

## SEED PRODUCTION AND FOOD SECURITY IN THE REPUBLIC OF BELARUS

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### СЕМЕНОВОДСТВО И ПРОДОВОЛЬСТВЕННАЯ БЕЗОПАСНОСТЬ В РЕСПУБЛИКЕ БЕЛАРУСЬ

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*Using high-quality seeds of varieties and hybrids is one of the prerequisites of getting the largest harvest of plants, which in turn guarantees the country's food security. The Republic of Belarus adheres to the strategy of the optimal self-sufficiency of the most important agricultural crops and raw materials and reduction of dependency on imports.*

*The result of the effective breeding work is the creation and zoning of new highly productive varieties of plants that are resistant to adverse environmental factors. New varieties, in comparison with previously zoned ones, give an increase in yield by 10–15 % or more, and due to the use of high-quality seeds of higher reproductions, an increase in yield can be up to 15–20 %. At present, in the republic as a whole, an increase in the use of seeds of higher reproductions has been noted, respectively, the areas under elite crops have been expanded by 15 percent.*

*Favorable market conditions will allow scientific organizations to ensure the production and sale on the domestic market of original and elite seeds to the elite-producing organizations of the republic with the aim of their subsequent reproduction and sale to the farms of the republic for sowing and mass production, to raise the volume of production and to reduce dependence on import.*

*Breeding and seed production work on creation and multiplication of new varieties of grain, leguminous and other crops is carried out in the academy. Scientists breeders and biotechnologists have recently created new varieties and hybrids of agricultural crops: winter and spring wheat, barley, white and narrow-leaved lupine, corn, meadow clover, eastern galega, a number of tomato and pepper hybrids, which are included in the State Register of Varieties. The Academy is a producer of original and elite seeds of spring wheat, white lupine, meadow clover, eastern galega and is included in the register of seed producers of agricultural plants.*

**Key words:** food security, selection, seed production, varieties, producers of seeds.

*Использование качественных семян сортов и гибридов сельскохозяйственных растений является одним из обязательных условий получения наибольшего урожая растений, что в свою очередь гарантирует продовольственную безопасность страны. Республика Беларусь придерживается стратегии оптимального самообеспечения важнейшими сельскохозяйственными культурами и сырьем и снижения зависимости от импорта.*

*Результатом эффективной селекционной работы является создание и районирование новых высокопродуктивных сортов растений, устойчивых к неблагоприятным факторам окружающей среды. Новые сорта по сравнению с ранее районированными дают прибавку урожая на 10–15 % и более, а за счет использования качественных семян высших репродукций прибавка урожая может достигать 15–20 %. В настоящее время в целом по республике отмечено увеличение объема использования на посев семян высших репродукций, соответственно расширены площади элитных посевов до 15 процентов.*

*Благоприятные рыночные условия позволяют научным организациям обеспечить производство и продажу на внутреннем рынке оригинальных и элитных семян элитопроизводящим организациям республики с целью их последующего размножения и реализации в сельскохозяйственные организации и фермерские хозяйства республики для увеличения объемов производства и снижения зависимости от импорта.*

*Селекционная и семеноводческая работа по созданию и размножению новых сортов зерновых, зернобобовых и других культур проводится в академии. Учеными-селекционерами и биотехнологами в последние годы созданы новые сорта и гибриды сельскохозяйственных культур: озимая и яровая пшеница, ячмень, люпин белый и узколистный, кукуруза, клевер луговой, галега восточная, серия гибридов томата и перца, внесенных в Государственный реестр сортов. Академия является производителем оригинальных и элитных семян яровой пшеницы, белого люпина, клевера лугового, галеги восточной и включена в реестр производителей семян сельскохозяйственных растений.*

**Ключевые слова:** продовольственная безопасность, селекция, семеноводство, сорта, производители семян.

#### Introduction

Food security of any country largely depends on the seed security. FAO pays special attention to seed safety issues with the aim of improving farmers' availability of quality seed material of suitable varieties as the basis of people's vitality.

In the Republic of Belarus, in 2017, the Doctrine of National Food Security until 2030 was adopted. It is aimed at increasing the provision of quality food and its availability for nutrition and a healthy lifestyle of the population [1].

The problem of food security in the Republic of Belarus has been quantitatively resolved. It was ensured during the implementation of the State Program for Rural Revival and Development (2005–2010), the State

Program for Sustainable Rural Development (2011–2015), the State Program for the Development of Agricultural business (2016–2020) [2, 3, 4].

