Breed as One of Significant Factors that Determine the Level of Yield and Its Quality

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Abstract. Breed is studied in the article as of significant factors that determine the level of yield and its quality. World experience shows that the consistent increase in the yield of cultivated crops is based on the improvement of the cultivation technology and the achievements of breeding. The production of agricultural products is based on the variety of breeds. According to A.A. Zhuchenko, breed determines the basic requirements for cultivation technologies: productivity, energy efficiency, environmentally friendly quality and environmental protection. It is believed that 25% of the yield is determined by the genetic characteristics of the cultivated breed. The role of the genotype in increasing and stabilizing the yield is constantly increasing, and the contribution of the breed during zoning is estimated at 30 ... 50%.

1. Rationale
At the current stage of agricultural development, with the introduction of new technologies for the cultivation of grain crops, the value of the breed has been preserved. The breed remains not only a means of yields increasing, but also becomes a factor without which it is impossible to realize the achievements of science and technology. In agricultural production, a breed acts as a biological system that cannot be replaced by anything [1,2,3].

It has established practically that the breed (like the machine) works effectively only under a certain operating mode in optimal technological conditions of growing [4].

The agricultural sector is an important sector of the national economy and plays an important role in the economy of the Russian Federation. According to the Ministry of Agriculture of the Russian Federation, the following regions can be mentioned among the leaders in terms of the rate of
implementation of digital approaches in agriculture: Altai and Krasnodar regions, Kursk, Lipetsk and Samara regions, the Republic of Bashkiria and the Republic of Tatarstan [5,6].

The introduction and use of digital technologies in the field conditions is very relevant and necessary at the present time, observing different crops, including determining the yield and its dependence on various varieties and other factors. In modern agriculture, digital technology is a term for the automation of all technological agricultural processes by simulating production cycles. Since the current situation in agriculture focuses on optimization of production costs and improvement of productivity, that are the main tasks of this work, the approach of precision farming becomes the most applicable [7]. For the application of precision farming, it is necessary to use digital information that agricultural producers can receive from various sources, depending on their needs:

1. Photos of fields from drones or satellites, followed by overlaying of vegetation maps on these photos;
2. Installation of field sensors such as weather stations, soil moisture sensors and temperature sensors;
3. Use of sensors for monitoring of equipment, for more accurate control not only over the progress of a particular operation, but also to rationalize the use of resources;
4. Analysis of field soil samples to determine the necessary elements and their compounds, which can increase the specific productivity of the soil.

The production of agricultural products is based on the breed. According to A.A. Zhuchenko, breed determines the basic requirements for cultivation technologies: productivity, energy efficiency, environmentally friendly quality and environmental protection.

The task of the above definition is to determine the role of the breed as one of the factors of improvement of productivity and its various qualities.

With the use of theoretical studies of the creation of breeds, the source material for breeding, breeds of various crops have been obtained (winter and spring wheat, barley, oats, corn, millet, rice, rye, etc.). These crops are capable of providing a stable grain yield over the years, they are sufficiently technological, the are of different use directions: for food purposes, confectionery, feed grain, monofeed, silage, etc.

2. Innovative technologies in the breeding of cereals, legumes, oilseeds and other crops

On the basis of the gene pool received from All-Russia Institute for Agricultural Development, winter wheat varieties with a productivity of 6–7 t/ha for the dry steppe zones have been created. As a result of studying the barley gene pool at All-Russian Research Institute of Grain Crops, Krasnodar Research Institute of Agriculture, Volga Research Institute of Agriculture, Samara Research Institute of Agriculture, a number of sources of economically valuable traits have been identified: by yield, coarse grain size, grain quality, early maturity. The creation of breeds with a high level of adaptability is considered as a priority for the stabilization of crop production. A classic example is the breeding improvement of spring wheat at the Research Institute of Agriculture of the South-East, where it was possible to form a whole line of development with the use of the world gene pool for the creation of breeds with increased suction force of the roots (25–32 atm.). Rye is a primordially Russian culture, not so long ago it was the main grain crop, but since the 50s of the last century, highly productive varieties of winter wheat have been created and rye was forced out of the fields [8,9].

