

## Monitoring of potato production and its forecast by 2020

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### Abstract

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The article attempts to make a forecast of potato production in the period until 2020 using economic and statistical tools. The problem of food security is revealed through the achievement of threshold values for the production and self-sufficiency of individual products. For the production of potatoes, the threshold value of food security is set at 95%. It is important to understand the prospects and opportunities to achieve the established threshold values. The conducted economic and statistical analysis showed that by 2020 gross potato harvest in Western Europe, especially in Russia, will be at the level of 30.2-35.5 mln t, and its yield, while maintaining current production conditions in the range of 164.4 to 177.4 centner/ha. The analysis showed that after the collapse of the Soviet Union, the former Soviet republics completely underwent a process of adaptation to market conditions. Thus, the Baltic countries drastically reduced the volumes of potato production in connection with the harmonization of their agrarian policy with the pan-European one.

*Keywords:* food safety; potatoes; gross potatoes; harvest; potato yield

### Introduction

In the State program of the agriculture development and markets regulation of agricultural products, raw materials and food for 2013-2020 it is planned to increase the potato production from 30 mln t to 34 mln t. In accordance with the Food Security Doctrine, the indicator (index) for the production of potatoes is 25 mln t or at least 95 percent of the supply. The article makes an attempt to assess the potato production opportunities in the country in accordance with the tasks set, and on the basis of the achieved indicators, the prospects of potato production in Russia until 2020 are estimated using economic and statistical methods.

The problems of monitoring potato production are discussed in the works of Blasingame, Blauer, Grubb, Guilford, Cook, Zhevory, Kislova, Kozlova, Tulcheeva, Yakovleva, Spear, Tarkalson and others.

Historically, agricultural statistics provide a large number of indicators characterizing the production and consumption (provision) of food. To assess the state of affairs with the production of potatoes in the world, and in Russia in particular, it is necessary to turn to the following sources of information:

– Food and Agriculture Organization of the United Nations (FAO) provides information on the production of major crops and animal species by country;

– Federal State Statistics Service provides information on Russia's agriculture, which are reflected in official publications such as the Russian Statistical Yearbook, Regions of Russia, and Main Indicators of Agriculture, Hunting and Forestry in Russia.

These sources will allow us to conduct an economic and statistical analysis of the dynamics and structure of potato production, as well as to assess the place occupied by the Russian Federation in the world market.

## Materials and Methods

During the research, general scientific and special methods and tools of economic research were used: a set of scientific methods of the abstract-logical method; economic-statistical method, the method of institutional analysis (Pigou, 1910).

Based on the data of the Food and Agriculture Organization of the United Nations and Federal State Statistics Service, we will perform a statistical analysis of the dynamics and structure of potato production in Russia, as well as assess the place occupied by our country in the world space.

According to the data presented in Table 1, India has made significant progress in potato production, increasing its output 11-fold, and bringing the share in the global volume to 12%. In addition, a significant increase in China is 4.6 times and the largest share is equal to 26%. A significant increase in production in these countries is due to the constant growth of the population that should be fed. Thus, popula-

tion growth was the driver of the growth rate of potato production in these countries (Kozlova, 2002; Kislova, 2017; World potato market, 2018).

As for Russia, there is a 40% decline in production in the country, but the share in the world volume remains high and at the time of 2016, it is 8% of world production.

Since the volume of production in the Soviet Union was much more than the current result, it makes sense to review the positions of ex-members of the union in the current conditions for carrying out independent economic and agrarian policies, for this we refer to the data in Table 2.

The data presented in Table 2 indicate a 20% decline in total potato production, but the most significant drop is observed in the Baltic countries: Estonia by 90%, Lithuania by 80%, Latvia by 70%. The established pattern is explained by their accession to the European Union, on demand, the in-country agrarian policy is harmonized with the European one, including in terms of output and sowing areas.

