

Current Status of the Soybean Industry and Research in the Russian Federation

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Abstract: Russia has abundant land resources, and the per capita arable land area is ranked in the top five in the world. In recent years, soybean planting has experienced rapid growth in Russia, and the soybean production in the Amur Region of the Far East District was nearly 1/3 of the 3.34 million t of total domestic production in 2016, maintaining its leadership among the 7 major soybean planting regions in this country. Notably, the soybean imports of Russia have increased significantly, and a total of approximately 2 million t of soybeans were imported annually over the 3 years of 2014-2016. However, the Far Eastern regions have exported soybeans to China due to its geographical advantages. The initial soybean breeding works in Russia began in 1912 and the major soybean breeding research in this century has been contributed by the research institutes and the agricultural universities in Russia. In 2016, domestic soybean varieties accounted for approximately 70%, and the introduced foreign varieties occupied 30% of the total standard planting seeds. This paper analyses the dynamic of soybean production and trade, introduces the current state of processing, cultural and farming practices, research system, breeding progress and seed industry, etc., and discusses the prospect of soybean industry in the Russian Federation, in order to present an overview of this potential big soybean producer in the world.

Keywords: Russia; Soybean; Production; Trade; Variety

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俄罗斯联邦大豆产业现状及研究进展

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摘要:俄罗斯土地资源丰富,人均耕地面积位居世界前五位。近年来,俄罗斯大豆种植业快速发展,2016 年全俄大豆总产量达 334 万 t,其中,位于俄罗斯远东地区的阿穆尔州大豆产量约占全俄大豆总产量 1/3,在全俄 7 个大豆主产区中居首位。值得注意的是,近年来俄罗斯大豆进口量显著增加。2014 – 2016 年,全俄大豆年进口量约为 200 万 t,而远东地区因地理优势则出口大豆到中国。俄罗斯大豆育种工作始于 1912 年,目前大豆育种工作主要由农业科研院所和农业大学承担。2016 年,俄罗斯自育大豆品种约占合格种子总销售量的 70%,外国品种约占 30%。本文分析了俄罗斯联邦大豆生产和贸易动态,介绍了栽培耕作制度、大豆科研体系、大豆育种和种子产业发展等方面的现状,并讨论了该国大豆产业发展趋势,以为读者提供俄罗斯这个潜在大豆主产国的总体情况。

关键词:俄罗斯;大豆;产量;贸易;品种

The Russian Federation's total land area is 17.098 million square kilometres, agricultural land accounted for 13% of the land area, and the cultivated area was approximately 120 million hectares. Russia has abundant natural resources and the world's largest chernozem belt zone. The per capita arable land area of Russia was 0.9 hectares, ranked in the top five in the world and more than 4 times of the world average. However, the scope of Russian agricultural activities accounted for only approximately 1/5 of the country's land area due to climate and geographical constraints. The strategic goal of the Russian Federation for food se-

curity is to provide the country's population with good-quality products. In recent years, Russian agriculture has experienced rapid growth, especially in the rapid recovery of grain production, under increasing government support. In Russia, wheat, sugar beet, sunflower, potato and maize are the top five major crops. In 2016, Russia produced 72.50 million t of wheat and exported 27.80 million t. The planting areas and production of sugar beet (1.11 million ha and 51.4 million t, respectively) and sunflower seed (7.60 million ha and 11.80 million t, respectively) are also large, as they are economic crops in Russia^[1]. Soybean is a

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regional crop in Russia that is mainly distributed in the Far East parts of the country. Due to the increasing demand for soybeans in Russian and foreign (mainly Chinese) markets, soybean has become a major crop in Russia [2-5].

1 Soybean production in Russia

Six major regions, including Amur Region, Primorye Territory, Belgorod Region, Krasnodar Territory, Kursk Region and Jewish Autonomous Region, accounted for nearly 80% of the entire production of soybean. Among them, the Amur Region in the Far East region, located in the southeast part of the Russian Federation and bordering the Heilongjiang Province of China, is the Russian leader in soybean production due to the temperate geographical zone, the large and rich meadow chernozem soil and a high level mechanized farming

system [6-7]. For decades, soybean has remained the main agricultural crop of the Amur Region, where soybean is grown every year. In 1997, the share of soybean in the planting areas of the region was 25%, 30% in 2000, and then reached 70% in 2016. In recent years, soybean production in Russia has experienced stable growth due to the expansion of the crop acreage. In total, Russia produced more than 3 million t of soybeans in 2016 [8-10]. Over the last 15 years, soybean area has increased 5-fold, as well as the share of the all-Russian indicator of planting areas, which on the whole remained low (3% in 2016). In 2016, the acreage of soybean in Russia increased almost 2 times (2.2 million hectares) compared to that in 2010 (Table 1) [11-12]. This confirms that farmers' interest in soybeans is growing.

