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## **A Socio-economic Study of the Food Sector: The Supply Side**

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**Abstract:**

*The aim of the study was to elaborate theoretical principles and practical recommendations for solving the problem of providing the Russian population with fruits. The authors have used the following methods: statistical-economic, monographic, economic-mathematical, computational and constructive ones.*

*The analysis of providing the population of the country and its regions with fruits, their economic and physical availability, the state and trends of horticulture development, the level of commodity production in various categories of farms and their role in the formation of commodity resources are given.*

*The parameters for the production of fruit and berry products in the Russian Federation have been calculated to meet the needs of the country's population taking into account rational nutrition standards.*

*The main directions of increasing the output of fruits and berries are substantiated: the improvement of state support for horticulture and its increase, concentration in special farms, the reappearance of industrial horticulture, the intensification of the industry, the development of cooperation and agro-industrial integration. The way of regulation of production and economic relations between the participants of integration is proposed.*

**Keywords:** *Horticulture, population fruit supply, state support, intensification, agro-industrial integration, Russia.*

**JEL Classification:** *I30, I31, E20, E21.*

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## 1. Introduction

A reliable supply of the Russian population with quality agricultural products and food is a strategic goal of food security (Kvochkin 2012). In the context of international sanctions and agricultural products' import embargo from the EU and US countries, the problem of supplying the country's population with fruit and berry products is especially acute (Kulikov and Minakov, 2016; Zinchuk *et al.*, 2017; Kormishkina and Semenova, 2016). The achieved level of fruit production does not fully meet the needs of the population in these products. In 2016, the actual consumption of fruits was 62 kg per capita per year with a rational diet of 100 kg (Recommendations Concerning Rational Norms of Food Nutrition, Meeting Modern Requirements of Healthy Nutrition, 2016). At the same time, the Russian food basket has the share of imported fruits 72.3%.

Since the domestic market is not filled with its own products, they are replaced by imported ones. The import of fruit and berry products tended to rise before the introduction of international sanctions, and then its decline was outlined. The import of fruits for 2000-2013 increased from 5.7 to 7.2 million tons; in 2016 it decreased to 6.5 million tons. The low level of fruit and berry products' supply at the expense of own production determined the purpose of the research and its relevance.

## 2. Methods

The statistical-economic method was used to study the supply of the population of the country and its regions with fruits. The following indicators were used: per capita production; the level of supply that characterized the supply with imported and domestic products; the level of self-sufficiency that gave the information of how domestic production could meet the needs of a country or its regions. The level of supply is the ratio of actual consumption of fruits to a rational nutritional standard and is expressed as a percentage.

The level of self-sufficiency is defined as the percentage of production in the territory of a country or region to its internal consumption. Internal consumption includes personal and industrial consumption and loss of production (Methodological Guidelines for Annual Balances of Food Resources, 2006). In addition, the statistical-economic method was used to analyze the state and trends of horticulture development.

The monographic method was used to study the activities of horticultural companies, which were distinguished by high economic results; the economic and mathematical method was used in optimizing production in horticultural facilities, the calculation and constructive one – to justify the development of horticulture for the future with the aim of solving the problem of fruit supply according to rational dietary norms.

## 3. Results

The implementation of the national project called Development of the Agro-Industrial Complex and the State Program for the Development of Agriculture and Regulation of the Market for Agricultural Products, Raw Materials and Foodstuffs allowed stabilizing the production of horticultural products (Table 1).

The gross output of fruit and berries in farms of all categories increased from 2.7 to 3.3 million tons, or by 22.2% for the period of 2000-2016 as a result of increased yields while reducing the acreage of fruit and berry crops. The yield of fruit and berry plantations increased from 40.5 to 85.6 centners per hectare, or by 2.1 times. The total area of fruit and berry plantations for the indicated period decreased from 767 to 517 thousand hectares, or by 32.6%; plantations in fruit-bearing age – from 641 to 410 thousand hectares, or by 36.0%. In recent years, this trend has remained, but the rate of decline in the area of these crops has declined sharply.

