prepared and suggestions have been made for selecting potential customers of the CSTP of FSTP. The analysis of the results of higher education institutions subordinated to the Ministry of Agriculture of Russia as potential participants of the CSTP in the field of selection and seed production of agricultural crops is given.

1 Introduction

As a result of the impact of various factors in agriculture, the situation has developed that for many crops, domestic selection and seed production are not competitive. Despite the fact that there are domestic developments that are not inferior to world analogues, the share of imported varieties and hybrids for some crops is very high (for example, for sugar beet-80%, corn-50%), which is due to both high quality indicators of seeds, and a fairly aggressive policy of implementation by developers - foreign giant firms [1-3].

According to the new food security Doctrine approved by Presidential decree No 20 of January 21, 2020, the share of seeds of the main agricultural crops of domestic selection should be at least 75%.

World experience shows that professional Associations, national Unions of breeders, seed growers and businesses play a leading role in the development and solution of industry problems. Successful selection achievement occurs and is implemented as a result of the manufacturer's request and its subsequent active promotion, often in the form of package solutions (simultaneously with growing technologies, means of protection, etc.) [4-7].

Therefore, for the development of domestic selection, most selection organizations need to change the requirements for the methodology of traditional selection and primary seed

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production, establish communication with production, and almost completely reequip the laboratory base [8,9].

The following can be identified as the main promising areas of selection for all agricultural crops: increasing resistance to the most harmful diseases and pests; increasing productivity and product quality. The most used method for obtaining all these properties in new selection samples is heterosis, according to numerous studies, heterosis hybrids significantly outperform varieties in terms of economic and valuable characteristics [10].

The presence of geographical and climatic diversity of territories, scientific and production potential provides the necessary conditions for the successful development of seed production in the Russian Federation. There are domestic effective methods of seed production, but their further development requires the creation of specialized farms in suitable climatic conditions, provided with equipment, personnel and financially, as well as active integration into the world seed industry [11,12].

The FSTP is aimed at ensuring stable growth in agricultural production, including through the use of seeds of new domestic varieties. The main priorities of FSTP are to create conditions for the development of scientific, scientific and technical activities and to obtain the results necessary for creating technologies, products, goods and services that ensure the independence and competitiveness of the domestic agro-industrial complex.

Achieving the goal and implementing the objectives of the program will reduce technological risks in the food sector and improve the quality of domestic agricultural products on the basis of scientific and technological support for the development of the agro-industrial complex in the long term.

The FSTP is executed by implementing subroutines. Currently, the following subprograms being implemented and are in preparation: “Development of selection and seed production of potato”, “Development of selection and seed production of sugar beet”, “Creating competitive domestic meat crosses broiler-type”, “Development of feed production and feed additives for animals”, “Improving the genetic potential of cattle specialized meat breeds of domestic selection”, “Enhance the genetic potential of the cattle dairy breeds”, “Development of selection and seed production of oil crops”, “Development of selection and seed production of vegetable cultures”, “Development of viticulture, including the nursery”, “Development of selection and processing of crops”, “Genetic improvement of small livestock”, “Development of selection and seed production of corn”, “Development of selection and seed production of industrial crops”, “Development of nursery and horticulture”, “Aquaculture development”.

CSTP is set of coordinated and managed types of work approved in accordance with the established procedure by the Program Council, structured according to the Program’s activities, coordinated in order to achieve the planned results, implemented by the project customer on the principles of public-private partnership and aimed at obtaining scientific and (or) scientific and technical results within the framework of the subprogram, forming a set of technologies and their transfer for application (implementation) in production and obtaining innovative products on an industrial scale.

We have reviewed in this paper the state of implementation of the FSTP for selection subprograms in crop production based on research and information and analytical monitoring, and made recommendations for selecting potential customers and participants of complex scientific and technical projects.

2 Methods

The research was carried out using theoretical methods of analysis and generalization of information about the implementation of selection subprograms of the FSTP in crop production from available sources. Functional characteristics of objects were studied by the

structural method.

The results obtained were processed and presented in the form of tables with the selection of indicators that are essential for the study. Based on the data obtained, conclusions were made about the level of implementation of the FSTP subprograms in the field of selection and seed production of priority agricultural crops.

3 Results and Discussion

One of the areas of research was the analysis of measures taken by the subjects of Russian Federation in order to implement the subprograms of the FSTP. Processing and analysis of the submitted information from the subjects of Russian Federation showed that more than half of the regions - 62% (53 subjects out of 85) - have an idea about the implementation of the FSTP subprograms and provided information about the measures taken in this area. Only 40% of regions have worked out and prepared action plans for participation in the implementation of FSTP subprograms.

