Developing the specialized potato growing in the region

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Abstract. With the development of the market in the agro-industrial production, the growth of the effective functioning of the food market and the development of a more developed potato market, its supply through the inter-regional exchange will increase due to the further deepening of the specialization of regions in which there are more favorable both natural and economic conditions for growing potatoes intended for consumption in fresh and processed form. The main direction of deepening specialization and increasing the concentration of the production of marketable potatoes should be a focus on those regions in which economic and natural factors contribute to the more efficient development of interregional relations. It will also have a beneficial effect on the process of formation of the all-Russian potato market, an increase in the import of potatoes to regions where its production does not provide rational consumption rates, and export from regions with a high level of per capita production.

1. Introduction

Among the subjects specializing in the production of potatoes, a special place is occupied by the Bryansk region. It is one of the leading regions for potato cultivation, where in recent years its average yield was 196.5 q / ha, or 35.3% higher than the average yield in the country. With its production of 891 kg per capita, 159 kg of potatoes were consumed per person each year at the average Russian level of 111 kg.

Potato farming is a system for the production and sale of potatoes in order to provide them with a country's population. It is an important food crop with high nutritional value, high-yielding and relatively undemanding to growing conditions. Per unit of area, gross production exceeds all other agricultural crops. In terms of caloric and nutrient content, this crop is superior to cereals, vegetables, and industrial crops. It is grown in a variety of climatic zones. Almost every fifth inhabitant of the planet consumes potato products, and for every tenth it is one of the staple foods, more than 2/3 of the world's potato harvest is used as food. Its caloric value per 1 ha is 75% more than wheat and 58% more than rice. Potatoes are also a source of carbohydrates, vitamins, trace elements, fiber. It is important in ensuring global food security.

To solve the problems and prospective development of potato farming, it is necessary: to study the measures aimed at the development of potato seed production (including through the creation of fixed multisite seed complexes, the development of innovative technological methods and scientifically based regulations for the production of original, elite and reproduction seed potatoes); construction of potato storages; construction of enterprises for the processing of potatoes in a variety of food and technical products: chips, flakes, different types of starch, frozen potatoes, alcohol, ingredients for the
food industry (production of jelly, thickeners, various sauces and other foods and semi-finished products). Successful implementation of these and other necessary measures will enhance the efficiency of potato production.

2. Results and Discussion

By the size of the planting area occupied by potatoes, the Russian Federation is one of the world leaders. However, its share in the total agricultural area is very small and amounts to 2.7%. Since 1993, there has been a dynamic decline in planting areas for potatoes. This process stopped only in 2005, since then the total size of these areas in Russia has stabilized at the level of 2.1-2.2 million hectares. In the Bryansk region, the area of potato planting decreased from 141.9 thousand hectares in 1990 to 46.8 thousand hectares in 2005. In 2017, it amounted to 554.1 thousand hectares, or 6.2% of the area of agricultural crops.

Planting of potatoes in all categories of farms in the country in 2017 amounted to 1,805.5 thousand hectares, which is 39.0% lower than the 1990 level. This was due to a decrease in the area of agricultural organizations by almost 7.7 times. In the farms of the population during the period under review, the area of potato planting first increased significantly, and then there was a reduction and, by the level of 1990, they were lower by only 11.0%. At the same time, there was an increase in the area under potatoes in peasant (farmer) farms and in individual entrepreneurs. This is due to the fact that in recent years, on the basis of a comprehensive support strategy for small and medium-sized businesses in the country, farmer (peasant) farms have become available on a par with agricultural organizations any kind of state support. Since 2012, the target program “Support for Beginning Farmers in the Bryansk Region” has been implemented in the region.

In the Bryansk region, the reduction of potato plantations was at a higher rate than the national average. By 2017, the area of landings in all categories of farms to the level of 1990 decreased by 2.6 times, and in agricultural organizations by 6.0 times. In the farms of the region’s population, as in the country as a whole, the areas where potatoes were planted first grew, then they decreased to 29.3 thousand hectares.