**Table 1.** Development of horticulture in the Russian Federation

Indicators	2000	2010	2013	2014	2015	2016
Acreage of fruit and berry plantations in total, thousand hectares	767	518	502	514	512	517
including ones in the fruit-bearing age	641	428	406	416	411	410
Gross output of fruits and berries, million tons	2.7	2.2	2.9	3.0	2.9	3.3
Yield, centner per hectare	40.5	49.2	77.1	75.9	75.7	85.6

During the period under review, the volume of fruit and berries' production in farms has sharply decreased, its concentration in the households of the population has occurred, and the structure of production has changed by farm categories. In agricultural enterprises, the gross output of fruits and berries declined from 1,587 to 785 thousand tons or by 50.5%. A reduction in the volume of fruit production was due to a decrease in the acreage of fruit and berry plantings in their fruit-bearing age. The total acreage of fruit and berry plantations declined from 521 to 136 thousand hectares, or by 73.9%, the acreage of plantations in fruit-bearing age – from 348 to 87 thousand hectares, or by 75.0%. Yields of gardens and small fruit acreage increased from 45.6 to 119.3 centners per hectare or by 2.6 times. The main reasons for the decline in the production of fruit and berry products in farms are the low investment attractiveness of horticulture and low profitability, which does not allow for extended reproduction in the branch, high labor intensity and difficulties with the sale of fruits.

As a result of agrarian transformations, the structure of production of fruit and berry products by farm categories has changed. If the main fruit producers were agricultural enterprises in the prereform period, now there are the farms of people. In 2016, they accounted for 74.4% of the gross output of fruits and berries.

For the period of 2000-2016, the production of fruits in the households of people increased from 1,343 to 2,463 thousand tons or by 83.4% as a result of the increased yields of fruit and berry plantations from 43.3 to 79.3 centners per hectare. The high rates of development of horticulture in the households of people can be explained by the fact that many families in the conditions of a sharp rise in food prices are trying to solve the food problem through their own production of fruit and berry products. In connection with this, personal and collective gardening was further developed. In 2016, farms raised 63.6 thousand tonnes of fruits and berries, or 1.9% of their gross output. Every year the production of fruit and berry products in this category of farms is growing.

Despite the fact that the main producers of fruit and berry products are the households of people, agricultural organizations supply most of the fruits to the agro-food market. In 2016, agricultural organizations sold 597 thousand tonnes of fruits and berries or 54.6% of the sold fruits by farms of all categories. The households supplied 449,000 tonnes of products to the market or 41.1% of the total number of fruits and berries sold.

The current situation with the supply of domestic fruit and berry products is determined by the level of commodity production. There is an intensive production in agricultural organizations and farms. In agricultural organizations, the level of commodity production of fruits and berries amounted to 76.1% and 73.4% in farms. A low level of commodity production of fruits was observed in the households of people. It was 18.3%. In the households of people, the products are mainly planted for own consumption but the surplus of their produce is supplied to the food market.

As we already noted, the main producers of fruit and berry products are the households of people, but the level of marketability of gardening there is very low. The creation of supply-marketing, processing, and other consumer cooperatives will significantly increase the marketability of the industry, as they will be engaged in the procurement, processing, and sale of products. This will contribute to saturation of the market with fruit and berry products and further development of collective and homestead gardening.

Horticulture is developed everywhere in the Russian Federation. The predominant part of the area of fruit and berry plantations and the volume of fruit production is concentrated in the main zones of commercial horticulture with the most favorable climatic and economic conditions. In four federal districts, more than 78% of the total area of gardens and small fruit acreage is concentrated and about 83% of fruits and berries are planted: Central Federal District – 20.5%, Southern Federal District – 29.5%, Volga Federal District – 21.8%, North Caucasus District – 11.5%. The volume of fruit production in the region is determined not only by the area of fruit and berry plantations but also by their yield. In 2016, the highest yields of plantations were in the Southern Federal District (118.0 c/ha) and the Volga Federal District (106.2 c/ha).