Table 1 Soybean acreage in the Russian Federation and its main regions (Thousand ha)

The Russian Federation and its regions	2010	2011	2012	2013	2014	2015	2016
Russian Federation	1,205.7	1,229.0	1,481.3	1,531.8	2,006.1	2,123.3	2,228.5
Amur Region	484.1	563.5	682.4	649.7	766.3	884.9	893.5
Belgorod Region	56.5	80.0	92.9	127.4	170.4	180.9	210.4
Jewish Auton • Region	72.1	77.3	82.0	92.5	100.3	110.6	104.7
Krasnodar Territory	140.9	132.2	173.4	153.3	166.2	167.1	156.3
Kursk Region	38.5	26.2	43.9	56.7	110.7	111.3	136.1
Primorye Territory	139.1	146.2	171.3	173.9	218.2	223.1	243.5
Other regions	274.5	203.6	235.4	278.3	474.0	445.4	484.0

Fig. 1 clearly shows the main regions of the Russian Federation producing soybeans, the high current yield of soybeans has stimulated agricultural producers to di-

vert an increasing amount of land in the Amur Region to this crop. However, the potential ways to increase volume are limited.



1. Amur Region, 2. Primorye Territory, 3. Belgorod Region, 4. Krasnodar Territory, 5. Kursk Region, 6. Jewish Autonomous Region.

Fig. 1 The major soybean producing regions (green colored) ranked by the planting area in the Russian Federation (modified from Ros-soya. su [13])

Data on soybean production in the main Russian regions from 2010 to 2016, indicating the annual growth both for Russia as a whole and for individual regions are shown in Table 2. In the Amur Region, despite a

sharp reduction in the volume of soybean production due to a catastrophic flood in 2013, the general increasing tendency of this indicator ensured positive overall Russian growth.

Table 2 Soybean production in major Russian regions in 2010-2016 (Thousand t)

The Russian Federation and its regions	2010	2011	2012	2013	2014	2015	2016
Russian Federation	1,222.4	1,756	1,806.2	1,636.3	2,596.6	2,708.2	3,342.4
Amur Region	569.9	826.8	777.6	398.4	1,061.0	1,002.0	977.2
Belgorod Region	49.3	152.6	158.0	235.2	241.5	323.9	515.3
Jewish Auton. Region	79.7	100.0	65.3	60.8	125.7	118.4	99.4
Krasnodar Territory	213.3	244.9	312.8	313.8	281.3	254.9	330.6
Kursk Region	18.1	43.8	61.5	98.2	151.3	170.2	325.0
Primorye Territory	152.2	168.3	169.7	168.5	305.1	262.0	294.3
Other regions	292.1	387.9	431.0	529.9	735.8	838.8	800.6

2 Soybean trade in Russia

The total volume of production of soybean is insufficient to meet the needs of the national economy for high-protein raw materials in Russia^[1, 14-17]. Only half of the

demand is met by the domestic production, and the rest is covered by imports from Paraguay (44%), Brazil (41%), and the USA (9.4%). In 2016, a total of over 2 million t of soybeans was imported to Russia, with the value of approximately 1 billion \$ (Table 3).

Table 3 Soybean import of the Russian Federation in 2012-2016

Source country	2012	2013	2014	2015	2016
Argentina					
Amount / (Thousand t)	–	–	–	–	26.24
Value / (Million \$)	–	–	–	–	12.68
Brazil					
Amount/ (Thousand t)	125.10	–	515.57	549.90	946.28
Value / (Million \$)	90.29	–	311.64	252.15	412.90
Canada					
Amount/ (Thousand t)	5.46	0.19	2.33	0.88	30.30
Value / (Million \$)	2.94	0.33	2.65	1.43	14.80
Paraguay					
Amount/ (Thousand t)	441.19	769.89	964.54	1084.76	1005.83
Value / (Million \$)	271.23	456.68	533.21	459.06	428.69
USA					
Amount/ (Thousand t)	55.96	208.27	390.01	526.10	216.02
Value / (Million \$)	31.83	121.98	215.29	219.72	81.54
Other countries					
Amount/ (Thousand t)	66.01	166.81	155.71	17.48	58.64
Value / (Million \$)	44.68	96.79	87.89	9.22	26.88
Total					
Amount / (Thousand t)	693.72	1,145.16	2,028.16	2,179.12	2,283.31
Value / (Million \$)	440.97	675.78	1150.76	941.58	977.49

