An analysis of the current state of vegetable production of open and protected soil in the Russian Federation

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Abstract. The article analyzes the current state of vegetable production in the open and protected soils of the Russian Federation. Tomato (17.3%), cabbage (16.7%), onion (13.0%), carrots (10.4%), cucumbers (10.0%), and table beet (7.0%) occupy the largest share in the structure of vegetable crops cultures. In the structure of products of the whole agriculture, 49.5–52.8% is accounted for by agricultural organizations, 40.5–34.7% is produced by households. The bulk of commercial vegetables produced in the open ground. all categories of farms produced 14.7 million tons each, in 2016–2017. The main production of vegetables in open ground is concentrated in the Southern, Volga and Central federal districts, where about 65% of the vegetables from the total production in the Russian Federation are produced annually. The average yield of vegetables in greenhouses in the whole country is growing steadily, reaching the figure of 36.9 kg/m² in 2017, which is 31.8% higher than the 2013 level (28 kg/m²). According to the Ministry of Agriculture of the Russian Federation, the level of self-sufficiency of the Russian Federation of vegetables of the protected ground was 53.4% in 2017. This indicator is 7.1% higher than the 2016 level (46.3%) and 13.0% higher than the 2015 level (40.4%).

1. Introduction
In the human diet of the Russian Federation, vegetables occupy the third place after bread and potatoes. Since vegetables are the main suppliers of phytonutrients necessary for the normal functioning of the body, the annual demand of the population of the Russian Federation for fresh vegetables is about 18.3 million tons (the current level of production is 15-16 million tons). This standard is determined in accordance with the rational norms of food consumption that meet contemporary requirements for healthy nutrition. According to the Food Security Monitoring System, the self-sufficiency of open and closed ground vegetables was 81.1% in 2017. Insufficient provision of the domestic market of the country with vegetables of domestic production is replenished with imported products from China, Turkey, Israel, Morocco, Belarus, Egypt, and other countries. Prior to the introduction of international sanctions, imports of vegetable products tended to increase, then its decline was outlined [1]. Vegetable production in the Russian Federation is inferior to industrialized countries in many respects. The vegetable production is lower by an average of 1.5-2 times. In terms of the range of products being produced on an industrial scale, vegetable production is lower by 2-3 times etc. [2].

The purpose of the study is to analyze the current state of vegetable growing in open and protected ground in the world and in the Russian Federation.
2. Materials and Methods

Scientific studies were conducted on the basis of the first item of the FNI Program of the State Academies of Sciences for 2013–2020 and the approved research direction “Modern Economic Theory and Principles of Development of the Country's Agro-Industrial Complex in the Context of Globalization and Integration Processes in the Global Economy”. In the framework of the general systems approach to the study of the problem, the tools of the abstract-logical, comparative, economic-statistical, economic-mathematical, and computational-constructive research methods are used. Legislative and regulatory documents of state authorities, methodological and instructional materials of the Ministry of Agriculture of the Russian Federation were the information basis of the study. The empirical base of the research is presented by the materials of the Federal State Statistics Service, data of the consolidated annual reporting on the financial and economic status of enterprises of the agro-industrial complex of the Russian Federation.

3. Results

The highest level of self-sufficiency in vegetables was found in the Southern Federal District (170.5%), Volga Region (88.1%), North Caucasus (76.5%), Siberian (73.6%), Ural (56.4%), Central Federal District (55.6%), and the Far East (53.1%). The lowest level of provision with vegetables is noted in the regions of the North-West Federal District (35%). For full provision of the population with domestic vegetables, it is necessary to additionally produce about 3 million tons of vegetable products. Such countries as China (25%), Turkey (14%), Israel (10.5%), Morocco (8.6%), Belarus (8.3%), Egypt (7.8%) are the main countries-suppliers of vegetables in Russia. Before the introduction of international sanctions, the import of vegetable products tended to increase, then its decline was evident. Almost twice less imported vegetables are imported into the country compared to previous years. Thus, the vegetable imports to Russia amounted to 3,000 thousand tons, in 2013, 3,380 thousand tons in 2014, 2,607 thousand tons in 2015, 1,724 thousand tons in 2016, 1,864 thousand tons in 2017. Vegetable imports to Russia amounted to $10.4 billion, with a total weight of 12,575 thousand tons, for the period 2013–2017. Tomatoes (42% of the value of imported vegetables), onions and garlic (12%), cucumber (10%), other vegetables (27%) were the bulk of imported vegetables [3]. Vegetable exports amounted to 4348 thousand tons worth $1.56 billion. Exports of Russian tomatoes increased almost 4 times, exports of domestic cucumbers increased by 29%, cabbage - by 12.6%, from the beginning of 2018 [4].