The greatest interest and activity in the regions among the selection subprograms in crop production was caused by participation in the implementation of the subprogram "Development of selection and processing of crops" - 66% of subjects, in relation to all regions that submitted action plans in accordance with table 1.

Table 1. Planned participation of the subjects of Russian Federation in the implementation of the FSTP (according to the data of the subjects of Russian Federation as of 01.02.2019).

No	Name of the subprogram of FSTP	Number of subjects of the Russian Federation planning to participate in the implementation of the subprogram	Number of CSTP in accordance with the subprogram	Planned number of customers of CSTP	Planned number of participants CSTP (scientific research Institute, high education institutes, etc.)
1	Development of selection and seed production of oil crops	7	7	7	6
2	Development of selection and seed production of vegetable cultures	4	6	2	3
3	Development of selection and processing of crops	14	14	13	20
4	Development of selection and seed production of corn	4	2	2	2
5	Development of selection and seed	7	8	6	6

	production of industrial crops				
6	Development of selection and seed production of sugar beet in Russian Federation	1	1	6	7

For the rest of the subprograms, we need: to analyze the reasons for low activity and additional involvement of interested performers.

For this purpose, Federal state budgetary scientific institution “Rosinformagrotech” has justified the criteria and proposed a method for selecting the required number of CSTP customers for selected subprograms.

The main criteria were selected in accordance with the Order of the Ministry of agriculture of Russia “On approval of the Procedure for selecting complex scientific and technical projects” dated July 23, 2018, No 320 [Electronic resource]. URL: http://www.consultant.ru/document/cons_doc_LAW_304268/ (accessed 22.10.2019)]. In accordance with this document, the criteria to be applied to participants in the selection of the CSTP are:

- a) compliance of the main types and results of activities with the FSTP subprograms;
- b) the presence of professional experience in the field of agro-industrial complex in the areas of subprograms, confirmed by documents;
- c) the absence of the processes of reorganization, liquidation, or bankruptcy processes;
- d) the absence of an unfulfilled obligation to pay taxes, fees, insurance premiums, penalties, fines, and interest payable in accordance with the legislation of the Russian Federation on taxes and fees (as of the first day of the month preceding the month of the selection of the CSTP).

In addition to these indicators, it was determined that, in selecting it’s needed to focus on production volume in agriculture by type of subprograms, on the ability or the knowledge to invest in CSTP.

The justified criteria and the developed methodology became the basis for selecting potential customers of the CSTP. Various information resources, including electronic ones, were analyzed for selection. We used site materials that characterize existing organizations, such as the largest independent source of information about Russian organizations <https://www.rusprofile.ru>, directory organizations in Russia <https://www.list-org.com> etc., data from organizations’ own websites. In the analysis, we used the existing ratings of top companies in the areas of activity related to subprograms. Under the analysis was also information about planned participation of subjects of the Russian Federation in the implementation of subprograms FSTP presented in table 1, organizations that wish to be customers of CSTP were also considered in the selection. As a result, 10 potential CSTP customers were recommended for each subprogram. As a result, the top 3 of potential customers for the subprogram “Development of selection and seed production of oil crops” were LLC company “Bio_Ton”, LLC “Avangard-Agro-Voronezh”, LLC “SSP “Genofond”; under the subprogram “Development of selection and seed production of vegetable crops” - LLC “SF Gavrish”, Agroholding Search, LLC “Selection station named after N. N. Timofeev”; under subprogram “Development of selection and processing of crops” – Company “Bio-Ton”, LLC AIC “Aleksandrovskoye”, JSC “Agrofirma Pavlovskaya Niva”; under subprogram “Development of selection and seed production of corn” – LLC “Stavselkhozinvest”, APC “Kolkhoz-Plemzavod “Kazminsky”, LLC “Rossosh – hybrid”; under subprogramme “Development of selection and seed production of industrial crops” -

the farm “Mir”, OJSC “Len”, APC (farm) Suburban “Plus”; for the subprogram “Development of selection and seed production of sugar beet” – LLC “SouzSemSvekla”, LLC “Betagan Ramon”, LLC “KubanSemAgro”.

CSTP are formed by customers taking into account complex research plans on the terms of scientific and production partnership with participants of complex scientific and technical projects, which can be state scientific and educational institutions, other organizations of the agro-industrial complex of various forms of ownership that have a huge scientific and production potential in the areas of implementation of the program [13-15].

Given the fact that the agricultural universities of the Ministry of agriculture of Russia have a high enough scientific potential, their involvement in CSTP of FSTP is appreciated.

The analysis of the database of intellectual activity results (IAR) of the Ministry of agriculture of Russia, conducted by Federal state budgetary scientific institution “Rosinformagrotech”, showed that agricultural universities received a significant number of results– 2950, including: database-381, patents-1813, computer programs-756. Thus, only in 2018, agricultural universities of the Ministry of agriculture of Russia conducted research on 163 topics, as a result of which 13 new varieties and hybrids of agricultural crops were obtained.