In the Russian Federation, the largest share in the structure of the planting areas of potatoes falls on households. In 2017, their share was 84.3%, which is less than the 2000 value by 6.4%. The share of peasant farms and individual entrepreneurs increased in the total area of potato plantations from 1.4 to 6.7%, the share of agricultural organizations slightly increased. In the Bryansk region, specializing in the production of potatoes, in recent years, its planting in agricultural organizations has increased significantly (Figure 1). Thus, their share increased from 7.1% in 2000 to 28.7% in 2017, the share of peasant farms and individual entrepreneurs increased from 1.1 to 17.2%, and the share of household farms decreased from 91.7 to 54.2%. In recent years, more than 230 agricultural commodity producers are engaged in the production of potatoes in the region, of which about 80% are from peasant farms.

Agricultural producers of the Central Federal District, including the Bryansk region, make a major contribution to the increase in potato production in the country. The yield of potatoes in the Bryansk region in the context of all types of categories of farms exceeds the average in the Central Federal District, and in the whole country. So, the potato yield in the region in all categories of farms exceeded the national average by 76.7% in 2017. But the highest yields were achieved by the producers of agricultural organizations, which 371.6 c / ha, or 2.4 times higher than the average Russian level. One of the most important factors for increasing the yield of potatoes in the Bryansk region is the quality of planting material. A serious problem in the potato industry is the frequent damage to the culture by various infectious diseases. Therefore, it is necessary to introduce new (virus-free) potato varieties, which increase the potato yield by 20-25% and significantly reduce the cost of the final product compared to using common varietal material.
In the Bryansk region, all municipal districts and urban districts are engaged in potato cultivation. However, the main potato production is concentrated in 6 municipalities.

On average for 2016-2017, 23.2% of the total volume in the region was produced in Starodubsky District, 9.3% in Pogarsky, 8.8% in Unechsky, 6.7% in Klimovsky, 5.6% in Bryansk, and in 4.7% in Trubchevsky, or 58.3% generally. All of them, with the exception of Bryansk, region, are located on the border with the Republic of Ukraine and have more favorable climatic conditions.

In 2017, in specialized areas of the region for the production of potatoes were produced: 337.7 thousand tons in Starodubsky (22.7% of the gross production in the region), 142.5 thousand tons in Pogarsky (9.6%), 118.8 thousand tons in Unechsky (8.0%). The largest producers of potatoes in the region are the group of companies called Individual Entrepreneur Peasant Farm O. A. Bogomaz, where 117.7 thousand tons, or 8.5% of the regional volume, were produced, and the Farm “Putsko” LLC with production 85.9 thousand tons, or 6.2% of regional production.

In 2011-2015 (in comparison to the level of 1991-1995) the gross potato production in the Bryansk region decreased by almost 30%. However, the growth of potato production in 2016-2017 reduced this figure to 9.7%. This was due to a significant increase in gross yield in Starodubsky district, the most specialized in the production of potatoes, where the growth was 2.4 times, as well as in Zhirtyatinsky (2.0 times), Bryansk (1.7 times) and Navlinsky (in 1.2 times) districts. The growth of potato production in recent years has occurred due to the expansion of potato plantations and an increase in its yield in the agricultural organizations of the region. So, in 2017 compared to the level of 2010 in the region as a whole, the gross harvest of potatoes in agricultural organizations increased by 3.9 times due to the expansion of plantings by 1.7 times and yield growth by 1.8 times. During this period, the share of agricultural organizations in the total potato production increased from 20.7 to 38.6%.

The yield of potatoes in the agricultural organizations of the region and municipal areas is much higher than the average level for all categories of farms.

In 2017, in agricultural organizations, the average yield in the region was 372 c / ha, or almost 96 centners higher than in all categories of farms. The highest yield was obtained in epy Starodubsky district (424 c/ha), where agricultural organizations concentrated 27.2% of potato plantations and received 32.6% of the total yield. In addition, in this area, in peasant farms, the potato yield was 345 c/ha, which accounted for 57.2% of potato plantations and 54.2% of gross production in the region.

In recent years, the planting of potatoes in the agricultural organizations of the Bryansk, Vygonichny, Zhirtyatinsky, Pogarsky, Starodubsky, and Unechsky districts have also been
significantly increased. The expansion of potato plantations in agricultural organizations and an increase in its yield through the use of advanced cultivation technologies, new varieties, and an increase in fertilizer dosage have significantly increased production in these municipalities and in the region as a whole.