The largest area of fruit and berry plantations is concentrated in the Central Federal Districts. The natural and climatic as well as economic conditions of the regions of this district differ sharply, and consequently, not all entities of the Russian Federation have developed horticulture. Horticulture is now successfully developing in the Voronezh, Lipetsk, Tambov, Tula, Belgorod and Moscow Regions. Horticulture is not developed in the Kostroma, Smolensk, Tver and Yaroslavl Regions. Thus, horticulture is developed in the regions located in the southern part of the Central Federal District, characterized by the most favorable natural and climatic and economic conditions.

The supply with certain types of fruits is determined by the species composition of fruit and berry plantations. The species composition of perennial plantations in our country is very diverse. Pomaceous fruits predominate in the structure of fruit and berry plantations. They account for 48.5% of the total area of plantings, of which apple-trees constitute 42.2%, and pear-trees - 6.1%. The proportion of stone fruit crops is 24.9%; of cherry - 11.1%, and of plum - 7.0%. The share of small fruit crops in the structure of plantations is 24.8%, of which strawberry is 7.7%, currant is 6.7%, raspberries and blackberries are 5.6%. Nucicultures and subtropical fruits occupy the smallest proportion (1.8%) in the total area of fruit and small fruit plantations.

The structure of fruit and small fruit plantations by categories of farms is very different. Pomaceous fruits prevail in agricultural enterprises – 79.4%; the share of stone fruit crops is 10.8%, small fruit crops – 8.6%. In farms, pomaceous fruits occupy 61.9%, stone fruit crops are 19.0%, small fruit ones are 8.0%. In the households, the share of pomaceous fruits is 35.7%, stone fruit crops are 30.6%, and small fruit crops are 32.2%.

The low specific gravity of stone and berry crops in the structure of fruit and small fruit plantations of agricultural enterprises is due to the higher labor intensity of production of these crops and their lower profitability compared to pomaceous fruits. The majority of agricultural enterprises engaged in the cultivation of fruit and small fruit crops experience difficulties in carrying out basic work (trimming of fruit trees and harvesting) in horticulture due to a shortage of labor. The level of self-sufficiency in fruits varies considerably by region (Table 2). In 2016, for Russia as a whole, it was 37.8% and fluctuated from 8.5% in the Far Eastern Federal District to 69.1% in the Southern District. In recent years, this indicator has not changed much. In comparison with 2005, it increased by only 0.1 percentage points.

During the period under review, the domestic consumption of fruits increased from 6,501 to 10,215 thousand tonnes, or by 57.1%, both due to the growth of their imports, and an increase in domestic production. The largest amount of fruits per capita is consumed in the Southern Federal District (78 kg). Among the subjects of the Russian Federation with a high level of fruit consumption, we can note the Kabardino-Balkarian Republic (101 kg) and the Krasnodar Territory (94 kg). The

high level of consumption of fruit and berry products in these regions is largely due to the large volume of production per capita. Therefore, fruit production per capita is 79.6 kg in the Southern Federal District, and 61.4 kg in the North Caucasus. In 2016, the level of supply with fruits was 62%. It ranges by regions from 47% in the Siberian Federal District to 78% in the Southern District.

**Table 2.** *Supply of Russian population with fruits*

Federal District	Production per capita, kg		Consumption per capita, kg		Level of self-sufficiency, %		Level of supply, %	
	2015	2016	2015	2016	2015	2016	2015	2016
Russian Federation	23.1	26.4	61	62	33.7	37.8	61	62
Central	17.1	17.5	63	63	26.3	26.8	63	63
North West	9.5	14.0	61	62	15.2	21.8	61	62
South	67.4	79.6	76	78	55.5	69.1	78	78
North Caucasian	56.0	61.4	60	61	59.2	63.1	60	61
Volga	19.5	24.6	57	59	32.9	39.9	57	59
Ural	13.9	13.4	64	63	21.8	21.1	64	63
Siberian	7.7	8.6	46	47	16.0	17.4	46	47
Far Eastern District	6.0	5.5	65	64	9.1	8.5	65	64