Nowadays, the Federal State Budgetary Education Institution “Russian State Agrarian University - Moscow State Agrarian Academy named after K.A. Timiryazev” is working on the development of promising varieties of grain and leguminous crops. The Mikhailovsky variety is included in the State register of selection achievements approved for use in the North-Western, Central, Volga-Vyatka and Ural regions of the Russian Federation. In 2019, 19 varieties and hybrids of vegetable crops were among the completed developments of the Academy.

Irkutsk State Agrarian University is conducting tests for the production of high-quality wheat, triticale and oat seeds in primary nurseries. Irkutsk State Agrarian University, together with AC JSC “Belorechenskoye”, participates in the implementation of the subprogram “Development of selection and seed production of potato in the Russian Federation” of the Federal scientific and technical program for the development of agriculture of the Russian Federation for 2017-2025.

In 2018, Michurinsky State Agrarian University launched a comprehensive scientific and technological project “Development of innovative technologies for the production of elite seed potatoes of promising varieties of domestic selection in the Tambov region conditions” within the framework of the subprogram “Development of selection and seed production of potato in the Russian Federation”. The main theme of creative agreements with foreign partners is to conduct fundamental scientific research in the field of protected soil vegetable growing.

The Smolensk State Agricultural Academy has a scientific school “Development and implementation of innovative areas of cultivation of grain, cereals and industrial crops based on the agroecological and biogenetic potential of new varieties”. In order to develop the flax industry in the region, the Smolensk State Agricultural Academy actively cooperates with leading institutions and farms in Russia and Belarus engaged in selection, seed production, cultivation and processing of flax. The Academy plays an important role in forming a high-level scientific foundation in the field of selection and seed production of flax and the production of this crop, which ensures the development of innovative technologies.

Ural State Agrarian University together with LLC “Breeding and seed company “Uralskiy kartofel”” in the framework of FSTP included in the subprogram “Development of selection and seed production of potatoes in Russian Federation” with a complex scientific and technical project “Selection and seed production of new domestic varieties of

potatoes of Ural breeding for various purposes”. On the basis of LLC AC “Uralskiy kartofel”, in 2018 the technology of industrial seed production of domestic (Ural) potato varieties based on virus-free microclonal reproduction technology using modern robotic DNA technologies and PCR analysis has been developed. Work was carried out on selection and seed production of new highly productive hybrids of cucumber and tomato resistant to major diseases for industrial greenhouse plants.

Chuvash State Agricultural Academy became a participant of the comprehensive scientific and technical project “Development of potato seed and creating a competitive seed fund for promising native varieties of potatoes in the Volga Federal district” FSTP, subprogram “Development of selection and seed production of potato in the Russian Federation”. The Academy has a laboratory for microbiological research, and a laboratory for meristemic reproduction is being created.

Among the many areas of scientific research carried out in the Altai State Agrarian University, the work “Studies of the adaptive potential of spring grains and forage crops on zonal and saline soils” is important for the development of agriculture in the Altai agricultural complex.

For more than 15 years, scientists of the Nizhny Novgorod State Agricultural Academy have been engaged in potato breeding in experimental fields, this work is carried out jointly with the Falensk breeding station of the Kirov region. The Academy has a scientific and production system “Elite”, whose tasks are the organization of seed production in the Nizhny Novgorod region and the introduction of new, adaptive, high-yielding varieties based on modern crop technologies. In 2019 SPS “Elita” became a member of the National Union of breeders and seed growers.

In order to speed up the process of selection and seed production, Bryansk State Agrarian University has recently launched research on a new original aeroponic method for growing potato mini-tubers. In contrast to the fairly common method of hydroponic plant growth, in which the roots are immersed in a nutrient solution, in aeroponics, the roots hang freely in the zone of formation of the root system and stolons. The solution is sprayed on them. The complete absence of the substrate removes the cost of its replacement and disinfection, and also eliminates soil infections and pests. The use of a special nutrient solution provides plants with a balanced diet, eliminates the lack of moisture. The experience of implementing this method of obtaining potato mini-tubers on an aeroponic installation allows to recommend this method as an effective tool for accelerated reproduction of the original healthy test tube potato plants and obtaining mini-tubers suitable for planting in the open ground. To ensure the planned annual production of 20 000 mini-tubers of original potato material in the region where potatoes are cultivated, it is sufficient to have 50-70 m² of the area of the aeroponic year-round cultivation system. The advantages of this method are obvious and consist in the following: efficiency, environmental friendliness, low energy and material consumption, the ability to control the concentration of the nutrient solution.