One of the significant areas of growth in the efficiency of potato cultivation is the use of high-performance agricultural machinery and technology, which ensures, above all, a reduction in labor intensity. However, for the 1990-2017, the material and technical base of agricultural organizations was significantly reduced both in the whole country and in the Bryansk region. During this period, the tractor fleet decreased 6.3 times, and it was 6.7 times in the Bryansk region. The availability of plows, potato planters, cultivators, potato harvesters, machines for applying mineral and organic fertilizers, as well as other types of equipment (table 8) significantly decreased. During this period, in all regions of the country there was a reduction in the area of arable land and crops under agricultural crops; therefore, the number of tractors per 1,000 hectares of arable land was reduced by lower rates. Similarly, the arable land load per 1 tractor grew. So, in 2017 in the Bryansk region the load of arable land on 1 tractor was 246 hectares and was lower than the average Russian indicator, but compared to the level of 1990 it increased by 3.7 times while the average growth in the country was 3.4 times.

Among the districts of the Bryansk region, the Trubchevsky municipal district has the largest number of tractors in agricultural organizations (Application 4). In 2016, there were 339 tractors, or 11.9% of the total number of tractors in the region. At the same time, to the level of 2008, the number of tractors in this area increased 3.5 times with a decrease in their number in almost all districts of the region with the exception of Zhiryatinsky, which accounts for only 2.2% of tractors. A significant number of tractors have the following districts: Starodubsky (10.8%), Pochepsky (8.5%), Brasovsky (8.3%), Mglinsky (7.9%), Bryansk (6.3%). From 2008 to 2016, the number of tractors in the region decreased from 3,421 to 2,852 pcs., or by 16.6%.

In 2017 compared to 1990, there was a decrease in the supply of potato farming with combine harvesters. In general, their number in the country decreased by 15 times, by 21 times in the regions of the Central Federal District, and by 33 times in the Bryansk Region. With a significant reduction in planting of potatoes in agricultural organizations both in the Bryansk region and in other regions of the country, their number per 1000 hectares of plantings decreased at a much slower rate and amounted to 1.4 times in the whole country, 2.1 times in the Central Federal District, and 4.1 times in the Bryansk region. Accordingly, the load on 1 potato harvester increased.

In the municipal districts of the Bryansk region in recent years, there has been a decline in the number of potato harvesters. Only for the period from 2008 to 2016, the total number of potato harvesters decreased by 2 times, including the main potato-producing districts of the region. Thus, in Starodubsky district, the most specialized in the production of potatoes, there were 28 potato harvesters in 2016 against 51 units in 2008. In Pogarsky district, the number of potato harvesters decreased from 17 to 10 units, Novozybkovsky – from 25 to 2, Klintsovsky – from 20 to 10, Unchesky – from 18 to 5, Pochepsky – from 13 to 6 units. During this period, potato harvesters were acquired by agricultural organizations of the Bryansk, Vygonichsky, Karachevsky, and Kletnyansky districts, but their number is insignificant and does not cover the reduction of equipment in other areas. Thus, with the expansion of potato planting in agricultural organizations and the reduction in the number of potato harvesters in the leading areas of the region, the load of the harvesting area per harvester increased significantly.

Reducing the number of tractors, potato harvesters, and other agricultural machinery was also due to the existence of positive trends in the development of mechanization of agricultural production, which include an increase in the average power of tractors and exclusion from the park low-power tractors, the presence of potato harvesters large capacity, the introduction of new cultivation techniques potatoes with minimal tillage. The use of powerful tractors and wide-range universal equipment allows one to save time on technological operations and ultimately reduce the cost of potato production.
Disposal of machinery in the agricultural organizations of the country significantly exceeds its receipt. However, in 2017, the coefficient of renewal for tractors in the whole country was 3.6% versus 2.3% in 2010, and it increased in the Bryansk region from 2.8 to 8.0%. The coefficient of disposal of tractors for this period decreased slightly, but in the whole country it still exceeds the level of upgrading equipment. In the Bryansk region, the renewal rate exceeded the level of liquidation of equipment as a result of wear. The situation is much worse with the renewal of the potato harvester fleet, especially in the agricultural organizations of the Bryansk region. Thus, the update rate for potato harvesters in the region in 2015 decreased to 1.8% against 4.7% in 2010. In 2016-2017, no potato harvester has been acquired. At the same time, the retirement rate in 2016 was 9.9% versus 6.7% in 2010. With a renewal rate of 3.3%, the service life of agricultural machinery increases to 30 years. The service life of the equipment and the load on it are several times higher than the standard indicators. Thus, the security of farms that grow potatoes, tractors and potato harvesters is 50% of the regulatory need. However, it should be noted that in this subcomplex, there is a significant deterioration of the energy means of production, which leads to the loss of grown potatoes. Thus, according to the data of the food balance in the Bryansk region, potato losses in its total resources increased in 2016 to 8.1% against 2.7% in 2000, which was largely due to the reduction of the potato harvester fleet.