The lowest level of fruit consumption per capita was in the Siberian Federal District (47 kg), and the lowest volume of fruit production per capita – in the Far Eastern (5.5 kg) and Siberian (8.6 kg) Federal Districts. The production of all types of fruits per capita is less than the rational rate of their consumption, although there is a tendency for it to grow. For the period of 2014-2016, fruit production per capita increased from 24.5 to 26.4 kg, including pomaceous fruits – from 11.9 to 12.6 kg, stone fruits – from 3.5 to 4.3 kg, berries – from 5.3 to 5.5 kg.

The supply of the population with food products characterizes their physical and economic availability. The physical availability of foodstuffs is the level of development of the commodity-producing sector, in which the population is provided with the opportunity to purchase food or arrangements for feeding in volumes and the range that are not less than the established rational norms for food consumption (The Doctrine of Food Security of the Russian Federation, 2010). It means an uninterrupted supply of fruits to places of consumption in volumes and the range that meet the established standards. The physical availability of fruits is characterized by a fairly high level, as the source of their receipt is their own production and imports.

The economic availability of fruit and berry products, which is determined by the possibility of purchasing them at current prices in volumes and the range that are not less than the established rational consumption standards, is characterized by an insufficiently high level. It is determined by the level of income of the population

and consumer prices, which have increased dramatically in recent years. For example, for the period of 2013-2016, the price of the main fruit production, apples, increased from 63.26 to 81.92 rubles per 1 kg, or by 29.5%. A significant part of the country's population (more than 20 million people) is below the poverty line and is not able to purchase fruits that meet the established standards in terms of quantity and range. The economic availability of fruit and berry products is increased when it is received from a farmer, personal subsidiary plots as well as gardening plots avoiding market channels. In Russia, a significant part of fruits is planted in households (74%).

In order to increase the economic availability of fruit and berry products, the government needs to take measures to increase the effective demand of the population, reduce poverty and support the neediest segments of the population. To increase physical availability, it is necessary to increase fruit production, develop interregional integration in the agro-food markets, increase the transport accessibility of individual regions for the food supply of their population, and create conditions for the development of market infrastructure.

It is possible to solve the problem of fruit supply by way of increasing their domestic production and the import of fruits that are not planted in our country. The import of fruits that cannot be produced in the territory of the Russian Federation (bananas, citrus fruits, dates, figs, pineapples, etc.) is about 3 million tons, including 1.5 tons of citrus fruits and 1.3 million tons of bananas.

To supply the population of the country with fruits according to rational norms of nutrition, their production should be up to 10.32 million tons (excluding grapes and fruits that are not planted in our country). To do this, the area of gardens and small fruit acreage should be increased from 517 to 895 thousand hectares, including the area of trees in their fruit-bearing age (from 410 to 760 thousand hectares).

The State Program for the Development of Agriculture and Regulation of Agricultural Products, Raw Materials and Foodstuffs for 2013-2020 planned to increase the area of fruit and small fruit plantations to 77.8 thousand hectares (State Program for the Development of Agriculture and Regulation of Markets for Agricultural Products, Raw Materials and Food for 2013-2020, 2012). The indicators of the State Program for the establishment of fruit and small fruit plantations are overachieved (in 2013-2016, 46.3 thousand hectares are actually planted with planned 34.2 thousand hectares), but their area is decreasing. This is because the fruit and small fruit acreages are rooted out more than they are planted.

The implementation of the State Program will not solve the food problem of supplying the population with fruits. Low rates of growth in the production of fruit and berry products indicate that the horticulture will develop mainly according to the delayed-action option with a focus on import. Horticulture is a capital-intensive branch of the economy requiring large investments for further development. In order

to increase the investment attractiveness of this branch, it is necessary to improve the forms and increase the size of state support. The state support of horticulture is carried out from the federal budget and budgets of the subjects of the Russian Federation. In recent years, the amount of subsidies for the establishment of fruit and small fruit plantations, their maintenance prior to the commencement of their commercial fruiting, and the rooting out of old gardens on a per hectare basis has increased.