**Table 1. Dynamics of gross harvest of potatoes in major commodity producers, million tons**

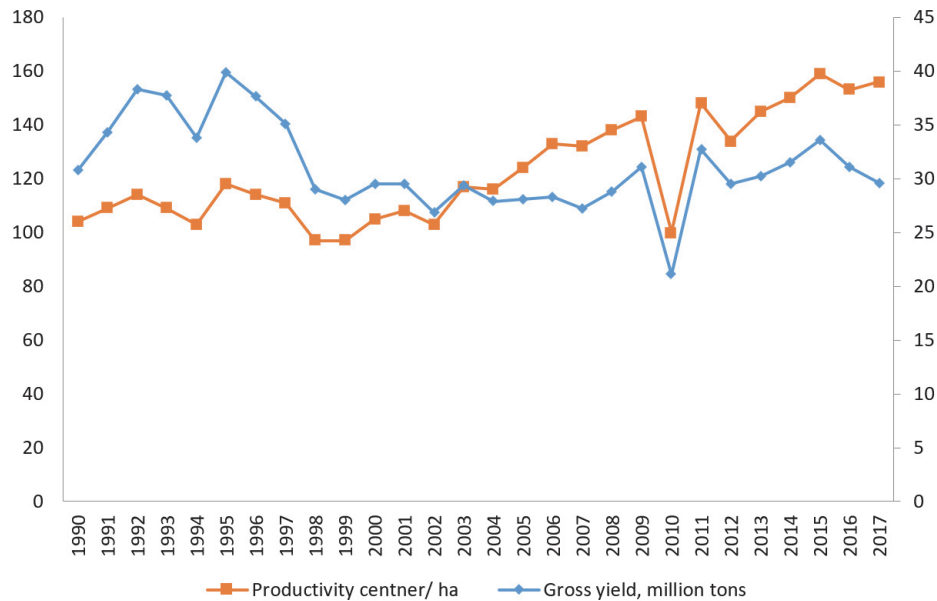
Countries	1970	1980	1990	2000	2010	2015	2016	The rate of growth (decline) in 2016 by 1970
Germany	29.3	17.1	14.5	13.2	10.1	10.4	10.8	0.4
India	3.9	8.3	14.8	25.0	36.6	48.0	43.8	11.2
Russia	53.9	37.0	30.8	29.5	21.1	33.6	31.1	0.6
USA	14.8	13.8	18.2	23.3	18.4	20.0	20.0	1.4
China	21.5	25.9	32.0	66.3	81.6	94.9	99.1	4.6
World in total	298.0	240.5	266.8	322.8	332.5	376.8	376.8	1.3

Source: The author's calculations based on FAOSTAT data

**Table 2. Dynamics of gross potato harvest in the post-Soviet countries, thousands of tons**

Countries	1960	1970	1980	1990	2000	2010	2016	The rate of growth (decline) in 2016 by 1960
In total	84374	96783	67023	63631	66284	57344	70811	0.8
Russia	46689	53933	36971	30848	29465	21141	31108	0.7
Ukraine	19461	19726	13133	16732	19838	18705	21750	1.1
Belarus	10641	13234	9333	8591	8718	7831	5986	0.6
Uzbekistan	163	180	239	336	731	1695	2925	17.9
Kazakhstan	1267	1896	2239	2324	1693	2555	3546	2.8
Georgia	200	299	393	294	302	229	249	1.2
Azerbaijan	114	130	172	185	469	954	902	7.9
Lithuania	2259	2721	1178	1573	1792	477	340	0.2
Moldova	255	297	308	295	330	280	214	0.8
Latvia	1688	2328	1199	1016	747	484	492	0.3
Kyrgyzstan	113	278	293	365	1046	1339	1388	12.3
Tajikistan	31	67	153	207	303	760	898	29.0
Armenia	185	267	254	213	290	482	606	3.3
Turkmenistan	5	13	12	35	89	250	316	63.3
Estonia	1303	1414	1146	617	472	163	90	0.1

Source: The author's calculations based on statistical yearbook „National Economy of the USSR“ (1960-1990) and FAOSTAT data (2000-2016)



**Fig. 1. Dynamics of gross harvest and potato yield in Russia**

Source: authors calculations based on annual Russian Statistical Yearbooks)

The largest growth in post-Soviet countries is observed in Turkmenistan (63 times), Tajikistan (29 times) and Uzbekistan (18 times), but the absolute values of these republics still remain insignificant against the background of such countries as Russia (31 mln t) Ukraine (22 mln t) and Belarus (6 mln t) (Kolivev, 2015). We get that, despite the rapid growth of indicators in the countries of Central Asia, the main producers of potatoes were and remain the three mentioned countries.