So, in 2020, compared to 2015, the production of grain, rapeseed, sugar beet, flax fiber, vegetables increased. The growth rate was 101.3–191.4 percent. But there was a decrease in the production of potatoes (87.3 percent).

Compared to 2019, the growth rate of gross production of grain and leguminous crops in 2020 was 118.9 percent, including rapeseed – 126.5 percent, flax fiber – 103.3 percent. But there was a decrease in the production of potatoes – 85.7 percent, vegetables – 95.6 percent, sugar beets – 81.1 percent.

8.8 million tons of grain and leguminous crops was harvested with an average yield in 2020 of 35.0 centners per hectare (against 7.3 million tons and 30.4 centners per hectare, respectively, in 2019).

The gross harvest and yield of potatoes amounted to 5.2 million tons with an average yield of 206 centners per hectare, flax fiber – 48 thousand tons and 10.2 centners per hectare, sugar beet – 4 million tons and 482 centners per hectare, rapeseed – 731 thousand tons and 20.6 centners per hectare, vegetables – 1.7 million tons and 277 centners per hectare, respectively.

By 2025, it is planned to produce at least 10 million tons of grain with a yield of 40 centners per hectare, potato – 6 million tons with a yield of 240 centners per hectare, flax fiber – 55 thousand tons with a yield of 12 centners per hectare, sugar beet – 4.6 million tons with a yield of 550 centners per hectare, rapeseed – 830 thousand tons with a yield of 24 centners per hectare, vegetables – 2 million tons with a yield of 320 centners per hectare [5].

### **Main part**

The most effective way of increasing the volumes of crop produce is the creation and use of domestic high-yielding varieties of agricultural plants. One of the elements contributing to obtaining high yields is the production of sufficient volumes of varietal seeds [6, 7].

In the Republic of Belarus, selection and crop seed production is carried out in accordance with the Law “On selection and seed production of agricultural plants” and international agreements in the field of selection and crop seed production aimed at the improvement of varietal and seed bank of agricultural crops which are in demand by plant growing companies [8].

Breeding work on the creation of new varieties and hybrids of various crops is carried out in specialized research institutions:

- selection of cereals, legumes, flax, fodder and sugar beets, cruciferous crops and corn is carried out in the Scientific and Practical Center for agriculture;
- selection of potatoes, fruit and berries, vegetables is carried out in the Scientific and Practical Center for potato, fruit and vegetable growing;
- selection of flax is carried out in the Institute of Flax;
- selection and seed production of sugar beet is carried out in the Experimental scientific station for sugar beet.

Breeding work is also carried out at regional agricultural experimental stations, which are located in all six regions of Belarus and higher educational institutions of agricultural and biological profile, for example Belarusian State Agricultural Academy, etc.

Varieties created in research institutions and superior to the control variety in terms of yield and a number of other characteristics are subject to inclusion in the State Register. State testing of varieties and maintenance of the State Register is carried out by the State Inspectorate for Testing and Protection of Plant Varieties [9, 10, 11].

Currently, there are 6383 varieties and hybrids in the State Register, a significant part of which belongs to Belarusian selection. Thus, more than 50 % of varieties of peas, soybeans, oats, millet, buckwheat, flax and lupine were created by Belarusian breeders, 10–20 % of hybrids of corn and varieties of millet and triticale are the result of co-breeding [10].

Domestic plant breeding successfully solves the problem of providing farms with highly productive varieties. 295 varieties of the Scientific Research Center of the National Academy of Sciences for Agriculture occupy 80 percent of all agricultural land in the country. They are also exported to many countries. For example, 80 varieties are registered in Russia, which are sown on 2.5 million hectares.