Using the gene pool, Russian scientists have succeeded in promoting this culture from the south by 500 km to the north over the past 40 years. Scientists from the All-Russian Research Institute of Corn, Krasnodar Research Institute of Agriculture (now known as Federal State Budgetary Scientific Institution National Grain Center named after P.P. Lukyanenko) are successfully work with this culture. Rice is a culture that was introduced to Russia. At present, more than 1 million tons of rice are produced in Russia; 51 varieties are included in the State Register of Breeding Achievements, approved for use. In 2015 6 varieties of rice have been transferred to the All-Russian Research Institute of Rice and the All-Russian Research Institute of Rice for state testing. Their yield ranges from 7 to 12 t/ha. Russian rice varieties are unique in terms of cold resistance and ripeness time. This is the northernmost area of
cultivation of this crop in the world. Therefore, foreign colleagues show an increased interest in the Russian rice gene pool [10].

Legumes are the most important environment-forming crops. In Russia, there is a fairly large genetic diversity of them (about 800 breeds of these crops have been created). Thus the Research Institute of Agriculture of the Northern Trans-Urals submitted peas with a seed yield of 4.33 t/ha for the conditions of the Northern Trans-Urals with a protein content of 24.7% for the State Breed Testing. All-Russia Research Institute of Cereals and Legumes has created a new breed of lentils named Chernava. This lentil has an excellent culinary qualities and a yield higher than the standard by 11% [11].

21 oilseeds are cultivated in Russia. Sunflower donor lines with a high content of oleic acid and antioxidant forms of tocopherols have been obtained. Soy is the most important source of vegetable protein. Its seeds contain up to 45% of complete protein, balanced in amino acids. In 2016, the All-Russian Research Institute of Soybeans submitted for state testing four varieties of soybeans of various maturity groups with a yield of 3.5–4.0 t/ha. These breeds are recommended to be cultivated in the Far East. In 2015, the Siberian Research Institute of Feed created a soybean breed with a yield of 2.5 t/ha with the protein content in seeds of 39–42%. This breed is intended for cultivation in the Urals and West Siberian regions. All-Russian Research Institute of Oil Crops and All-Russian Research Institute of Legume and Cereal Crops have created soybean breeds for the south and central regions of Russia with a productivity of 3 t/ha [12].

Samara Research Institute of Agriculture and Ershovskaya experimental station of irrigated agriculture of the research institute of agriculture of the South-East have created drought-resistant varieties of soybeans. Rapeseed is an oilseed and fodder crops that have spread widely in Russia. The All-Russian Rapeseed Research Institute has created breeds of spring rape with a productivity of 4–5 t/ha. Transgenic plants of winter rape of the Severyanin breed have been obtained: 5 lines contain the npt11 selective gene and the tscsdp3 target gene encoding a protein with the cold shock domain CspA from E. coli. Using fundamental methods to accelerate the breeding process, including biotechnological methods, scientists have created a series of breeds of fruit, berry crops and grapes with high productivity and complex resistance to diseases and adverse environmental factors. Thus in 2015, domestic breeders obtained promising breeds of columnar apple. These breeds combine immunity to scab (Vf gene), winter resistance (−41 °C), high commercial and consumer qualities of fruits. Growing scientists have developed technologies and methods for expansion of genetic diversity and acceleration of selection of vegetable crops. A genetic collection and donors of economically valuable traits have been formed in various areas of selection for potatoes. 128 species of vegetable and cucurbits crops (more than 8 thousand hybrids) are included in the State Register of Breeding Achievements admitted on the territory of Russia. Among these corps, in addition to traditional ones such as cucumber, tomato, pepper, cabbage, pumpkin, etc., there are breeds that are rare for Russia. Such breeds which will eventually take a worthy place on the menu: asparagus bean, white radish, rocket salad, anise lophanthus, pussley, rhubarb, black salsify, etc. On the basis of this genetic diversity, using the halophyte gene pool, long-term spring-summer and autumn-winter pasture ecosystems have been created in the Republic of Kalmykia and the Astrakhan region. It provides an increase in productivity by 5-6 times while simultaneously restoring biodiversity. Russia has a powerful potential for the production of herbal formulations. To study wild plants, scientists of All-Russian Scientific Research Institute of Medicinal and Aromatic Plants collect them in various regions of Russia. For the preservation of the gene pool of medicinal plants and their study, All-Russian Scientific Research Institute of Medicinal and Aromatic Plants has the only Botanical Garden of Medicinal Plants in the country, where 1272 species of plants of various life forms are studied. There is a collection of rare and endangered species. In the greenhouse complex, the gene pool of 373 species of tropical and subtropical flora is being studied. There is a unique herbarium of plants, represented by 20748 species. All-Russian Scientific Research Institute of Medicinal and Aromatic Plants has developed over 100 drug products based on the study of the gene pool. Due attention is not paid to the conservation of plant genetic resources in Russia. For five years, the Law on Plant Genetic Resources, prepared by scientists jointly with the Ministry of Agriculture of Russia, has been considered
in various instances. This law would regulate the collection, storage and study of general resources, the financing of works and the preservation of land plots involved in collecting activities [13].