For the period of 2008-2016, the subsidy rate of a part of the federal budget expenditures for the establishment of an ordinary garden increased from 30 to 53.9 thousand rubles, of an intensive garden (at least 800 trees per 1 hectare) – from 100 to 232.5 thousand rubles, and for young fruit and small fruit plantations' management – from 4.0 to 20.8 thousand rubles. The provided recovery of expenses for the plantation of new gardens, maintenance of young plantations and the rooting out of old plantations is about 30% of actual costs.

In foreign countries, the level of state support is much higher than in Russia. In Poland, farmers use some measures of direct state support. So, for the plantation of a garden and nursery, a loan for 25 years is allocated at a fairly low interest (0.5-2% per annum). However, the state undertakes the burden of interest payment. Half of the funds expended on planting are compensated by the state. The program to support young farmers is implemented. They receive an installation grant of 50 thousand euro for the establishment of their household. It is a non-repayable loan plus other benefits and payments, in particular for the construction of storage facilities, their equipping with modern equipment, temporary storage of products, etc. The Polish government not only actively supports horticulture with significant budgetary funds, but also promotes the effective sales of raised plants (Kulikov and Minakov, 2016).

Since 2017, a new mechanism for supporting agriculture has been introduced. Subsidies are distributed among the constituent entities of the Russian Federation according to certain criteria, and the subjects independently determine the directions and amounts of spending taking into account the achievement of the state program indicators. In 2017, it is planned to spend 3.0 billion rubles for establishment and handling of perennial plants. In many constituent entities of the Russian Federation, the rate of subsidies per 1 hectare of plantations was at the level of 2016.

In order to increase the investment attractiveness of horticulture and stimulate the planting of fruit trees, we propose to increase the level of state support to 50%, for rooting out of gardens – up to 80% of the cost. In addition, it is necessary to differentiate the level of state support depending on the density of planting: ordinary garden – up to 450 trees per 1 hectare (planting scheme is  $7 \times 4$  m,  $6 \times 4$  m), medium-intensive – from 450 to 800 trees per 1 hectare ( $6 \times 3$  m,  $5 \times 3$  m), intensive garden – over 800 trees per 1 hectare ( $5 \times 2$  m,  $4.5 \times 2.5-1.5$  m, etc.), as well as the quality of planting material. The planting of fruit and small fruit acreages with



certified planting materials makes it possible to increase the yield of plantations by almost 50%. The increase in the production of fruit and berry products will be facilitated by its concentration in specialized farms. The revival of industrial (commodity) horticulture is a necessary condition for solving the problem of supplying the population with fruits. In the prereform period, agricultural enterprises produced 54% of fruits and berries, and 23.7% in 2016.

Specialization in production as a form of social division of labor is expressed in the primary production of certain types of products, and sometimes in the implementation of a separate stage in the production of the finished product. Specialization is of great economic importance: first, it helps to concentrate material and financial resources in the production of competitive products; secondly, it creates favorable conditions for scientific and technological progress, transfer of the industry to an innovative development path; thirdly, it makes it possible to improve the forms of organization of labor; fourth, it contributes to the economic efficiency of horticulture. The conducted research shows that agricultural enterprises achieve the highest results, in which the share of horticulture in the structure of commodity agricultural products is 40-75%.

Further intensification of horticulture will be facilitated by the intensification of production, transfer of industries to an innovative development path, which is characterized by widespread use of achievements in scientific and technical progress, stimulation of investment in the industry and improvement of the material and technical base.