Vegetable production in the Russian Federation is inferior to industrialized countries in many respects, including yield, which in Russia is on average 1.5–2 times lower than in Western Europe, the USA, China. Russia, on the yield is in 57th place. The range of products produced on an industrial scale in the Russian Federation is very limited. If most countries in the world use more than 30–35 species of vegetable crops in industrial vegetable production, Russia uses no more than 12–15 species. 84% of the total harvest of vegetables accounted for the 6 main types of vegetable crops: cabbage (23%), tomato (18%), onion (13%), cucumber (12%), carrots (11%), table beet (7%). The share of other vegetables is not more than 16% of the total harvest of all vegetables [6].

Provision of the population with certain types of vegetable products is determined by the rational allocation of vegetable production on the territory of the Russian Federation and the species composition of cultivated crops. In the structure of vegetable crops, tomatoes (17.3%), cabbage (16.7%), onion (13.0%), carrots (10.4%), cucumbers (10.0%), and table beet (7.0%) are the largest share.

In Russia, 660–690 thousand hectares are under vegetable crops annually, which is about 0.9% of the total crop area in the country, the gross yield is 16.1–16.4 million tons, with an average yield of 22.5–23.6 t/ha. In the structure of products of all agriculture, the share of agricultural organizations is 49.5–52.8%, the share of households of the population is 40.5–34.7%, the share of peasant (farmer) farms and individual entrepreneurs is 10.0–12.5%. In the country as a whole, in recent years, a steady increase in agricultural production in agricultural organizations and peasant (farmer) farms has been observed, a decrease is observed in household farms. The same trend is observed in the production of...
vegetables. The main production of vegetables is concentrated in household farms, their share was 62.9% of the gross collection in 2017. And these farms had 478.9 thousand hectares in their use, or 70.9% of the total area of the country's vegetable field. In the course of the reforms, the vast majority of agricultural land became the individual property of workers and retirees of reorganized state and collective farms, citizens - members of garden cooperatives, owners of household plots [3]. Vegetable production (in % of total production in farms of all categories) increased in agricultural organizations from 17.1% to 21.2%, in peasant (farmer) farms was from 11.4% to 15.9%, and the vegetable production decreased in households from 71.5 to 62.9% for the period from 2010 to 2017.

The production of vegetables in agricultural organizations increased from 2.5 million tons to 3.5 million tons as a result of an increase in the sown area of 90.0 thousand hectares to 95.2 thousand hectares and an increase in yield from 276.0 c/ha to 285.7 c/ha for the period from 2012 to 2017. Modernization of old, construction and commissioning of new modern greenhouses also contributed to an increase in the production of vegetables in this category of farms.

In the Russian Federation, over the past 2 years, a positive trend in vegetable production has been observed. In all categories of farms, the gross yield of vegetables was obtained at the level of 16.3–16.4 million tons in 2016–2017, or 111.5% to the level of 2012. The bulk of commercial vegetables was produced in the open ground. All categories of farms produced 14.7 million tons each in 2016–2017. The main production of vegetables in open ground is concentrated in the Southern, Volga and Central federal districts, where about 65% of vegetables are produced annually from the total production in the Russian Federation. The main production of vegetables in the open ground in the country is concentrated in household farms. The share of open-field vegetable production in household farms is about 70% of the total gross collection. Gross harvest of open-ground vegetables in farms of all categories amounted to 14.7 million tons in 2017, or 112.5% of the 2016 level [3, 7, 8].

A comparative analysis of modern production and economic indicators showed greater stability of large-scale production in conditions of unfavorable economic situation in the vegetable industry and the country. The analysis was performed at the VNIIO in 12 large specialized farms and 12 farms of various specializations in the Moscow and Saratov regions. In small-scale farms, the average annual rates are minimal and varied over the sown area from 60 to 101 hectares, gross yield from 1.6 to 3.1 thousand tons, and crop yields from 17.8 to 38.4 t/ha. In large-scale farms, the average annual rates fluctuated respectively within 396-498 hectares (19.0-32.2 thousand tons, or 47.0-67.0 t/ha). The limit of these indicators in large-scale farms reached the level of 610 hectares in terms of area in 2016, 38.4 thousand tons in gross yield, 77.3 tons/hectare in yield. The profit per 1 hectare of sown area was 77-88 rubles / ha in large specialized farms, 17-34 rubles / hectare in small-scale farms. The average annual profitability was 27-28 and 11.7-20.1%, respectively [8, 9].

In the all-Russian structure of production cost of 1 quintal of outdoor vegetable production, the share of certain types of costs consists of: wages (19%), seeds and planting material (16%), the maintenance of fixed assets (14%), fertilizers and plant protection products (12%), petroleum products (7%), electricity (3%), general and other expenses (19%), on average for the years 2008–2011. The share of mechanisms in the production cost is so small that it is not separately allocated.