In total, Russia exported more than 400 thousand t of soybeans in 2016 and over 500 thousand t in 2017, with a sharp increase in exports of Far Eastern soybean to China. The export prices of soybean have been increased by both the domestic and international (mainly Chinese) high demands from soybean processors. Over the 4 years of 2013 – 2016, the Far Eastern regions were the main Russian suppliers of soybean to China, and the volume of soybean export increased 5.5 times (Table 4), which can be seen as a reaction to the strength of Russia-China relations in agriculture as well

as the introduction of measures for zero export customs duties on soybean. The 35 Joint Documents signed during the 20th regular Meeting of the Heads of Governments of the Russian Federation and the People’s Republic of China in 2015 created an institutional framework for two-sided cooperation in various fields. According to the agreements between Russia and China, the export of agricultural products to China is allowed from a limited range of territories of Russia, including the Khabarovsk, Primorye and Trans-Baikal Territories, the Amur Region, and the Jewish Autonomous

Region. As China is expected to increase soybean imports due to the increased demand to produce livestock feeds, competition in the market will be further exacerbated.

Table 4 Export of soybean to China from the Far Eastern regions of the Russian Federation

Far East District	2013		2014		2015		2016	
	Amount	Value	Amount	Value	Amount	Value	Amount	Value
	/(Thousand t)	/(Million \$)	/(Thousand t)	/(Million \$)	/(Thousand t)	/(Million \$)	/(Thousand t)	/(Million \$)
Amur Region	35.2	8.3	21.1	6.5	205.9	72.1	231.4	76.9
Jewish Auton. Region	8.7	2.1	20.2	5.1	88.4	20.0	74.7	19.3
Primorye Territory	22.9	6.1	31.2	8.7	75.6	22.3	51.8	15.2
Khabarovsk Territory	0.1	0.05	1.0	0.3	7.3	1.7	13.0	3.8
Total	66.9	16.55	73.5	20.6	377.2	116.1	370.9	115.2

3 Soybean processing in Russia

The processing of soybeans to produce hydrated soybean oil in the Amur Region began in 1935 at the Blagoveshchensk oil-mill [18-19]. At present, The Russian soybean processing industry is mainly located in the Far East and there are 12 soybean-processing enterprises in this region that produce soybean oil, soybean meal, and other products like canned soybean, phospholipids, margarine, soy flour, etc., and in total having the capacity to process 500 thousand t of soybeans annually. In the Far East region, a majority of the raw material producers and processors have established effective economic contracts. According to the contracts, soybean producers provide high-quality raw soybean materials to the processing enterprises under the standard crop rotations. All of the feed products are provided to agricultural units and farms, all of the phospholipids are used for the domestic food and pharmaceutical industry, 80% - 90% of the other products are supplied for domestic industry, and only 10% - 20% are exported. Soybean has become one of the most effective crops under the high enthusiasm from

The activation of cooperation between Russia and China in agriculture is a component of the intensification of the partnership between the two countries.

soybean processors, and the annual production capacity of soybean oil enterprises is approximately 500 thousand t in the Amur Region [20].

4 Soybean cultivation and farming system in Russia

Three major areas of soybean cultivation where the basic technologies of cultivation of this crop have been developed are located in the Amur Region: The southern, central and northern. Many farms in the Amur Region cultivate soybeans using the one-crop system for 2 to 4 years. The negative consequences of continuous soybean cultivation are increased weed infestation and diseases, resulting in a decrease in crop yields. The expansion of soybean planting areas in the Amur Region is due not only to fallow land reclamation but also to the uncontrolled growing of soybean in crop rotation and the reduction of other crops. From 2010 to 2016, the planting area of soybean increased by 84.6% and the planting area of potato and feeding crops decreased even the total planting area of crops increased by 53.6% (Table 5).

Table 5 Crop planting area and structure in the Amur Region of the Russian Federation

Item	Crop	2010	2011	2012	2013	2014	2015	2016
Planting area /(Thousand ha)	Total	790.3	855.4	1,001.3	929.3	1,059.2	1,165.1	1,213.7
	Cereal crops	204.0	189.3	222.8	177.7	194.4	180.2	219.0
	Soybean	484.1	563.5	682.4	649.7	766.3	884.9	893.5
	Potato	25.6	26.1	21.2	21.1	20.4	21.1	21.3
	Feeding crops	76.6	76.3	70.4	76.2	73.3	74.3	74.5
	Other crops	0	0.2	4.5	4.6	4.8	4.6	5.4
Structure of the crop planting area/ %	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Cereal crops	25.8	22.1	22.3	19.1	18.4	15.5	18.0
	Soybean	61.3	65.9	68.2	69.9	72.3	76.0	73.6
	Potato	3.2	3.1	2.1	2.3	1.9	1.8	1.8
	Feeding crops	9.7	8.9	7.0	8.2	6.9	6.4	6.1
	Other crops	0	0	0.4	0.5	0.5	0.4	0.4

The changes in the structure of planting areas in favour of soybeans are explained by the high profitability under favourable market conditions [21]. The sale price

for soybeans grew at a faster rate than its cultivation cost, increasing the profitability of the production up to 60% (Table 6).