The intensification of horticulture should be implemented not only through quantitative growth of resources, but primarily based on their more rational use. It provides more intensive and productive functioning of material, labor and land resources, and the growth of production of fruit and berry products at a faster rate than the growth of costs. In this regard, an important area of intensification of horticulture is the use of intensive, resource-saving technologies for fruit production. Resource-recovery technologies are aimed at reducing labor intensity and material consumption of products, obtaining the maximum output and profits because of the effective use of all production resources. Thus, their use makes it possible to reduce the labor intensity of the production of blackcurrant by 73% and the cost of production – by 26% (Egorov *et al.*, 2015).

For intensification of horticulture, it is necessary to make wider use of domestic technologies for the production of fruit and berry products, since the natural and climatic conditions of many regions of the Russian Federation differ sharply from the weather conditions of Western countries. Using imported technologies that are not adapted to local climatic conditions causes great damage to horticulture. The most acceptable and less expensive way of innovative development of horticulture in our country is the widespread use of scientific developments of Russian scientists. Scientific developments in the field of breeding of fruit and small fruit crops,

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production technologies of fruits and berries, mechanization of production processes, storage, processing and commodity processing of products, cultivation of planting material, were adapted to local natural and climatic conditions and can be successfully used in intensifying horticulture.

An important factor in the intensification of horticulture is the plantation of intensive gardens, which have at least 800 trees per hectare. In recent years, the area of these gardens has been growing. The yield of intensive gardens is much higher than that of conventional plantations. In intensive gardens, it was more than 200 centners per hectare, and 80-100 centners per hectare in ordinary gardens. In foreign countries, thick planting of fruit trees allows one to obtain high yields annually (Robinson *et al.*, 2004; Lauri 2008; Bravin *et al.*, 2009; Kuchmaeva *et al.*, 2017; Stroeva *et al.*, 2015).

An important condition for increasing the production of fruit and berry products and increasing its economic efficiency is the development of agro-industrial integration, which unites raw materials, processing and marketing in a single technological process. It allows taking advantage of large-scale production, without prejudice to the interests of agricultural producers (Kulikov and Minakov, 2016).

The basis of the combination of horticulture and the food industry is the fact that the products produced in the industry are hardly transportable and perishable, they must be processed as soon as possible, stored and sold, as well as the seasonality of production leading to incomplete use of labor and material resources. In addition, the development of agro-industrial integration is conditioned by a rather complicated macroeconomic situation in the country. This is, first, the presence of the price disparity in the commodity exchange within the fruit-canning industry, the low investment attractiveness of gardening, the lack of well-established links in the system of commodity flows, and the ineffective system of managing economic activity. Integration allows reducing the costs associated with the production and sale of the final product with the study of market conditions and organizing a competitive production of fruits and vegetables, their processed products.

In modern conditions, to increase the production of fruit and berry products and increase its economic efficiency, it is advisable to create integrated structures of various forms (agro-industrial enterprises, agro-firms, holding companies, clusters, etc.), united by the general principles of work. These formations should take an active role related to the production, purchase of fruits, their processing and sale. The mechanism for regulating production and economic relations among the participants in integration should be formed based on equal profitability at the stages of production, processing and sale of products. The economic interest of agricultural enterprises and other organizations in the creation of integrated structures should be based on income, additionally obtained from improving the range, quality and profitable sales of finished products, as well as from increasing the efficiency of production at all stages.

#### **4. Conclusion**

The achieved level of development of horticulture does not make it possible to completely satisfy the population's needs for fruit and berry products. It is possible to solve the problem by way of increasing domestic production and preserving the volume of imports of fruits that are not planted in our country. The increase in the production of fruit and berry products will be promoted by concentration of horticulture in specialized enterprises; an increase in the productivity of existing gardens and berry fields on the basis of intensification of production; an increase in the gross output of fruits as a result of the plantation of new intensive gardens; rational use of grown products, reduction of losses at the stages of production, storage, processing, transportation and sale of products on the basis of development of agro-industrial integration; an increase in the marketability of horticulture in the households of the population by creating consumer cooperatives, improving and increasing state support for the industry.

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