Database analysis of scientific-research works (SRW) of agricultural universities for the period 2014-2018, available at Federal state budgetary scientific institution “Rosinformagrotech”, enabled the distribution of educational institutions on the subject of subprogram of FSTP as potential participants of CSTP (table 2) (according to the database of the results of intellectual activities of the Ministry of agriculture of the Russian Federation [Electronic resource]. URL: <https://rosinformagrotech.ru/db/bd-rezultatov-intellektualnoj-deyatelnosti-minselkhoza-rossii>; Database of research works of scientific and educational institutions of the Ministry of agriculture of Russia [Electronic resource]. URL: <https://rosinformagrotech.ru/db/federalnaya-bd-nauchnykh-issledovaniy-v-apk>).

Table 2. Ranking of agricultural higher education institutions according to FSTP subprograms based on the subject of research works.

No	Name of subprogram	Agricultural higher education institutions
1.	Development of selection and seed production of potato in Russian Federation	Gorsky SAU, Kabardino-Balkaria SAU, Tver SAA, Ural SAU, Irkutsk SAU, Michurinsky SAU, Chuvash SAA, Nizhny Novgorod SAA, Bryansk SAU
2.	Development of selection and seed production of sugar beet in Russian Federation	Kursk SAA, Michurinsky SAU, Perm SAA, Chuvash SAA
3.	Development of selection and seed production of oil crops	RSAU-MAA, Kabardino-Balkaria SAU,
4.	Development of selection and seed production of vegetable cultures	RSAU-MAA, Samara SAA, Gorsky SAU, Volgograd SAU, Ural SAU
5.	Development of selection and processing of crops	RSAU-MAA, Altai SAU, Bryansk SAU, Smolensk SAA, Voronezh SAU, Vyatka SAA, Gorsky SAU, Far Eastern SAU, Irkutsk SAU, Kemerovo SAA, Kurgan SAA, Michurinsky SAU, Ryazan SATU, South Ural SAU, Chuvash SAA, Northern Urals SAU, Omsk SAU, Orenburg SAU, Bashkir SAU
6.	Development of selection and processing of corn	Perm SAA, Chuvash SAA
7.	Development of selection and seed production of industrial crops	Tver SAA, Smolensk SAA, Kabardino-Balkaria SAU, RSAU-MAA

Where: SAU – State Agrarian University, SAA- State Agricultural Academy, RSAU – Russian State Agrarian University, MAA- Moscow Agricultural Academy.

At the same time, the analysis of the database of research works of agricultural universities showed that the number of scientific works of agricultural educational organizations on the subject of FSTP for the study period was only about 30% of the total number, but there is a growing trend (table 3).

Table 3. Dynamics of the number of research works of agricultural higher education institutions by year and in the areas of FSTP.

	2014 year	2015 year	2016 year	2017 year
Total number of research works	280	212	174	181
Total number of research works in the areas of FSTP	67	54	47	57
Share of research on the subject of FSTP, %	24	25	27	31

The largest number of studies of agricultural educational organizations in the field of selection and seed production can be attributed to the subprogram “Development of selection and processing of crops” (43 topics). The least amount of research works is related to the subprograms “Development of selection and seed production of corn” (3 topics), “Development of selection and seed production of industrial crops” (5 topics).

4 Conclusions

Processing and analysis of the submitted information from the subjects of the Russian Federation showed that more than half of the regions - 62% (53 subjects out of 85) have an

idea about the implementation of the FSTP subprograms and provided information about the measures taken in this area. Only 40% among them have worked out and prepared action plans for participation in the implementation of FSTP subprograms.

The greatest interest and activity in the regions among the selection subprograms in crop production was caused by participation in the implementation of the subprogram “Development of selection and processing of crops” - 66% of subjects, in relation to all regions that submitted action plans.

For the remaining subprograms, further analysis of the reasons for low activity and additional involvement of interested performers is required. Possible reasons: insufficient awareness of potential participants of the CSTP, both about the program and subprogram, and the conditions for participation in the implementation of the CSTP; difficulty in processing the application; unacceptable co-financing conditions, etc.

To attract more performers as the basis of the method of selection of potential customers of CSTP, we propose to use the provisions contained in the Order of the Ministry of agriculture of Russia “On approval of the Procedure for the selection of integrated scientific-technical projects” dated July 23, 2018 No 320 and the volume of production of the organization in the field that meets the interests of the implementation of the FSTP subprograms.

The data obtained during analytical processing show the increasing activity of agricultural educational organizations in the development of domestic selection and seed production. In order to involve them more widely in the implementation of the FSTP as participants, it is necessary to form a plan for research works of educational institutions, taking into account the subjects defined by the FSTP subprograms. There is a need to increase developments in the field of selection and seed production of corn and industrial crops.

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