Next, we will dwell in more detail on the dynamics of gross harvest and potato yield in Russia, for this we refer to Figure 1.

As we can see in the figure, the gross harvest of potatoes stabilized during the period 1998-2017 (there is a lateral trend) and fluctuates at the level of 30 mln t. At the same time, the yield on the same interval tends to grow, which indicates the selection work, the introduction of mineral fertilizers and the improvement of the cultivation technology of the crop in question. In support of our conclusions, we add that the sowing area for potato in the interval 1998-2017 gradually decreases from 3014.8 ha to 1905.5 ha, according to Federal State Statistics Service data.

## Results and Discussion

The significant decline in both gross harvest and yield in 2010 is due to the drought in this period, which negatively affected not only the cultivation of potatoes, but

also all crop production of the country as a whole.

Using a stable area of indicators development (1998-2017), excluding from consideration the 2010 levels, we will perform analytical alignment on a linear trend and build a forecast for 2018-2020; the results are presented in Table 3.

As we would expect, the gross harvest of potatoes will

**Table 3. Results of the construction of an econometric model of the dynamics of gross harvest and potato yield in Russia**

Indicator	Gross yield, million tons	Productivity, centner/ha	
Model	$y = 27.69 + 0.18 t$	$y = 95.27 + 3.29 t$	
R <sup>2</sup>	0.34	0.92	
F	10.4	222.2	
Forecast	2018	30.1 < 31.5 < 33.0	158.7 < 164.3 < 170.0
	2019	30.1 < 31.7 < 33.2	161.6 < 167.6 < 173.7
	2020	30.2 < 31.9 < 33.5	164.4 < 170.9 < 177.4

Note: calculated by the authors in the package STATISTICA; the parameters of the models are statistically significant at the 5% level

grow insignificantly in the forthcoming periods (if the prevailing conditions and absence of force majeure circumstances, for example, drought), but the yield will continue to grow, but no significant changes in the value of the indicator are also expected (Osipov et al., 2016).

For a better understanding of the in-country patterns of potato production, let us turn to the data on the Russian federal districts presented in Table 4.

**Table 4. Dynamics of gross harvest of potatoes in the context of federal districts, thousand tons**

Russian federal districts	1990	1995	2000	2005	2010	2015	2016	Place in the all-Russian volume, 2016
Russia, million tons	30.8	39.9	34.0	28.1	21.1	33.6	31.1	x
Central federal district	9628	12583	11240	7812	5175	11042	9713	1
North West federal district	1955	3680	2961	1424	1258	1581	1434	7
South federal district	1952	2245	2300	1300	1356	2115	2109	5
North Caucasian federal district				1119	1187	1474	1491	6
Volga federal district	8462	10943	7661	7656	3504	8386	7505	2
Ural federal district	2549	2771	2484	2677	1896	2535	2391	4
Siberian federal district	5195	6178	5954	4944	5479	5324	5347	3
Far Eastern federal district	1108	1510	1379	1206	1286	1189	1119	8

Source: calculated by the authors on the basis of the statistical yearbook „Regions of Russia“

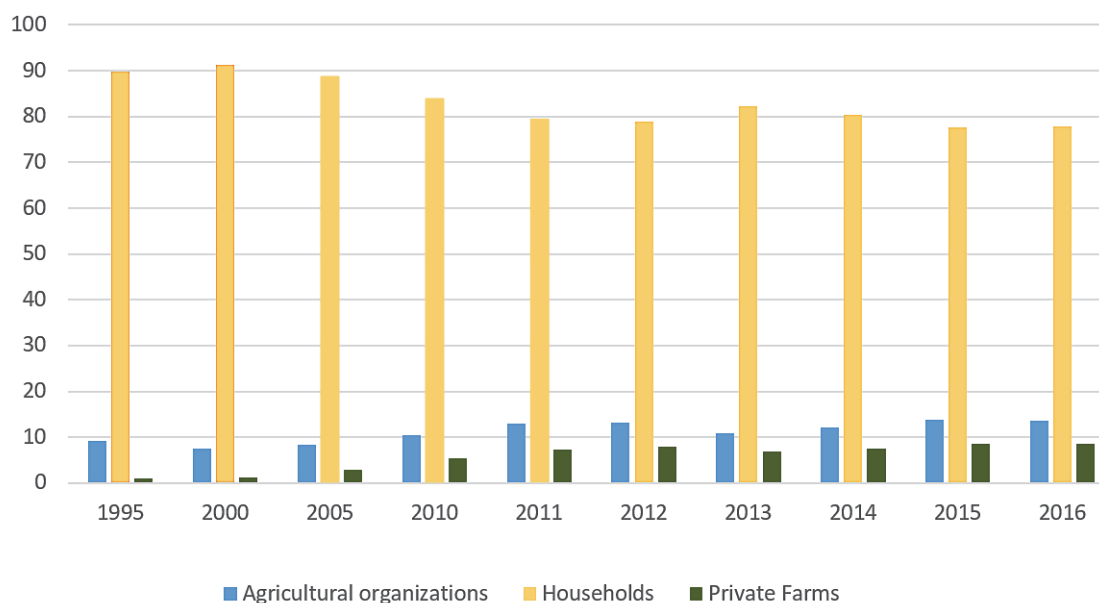
According to the data presented in Table 4, the largest volume of potato production throughout the period under review is observed in the Central Federal District, with the leaders in 2016 being the Voronezh Oblast with 1562.1 t (1 place in Russia) and the Bryansk Region from 1380.2 t (3rd place in Russia).