Agricultural organizations of the country for the maintenance in working mode of agricultural machines, tractors, and combines spend annually on spare parts almost 77 billion rubles, which exceeds the level of required expenses for the purchase of new tractors and agricultural machines. The use of the same old, worn-out equipment leads annually to significant amounts of excessive consumption of combustible and lubricants. Due to the tough financial conditions imposed by commercial banks, the majority of farms that grow potatoes cannot use subsidized loans to purchase the necessary new generation equipment, spare parts, fuel and lubricants.

It should be noted that farms in which the area of planting under potatoes is decreasing from year to year begin to use chemicals most of all. In 2017, in the Russian agricultural organizations, the total amount of fertilizer applied to agricultural crops to the level of 2010 increased by 28.8%, by 41.4% in the Central Federal District, by 4.3 times in the Bryansk region. Out of the total amount of mineral fertilizers, 1.7% were made for potatoes in the whole country, 2.2% in the Central Federal District, and 9.9% in the Bryansk region. The average Russian level of mineral fertilizer application per 1 hectare of planting area amounted to 353.5 kg a.s. in active substance, which was 34.5% higher than the 2010 level. In the Bryansk region specializing in the production of potatoes, the application of mineral fertilizers for potatoes in 2010-2017 in 1.3-1.9 times higher than the average Russian level (Table 11). In addition, the proportion of the fertilized area of potatoes in the total area of its plantings was 98.8% against 91.6% in the Central Federal District and 88.1% on average in the country.

In 2017, in the municipal districts of the Bryansk region, the amount of mineral fertilizer application increased the most where it was lowest in 2010 (Application 6). In areas with developed potato farming in agricultural organizations and high potato yields, the growth in the application of mineral fertilizers for agricultural crops was in: Brasovsky (14.0 times), Navlinsky (11.3), Pogarsky (5.3), Klimovsky (4.9), Bryansk (3.8), Zhiryatinsky (3.5), Starodubsky (2.7), Uchensky (1.5), and Trubchevsky district (1.3 times).

Potatoes are one of the most demanding crops for soil nutrition. Of the main nutrients, potatoes consume the most potassium, then nitrogen and less phosphorus. In 2017, in the Bryansk region, 7.4 thousand tons of mineral fertilizers were used for planting potatoes, including 1.9 thousand tons (25.7%) of potash fertilizers, 3.8 (51, 3%) of nitrogen, and 1.7 thousand tons (23.0%) of phosphoric. The proportion of the fertilized area in the total area of potato plantations was higher than the national average and the Central Federal District. As a result, potato yield in agricultural organizations of the Bryansk region was higher by 113.3 centners (43.3%) than the national average. The yield of potatoes in peasant farms in the region also exceeded the average for the country and the Central Federal District. It should be noted that the proportion of the fertilized area of potatoes in the total area of its...
plantings in the Bryansk region for the entire period under consideration exceeds the average level of the Central Federal District and the country as a whole.

With an increase in the introduction of mineral fertilizers for planting potatoes, the use of organic fertilizers sharply decreased. So, if the national average in 2000 was 27.4 tons per hectare of potato planting, they amounted to 6.4 t/ha, or decreased by 4.3 times, and in the Bryansk region only 2.6 t/ha (Figure 2).

![Figure 2. Fertilization for planting potatoes of agricultural organizations of the Bryansk region. * Compiled by the authors.](image)

Organic fertilizers improve the physical properties of the soil, while clay and loamy soils become less cohesive, which is especially important for mechanized harvesting of potatoes, sandy and loam better retain moisture. Significant doses of organic fertilizers increase potato yield and starch content in tubers. However, in recent years in the Bryansk region there has been a more significant reduction in the introduction of organic fertilizers for planting potatoes than the national average and the Central Federal District. So, if 13.3 t / ha were applied in the field of organic fertilizers in 2011, 2.6 t/ha respectively were made in 2017. At the same time, the proportion of the fertilized area of potatoes with organic fertilizers, amounting to already insignificant quantities, continues to decline, especially in the Bryansk region.