3. Role of the breed in adaptive system of agrarian production

The production of agricultural products is based on the variety of breeds. According to A.A. Zhuchenko [14], breed determines the basic requirements for cultivation technologies: productivity, energy efficiency, environmentally friendly quality and environmental protection.

The adaptability of a breed (hybrid) is a balanced combination of a large number of traits, where preference is given to the most valuable of them. The degree of adaptability of a breed depends not only on its adaptability, but also on the specifics of the ecological conditions created in the agrocenosis [7].

The following requirements are imposed on an adaptive breed:

- environmental plasticity, i.e. the ability to give a yield, at least average, in a wide range of fluctuations in climatic conditions;
- heterogeneity of agropopulations, i.e. the presence in their composition of plants that differ in height, depth of the root system, drought resistance, flowering time, etc.;
- early ripeness, i.e. the ability to rapidly develop and outstrip weeds in the rate of development;
- intensity, i.e. the ability to respond quickly to improved growing conditions (for example, to precipitation);
- resistance to fungal and other diseases;
- low vulnerability to insects and high ability to regrow when attacked [7].

The breed is one of the significant factors that determine the level of crop yields, the cheapest and most affordable means of its’ increasing. If in the world new breed has 30-50% yield increase, then in Russia, the share of a breed in the formation of the size and quality of the crop reaches 50-70%. This is due to the fact that most of the agricultural area is in unfavorable and often has an extreme soil, climatic and weather conditions. It is believed that the worse the soil, climatic and weather conditions, the lower the level of technical equipment and subsidies of farms, the higher the role of the breed and hybrid. It is believed that 25% of the yield is determined by the genetic characteristics of the cultivated breed. According to Borisovtsev T.V. (2000), the role of the genotype in increasing and stabilizing the yield is constantly increasing, and the contribution of the breed during zoning, according to T.V. Borisovtseva (2000), estimated at 30 ... 50% [9].

A breed as a means of agricultural production is one of the most important elements ensuring the receiving of the required amount of high-quality products. World experience shows that the consistent increase in the yield of cultivated breeds is based on the improvement of the cultivation technologies and the achievements of breeding. Breeding of complementary breeds is quite difficult breeding task. When they are applied, the yield increases due to the differentiation of niches and more complete use of soil resources and light [7].

The role of the breed as a biological system ensuring the stabilization of productivity at a high level is especially important in the variety of soil-climatic and economic conditions of agricultural production [15]. The fundamental principle in the modern breeding strategy is the principle of adequacy, which provides for the formation of a new adaptive breed in the process of its creation in strict accordance with the conditions of its cultivation in production. A scientifically grounded, differentiated approach to the selection and placement of breeds in specific farms and crop rotation fields is one of the important and available reserves for increasing of the level of adaptive intensification of crop production.

Resistance to environmental factors that limit the formation of potential productivity is highlighted among a number of requirements for breeds. This problem is especially relevant in areas with a sharp manifestation of climate elements unfavorable for plants. In this regard, the study and assessment of the ecological plasticity of breeds, the scope of their application and adaptation to real natural and climatic situations is an urgent issue of the modern process of agricultural production. The adaptability of the breed to various weather, soil and economic conditions was determined as ecological plasticity in 1932 by Dr. of Agricultural Sciences Pushkarev I.I. Recently, breeders have paid special attention to the ecological plasticity of the breed, in particular, to the search for statistical parameters of its expression.
5. Quality and environmental protection are imposed on the breed. Domestic scientists, such basic requirements as productivity, energy efficiency, environmentally friendly quality and environmental protection are imposed on the breed. In the opinion of many domestic scientists, such basic requirements as productivity, energy efficiency, environmentally friendly quality and environmental protection are imposed on the breed.

4. Findings
Thus, it shall be noted that the breed is one of the most important factors that determines the level of productivity of various agricultural crops (winter and spring wheat, barley, oats, rye, millet, corn, rice), the cheapest and most affordable means of increasing the productivity of the crop reaches the range of 50-50% of yield increase, while in Russia, the share of a breed in the formation of the size and quality of the crop reaches the range of 50-70%. This is due to the fact that most of the agricultural area is in unfavorable and often has an extreme soil, climatic and weather conditions. In the opinion of many domestic scientists, such basic requirements as productivity, energy efficiency, environmentally friendly quality and environmental protection are imposed on the breed.

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