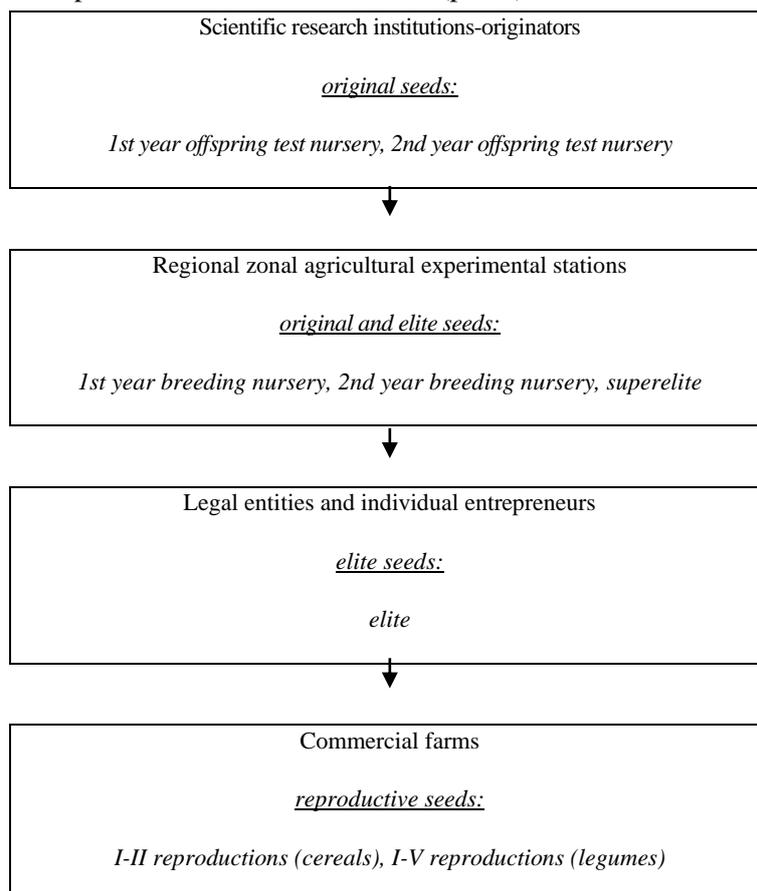
Thus, the use of high-quality seeds of varieties, hybrids, clones, etc., included in the State Register of Varieties, makes it possible to obtain the largest gross harvest of plant products, which in turn guarantees the country's food security [1].

Breeding results are implemented through the seed production system. The main directions in crop seed production are:

- selection and primary crop seed production;
- state variety testing of plants;
- subsequent introduction into production of varieties with the best quality indicators in order to carry out variety change and variety renewal in the required amounts.

As is known, new varieties, in comparison with previously zoned ones, give a 10–15 % yield increase or even more, and the use of high-quality seeds of higher reproduction can give 15–20 % increase. At present, an increase in the seed growing of higher reproduction has been noted, and the areas of elite crops have been expanded by 15 percent [5].

In accordance with the new Law «On selection and seed production of agricultural plants» [6], the seed production system in the Republic of Belarus is as follows (pic. 1):



Pic. 1. The seed production system in the Republic of Belarus

As its main activity, 11 scientific organizations are engaged in selection and primary crop seed production. The original and elite seeds of crops, which are produced by them, are of highest quality and highly productive seeds. They are the basis for the production of reproductive seeds.

Original and elite seeds are sold to 334 elite-producing organizations of the republic with the aim of their subsequent multiplication and sale to the farms of the republic for sowing and obtaining gross output.

Organizations that produce original and elite seeds are subject to registration in the State Register of seed producers of agricultural plants.

Supervision in the field of crop seed production, maintaining the State Register of producers of original and elite seeds, determining the sowing and varietal qualities of the produced seeds is carried out by the “Main State Inspection for Seed Production, Quarantine and Plant Protection” and its subdivisions [5, 11].

Further development of seed production is envisaged through the implementation of the following main directions:

- stimulating the competition in the field of crop seed production among seed producers;
- introduction and use in agricultural production of new highly productive varieties of crops that are resistant to adverse environmental factors;

- development and implementation of modern technologies for the production, refinement, use and storage of seeds;
- development, improvement and use of modern methods for determining the varietal and sowing qualities of seeds, as well as carrying out measures for testing and protecting plant varieties.

Thus, the main task of scientific and elite-producing organizations of the republic is to provide agricultural companies with elite seeds of highly productive varieties to satisfy the domestic needs [5, 8].

To solve this problem, it is envisaged to implement a set of measures:

1. Reducing the cost of original and elite crop seeds produced and sold by scientific organizations under the National Academy of Sciences of Belarus;
2. Reducing the cost of elite seeds and seeds of the elite of crops produced and sold by the elite-producing organizations of the Republic;
3. Purchase of seeds of parental forms of corn for the production of seeds of corn hybrids of the first generation;
4. Technical re-equipment of the "State Inspection for Testing and Protection of Plant Varieties" and its territorial organizations;
5. Technical re-equipment of the "Main State Inspection for Seed Production, Quarantine and Plant Protection" and its territorial organizations with laboratory equipment and instruments;
6. Buying agricultural selection and seed-growing machinery and equipment by scientific organizations;
7. Acquisition of agricultural seed-growing machinery and equipment for the preparation of seeds, including those not produced on the territory of the Eurasian Economic Union by elite-producing organizations of the republic.