The Volga Federal District is on the second position with 7505.000 t of potatoes in the reporting period, in this region the Republic of Tatarstan is leading with 1440700 t (2nd place in Russia) and the Republic of Bashkortostan with 1078.900 t (5th in the Russia).

Significant achievements in the production of potatoes

are explained by the fact that 39209 million people live in the Central Federal District, which is 27% of the total population of the country, respectively in the Volga Federal District – 29637 million people, which is 20% of the total Russian population. To provide citizens of these regions with food without resort to interregional supplies, it is necessary to develop production on the ground, which is what happens in practice. Thus, the global trends in the production of potatoes in accordance with the growth rates of the population are also observed in Russia.

Next, we refer to Figure 2 and analyze the structure of production in the context of agricultural producers.

**Fig. 2. Structure of potato production by types of commodity producers**

Source: authors calculations based on annual Russian Statistical Yearbooks)

**Table 5. Dynamics of fresh or chilled potato exports / imports, thousand tons**

Year	Export			Import		
	In total, mln t	CIS countries	Non-CIS countries	In total, mln t	CIS countries	Non-CIS countries
1995	47.5	45.5	2.0	69.4	12.3	57.1
2000	16.6	16.5	0.1	359.0	93.9	265.0
2005	26.8	22.8	4.0	103.0	58.9	44.0
2010	73.5	72.5	1.0	711.0	143.0	568.0
2015	164.0	163.0	1.2	553.0	70.8	482.0

Source: authors calculations based on annual Russian Statistical Yearbooks

According to the presented information in Figure 2, the largest share in the structure of owned households, as in 2016, the proportion was 78%, and in 1995 year even more than 90%.

At first glance, the revealed law is positive because it confirms the maintenance of the population of regions of work, but if we approach this issue in more detail, the phenomenon is seen in a different color, such as:

- the population resorts to self-employment due to a lack of jobs in rural areas;
- the population does not have sufficient resources to conduct breeding and pest control activities, respectively, the products received are of poor quality;
- the risk of loss of food safety in relation to potatoes, as small commodity producers can simultaneously switch to the production of another crop or animal species (Jánský et al, 2006; Galinato & Tozer, 2015; Jankelova et al., 2017).

The sufficiency of in-country potato production can be assessed by referring to the data of foreign trade (Table 5).

## Conclusion

According to the data presented in Table 5, it can be concluded that there is an excess of imports over exports, i.e. the gap between domestic production and consumed volume is replenished at the expense of foreign sources (through imports), while the key role is played by foreign countries (accounting for 87% of total imports in 2015). Despite the available natural and climatic potato growing opportunities within the country, in 2015 Russia spent 257 million US dollars on imports. Obviously, it is possible to reverse this situation by increasing the share of agricultural organizations in total potato production, which will allow the introduction of breeding, genetics, and cultivation techniques, and thereby reduce the cost of the final product.

As a conclusion, we also note that by 2020 gross potatoes harvest in Russia will be in the range of 30.2-35.5 mln t, while yields, maintaining the level of farm machinery and other conditions are from 164.4 to 177.4 centners/ha.

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