At the same time, in large-scale production with the latest technologies in vegetable production, the share of expenditures on machinery and equipment is 33.6% of the total cost, and the salary is 17%. The share of machine and tractor fleet costs in the cost structure of vegetables of the borshechevaya group was 26.2% for cabbage, 31% for beetroot, 33.2% for onions, and 44% for carrots.

In the Russian Federation, in recent years, the production of vegetable products has not decreased. The growth in gross harvest of vegetables is relatively steady and increasing (14.6 million tons in 2012 and 16.4 million tons in 2017), an the production profitability fluctuates from 9 to 36%, over the last 10–15 years.

Over 700 hectares of modern high-tech complexes built and put into operation, for the period from 2014 to 2017. State support provided for in the State Program helped to achieve this. As a result, the industry is experiencing an investment boom. The Russian government considers the development of the protected ground industry as a priority for the development of the agro-industrial complex, which
provides the population of the country with fresh vegetable products during the off-season period. According to forecasts, the state program of developing the agro-industrial sector provides for an increase in the area of winter greenhouses to 4.7 thousand hectares. The production of domestic greenhouse vegetables increased to 1,720 thousand tons per year by 2020. To fulfill this indicator, about 820 thousand tons of vegetables should be additionally produced, which would require the construction of 1.6 thousand hectares of greenhouses with an average yield of 50 kg/m². It is assumed that the demand of the country's domestic market for cucumbers will be fully satisfied. Additionally, the demand of the country's domestic market for tomatoes will be 70–80% satisfied by the end of 2020 [10, 11, 12].

In the structure of vegetable production in the Russian Federation, the products of protected soil have a small share (9.6%). The main producers of greenhouse vegetable products are agricultural organizations. Agricultural organizations grow 52.1% of the total volume of greenhouse vegetables, while household farms has a slower rate (45.4%). The role of peasant (farmer) farms in the production of greenhouse vegetables is insignificant (2.5%). The main production of greenhouse vegetables is concentrated in the following 4 federal districts: Volga, Southern, Central, and Siberian. The share of these districts in all protected soil products is 75.1%.

Winter greenhouses prevail in the production of vegetable. In agricultural organizations, their area is 21,425,000 m² (or 68%), the area of spring greenhouses is 9,132 thousand m² (29%), the area of insulated soil and greenhouses is 961,000 m², or 3% of the total area of protected ground. In winter greenhouses, the highest yield of vegetable crops is 34.4 kg/m², it is 8.4 kg/m² in the spring greenhouses, and 1.4 kg / m² in the greenhouses in the insulated soil. In the structure of the production of greenhouse vegetables, the share of cucumbers is 54.4%, and it is 39.7% of tomatoes. The rest of the crop (pepper, radish, green, eggplant, mushrooms) have a small proportion (5.8%). Agricultural organizations produced 922.2 thousand tons of greenhouse vegetables in 2017, which is 13.3% higher than the level of 2016 (813.6 thousand tons) and 49% higher than the level of 2013 (615.0 thousand tons).

In recent years, in the Russian Federation, the production of greenhouse vegetables shows stable growth dynamics in the vast majority of federal districts. The new 5th generation greenhouses are built using the latest technology and equipment; they are not inferior to the best foreign analogues. Due to this trend, the yield in new greenhouses reaches an indicator of 60 kg/m², it is 100 kg/m² in a photoculture. In general, in the country, the average yield of vegetables in greenhouse complexes is growing steadily, reaching 36.9 kg/m² in 2017, which is 31.8% higher than the 2013 level (28 kg/m²). According to the Ministry of Agriculture of the Russian Federation, the level of self-sufficiency of the Russian Federation of greenhouse vegetables was 53.4% in 2017, which was 7.1% higher than the 2016 level (46.3%) and 13.0% higher than the 2015 level (40.4%) [9].

4. Conclusion
The agricultural organizations supply most of the vegetable products to the country’s agri-food market, although the main producers of vegetables are the household farms. The agricultural organizations sold 2,443 thousand tons, or 36.7% of the products in all categories. The households sold 2,410 thousand tons (36.2%, respectively, in 2016). Also, the farms play a significant role in providing the population with vegetables. Their share is 27.1% of the volume sold by the households of all categories. The agricultural organizations and farms have high-quality production. In agricultural organizations, the level of marketability of vegetable production amounted to 79.4%, it was 75.9% in farms. In households, the level of marketability of vegetable production continues to be low, amounting to 23.3%. The Russian households grow vegetables for their own consumption and sell only a small surplus on the food market.

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