Funds for these activities (about \$ 3.4 million) is provided at the expense of the republican and local budgets, own funds of agricultural organizations, as well as other sources.

The implementation of these measures will contribute to:

- the increase of original and elite seeds sowing at least by 12 percent in the structure of sown areas in the republic;
- providing scientific organizations for the production and sale in the domestic market of original and elite seeds of highly productive plant varieties for the needs of elite-producing organizations of the republic for the subsequent implementation of seed production of these varieties;
- ensuring the production and sale of elite-producing organizations in the domestic market of the republic of high-quality elite seeds, including seeds of elite of crops, highly productive varieties for the needs of agricultural organizations of the republic, as well as export supplies;
- an increase in the volume of high quality seed production and other plant products for our own needs, which will reduce their import [5].

It should be noted that the training of highly qualified professional specialists in crop selection and seed production in the Republic of Belarus is carried out in the Belarusian State Agricultural Academy, where in 1920 the department of selection and seed production was organized. The teaching staff of the department in different years have created varieties of the following crops: yellow lupine, narrow-leaved and white lupine, winter rye, winter wheat, spring barley, corn, meadow clover, eastern galega.

In recent years, the department has carried out two scientific topics "The use of biotypic selection for the formation of high-yielding ecologically adapted complex hybrid varieties-populations of meadow clover and eastern galega of different ripeness" and "Creation and study of the initial breeding material for the subsequent breeding of highly productive varieties of white lupine adaptive to the conditions of the Republic of Belarus". Within the framework of these topics, a state variety testing of Rosbel white lupine and Verbush meadow clover has been created and is currently underway. Seed growing has been developed for 7 earlier created varieties of narrow-leaved and white lupine, eastern galega and meadow clover [12].

The policy for import substitution has been adopted in the Republic of Belarus which includes the production of seeds. To ensure food security and decrease food imports, it is necessary to increase the yield of wheat and improve the quality of grain.

To address this issue, promising areas are:

- environmental testing of agricultural crops and assessment of their adaptability;
- innovation in the breeding process when creating new varieties;
- exchange of initial material for wheat breeding.

Here international cooperation is very important. Within the framework of the signed agreement on cooperation between the academy and the North-West University of Agriculture and Forestry (PRC), an agro-

technicological park was created. The Chinese side provided seeds of wheat, Tatar buckwheat, common millet, and soybeans for testing in Belarus conditions. Analysis of sowing qualities and grain quality was carried out in the seed quality testing laboratory of the academy for compliance with the requirements of GOST ISO / IEC 17025-2019. Assessment of elements of productivity and yield was held in the conditions of the educational and scientific center of the academy. The results show that wheat of Chinese selection can give the yield compared to the local zoned variety with spring sowing, and with the winter sowing, the Chinese wheat was significantly inferior to the zoned variety, since due to low winter resistance, there was an insufficient amount of productive stems.

Employees of the Academy are conducting research on the scientific topic “Improvement of durum wheat selection and seed-growing in order to organize import-substituting production”. As a part of the research, 3 varieties of spring and winter durum wheat have been created.

In recent years, breeders and biotechnologists of the Academy have created a series of competitive hybrids of tomatoes and sweet pepper, varieties of pumpkin, oregano and other crops.

### **Conclusion**

Selection and seed production is an integral part of the efficient agricultural production, which, if successfully developed, can meet the demand for high-quality seeds and varietal diversity, and, therefore, become a solution for ensuring food security and food self-sufficiency.

It should also be noted that the Republic of Belarus has organized a multi-level control over the safety of manufactured and sold food products, which is designed to guarantee the purchase of high-quality and safe food products that meet modern trends.

Currently, more than 60 varieties of various agricultural plants created by breeders of the Academy are included in the State Register of Varieties. As of 2021, the Academy is a producer of original seeds of meadow clover variety GPTT-early and eastern galegi variety Nesterka (pre-breeding nursery), white lupine variety Rosbel (1st year breeding nursery) and spring wheat elite seeds Rosalia and Valenta (2nd year breeding nursery).

### *ЛИТЕРАТУРА*

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