The Bryansk region is included in the Central Russian subzone of the southern taiga forest zone, which has favorable conditions for the production of potatoes. In 2011-2015 In this zone, agricultural organizations produced 33.7% and sold 33.9% of potatoes. Profitability of potato production and sales amounted to 29.6%. At the same time, in the Bryansk region the cost of production and sale of potatoes was the lowest among the country's regions (410.8 rubles / c), or 1.7 times lower than the average Russian. However, potatoes were also sold at the lowest price (577.0 rubles / c), or lower than the national average by 1.6 times. As a result, the level of profitability was 40.5%. Relative to the previous five-year plan, the level of profitability of production and sales turned out to be higher, since the cost of production compared to 2006-2010. increased by 15.1%, and the selling price - by 23.0%.

In Russia, as well as throughout the world, with the almost ubiquitous cultivation of potatoes and the increasing efficiency of its cultivation, one of the important problems of the functioning of the potato sub-complex is the level of low marketability of potatoes.

From 2000 to 2016, the marketability of potatoes in agricultural organizations increased from 38.5 to 66.0%, which is explained by the increase in the number of specialized potato farms, the production of which is aimed at meeting consumer demand. Depending on the demand in these farms, it is
preferable to grow either table potatoes for delivery to wholesalers or directly to retail trade, or industrial (to provide raw materials for processing enterprises). In 2016, in the Bryansk region, the marketability of potatoes in all categories of farms amounted to 46.2% against 27.2% of the all-Russian level in agricultural potato manufacturing organizations (68.6%); it was more than 64% peasant farms and 15.4% in households.

Based on the development trends of the potato growing subsector, the increase in the efficiency of potato production should be based on a rational combination of potato cultivation for local consumption with the creation of large specialized cultivation areas for potato export and processing. Such farms should be concentrated in regions that are primarily with the most favorable soil and climatic conditions for the production of this crop.

Taking into account the established areas of efficient potato cultivation, investments in the development of its production should berationally directed primarily to the potato farms of the Center, the regions of the Northeast, the Central Black Earth Region, the Urals and Western Siberia in order to create highly specialized commercial potato production with further export of table and seed varieties of potatoes and its products to other regions of Russia. It is here that most of the planting areas of potatoes should be concentrated, to organize the production of chips, frozen potatoes, and other types of potato products.

The development of specialized commodity zones for potato growing will contribute to the creation of a modern, most efficient system for the sale of marketable products based on an association of agricultural organizations producing potatoes, processing them, and trading. The integrated development of the potato farming subsector in areas specialized in growing this crop, combined with an increase in the volume of supplies to the regions unfavorable for potato production, becomes the basis for food supply to the regions and the country as a whole.

The organization of rationally located raw zones with the cultivation of potato varieties recommended for each region, taking into account the purpose, adherence to scientifically-based technologies for growing tubers, rational transportation, and storage conditions can help ensure that potato processing enterprises use high-quality raw materials in the necessary volumes and assortment. This will contribute to the most complete saturation of the market with domestic competitive products.

At present, delivery of fried and frozen and potato products to remote regions is hampered by large transport costs. Therefore, enterprises specializing in obtaining frozen and fried potato products should be located in the places of their consumption, as a rule, in the vicinity of large cities with a significantly large market. Companies that process tubers for dry mashed potatoes, it is advisable to bring closer to the areas of potato cultivation. It should also be noted that enterprises producing dry mashed potatoes will contribute to the saturation of this product not only in the regions where they are located, but also in regions of the country with an existing deficit in potatoes.

Therefore, the introduction of waste-free technology of potato processing in specialized cultivation areas at industrial enterprises will become the basis for a more complete supply of the population of the country with processed potatoes. If we talk about the processing of potatoes for potato products, then, in our opinion, the most efficient production of dry mashed potatoes, grains, granules, powder in regions such as Bryansk, Moscow, and Orel and in the Republic of Bashkortostan.

3. Conclusion
Thus, the formation of specialized areas for the production of potatoes intended for sale, an increase in the efficiency of placement of potato plantations, taking into account the changes taking place in the subsector, requires a number of measures to develop a more advanced potato market. At the same time, the development of such a market is impossible without the rational placement and deepening of the specialization of potato production, based on the creation of commodity zones and the improvement of interregional relations.
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