Table 6 Economic indicators of soybean and cereal crop cultivation in the Amur Region of the Russian Federation

Index	2010	2011	2012	2013	2014	2015	2016
Cost of 1 t sold soybean/Rubles	6,358	6,767	8,721	11,770	10,783	13,146	15,396
The sale price of 1 t of soybean/Rubles	9,506	9,791	12,481	14,809	15,066	21,068	24,060
Profitability of soybean cultivation/%	49. 5	44. 7	43. 1	25. 8	39. 7	60. 3	56. 3
Cost of 1 t of the sold cereal grain/Rubles	5,501	5,628	6,544	8,227	6,034	6,505	6,816
The sale price of 1 t cereal grains/Rubles	4,598	5,690	6,655	7,607	5,729	8,014	7,913
Profitability cultivation of cereal crops/ %	- 16. 4	1. 1	1. 7	- 7. 5	- 5. 1	23. 2	16. 1

5 Soybean research system in Russia

From 1995 to 2016, a total of 101 soybean-related articles were published from Russia based on the SCI-EXPANDED database of the Web of Science. The top 3 institutions by article number were the Russian Academy of Sciences, Lomonosov Moscow State University and Plekhanov Russian University of Economics. Articles most frequently focused on the categories of biochemistry & molecular biology, chemistry, plant sciences, and biotechnology & applied microbiology.

In the Far East regions, the major soybean research institutions are All-Russian Scientific Research Institute of Soybean, Primorskiy Institute of Agriculture, Far East Institute of Agriculture, and Far East State Agrarian University. The All-Russian Scientific Research Institute of Soybean, which is the centre of the Russian soybean research, constitutes a strong soybean breeding system in Russia. The institute has a world-class level of soybean improvement research and has released 30-early and middle-maturing varieties. The planting area of these varieties occupied approximately 70% of the central and southern soybean producing area of the Far East region. In addition, they also focused on research on varieties for industrial raw materials, including processing soy oil, high protein, and green beans. The Far East State Agrarian University, mainly referred to teaching courses, also carried out the breeding work of the ultra-early maturing soybean varieties, which covered a certain area in the northern region. The Far East Institute of Agriculture specializes in research on soybean breeding methods and processing technologies and has released 5 new soybean varieties. Primorskiy Institute of Agriculture is devoted mainly to breeding early maturing varieties with late sowing dates, which were expected to be well adapted in various soil types.

6 Soybean breeding and seed industry in Russia

The initial breeding works on soybean in Russia began

in 1912 at the Amur Experimental Station. The geographic historical factors determined its penetration into the Amur Region from China. The beginning of the mass introduction and distribution of soybeans in Russia was from 1924-1927. At the same time, soybean was cultivated in the Krasnodar and Stavropol Territories, as well as in the Rostov Region. The new varieties released by the the All-Russian Scientific Research Institute of Soybean yielded up to 3.9 t of soybean seeds per hectare in Amur Region^[22].

The developing market of soybean seeds in Russia is attractive to foreign seed companies. Recently, it was believed that the domestic varieties form the basis of the soybean assortment in most regions of Russia. However, the number of foreign soybeans used in the main regions of the country was greater than that from domestic selection in 2016 (Table 7).

Table 7 Number of soybean varieties sown in the main planting areas of the Russian Federation in 2016

Russian Federation's regions	Number of local (Russian) soybean varieties	Number of the introduced (foreign) soybean varieties
Russian Federation	170	225
Altai Territory	8	8
Amur Region	21	11
Belgorod Region	12	26
Voronezh Region	10	24
Jewish Auton. Region	12	2
Krasnodar Territory	22	25
Kursk Region	12	21
Lipetsk Region	9	20
Orel Region	9	14
Penza Region	3	13
Primorye Territory	16	15
Samara Region	5	10
Saratov Region	7	6
Stavropol Territory	12	16
Tambov Region	8	14
Khabarovsk Territory	4	-

In 2016, the share of foreign varieties accounting for 30.9% of the standard soybean seeds in Russia in term of planting area. Information about the varietal proportion of soybean seeds sown in 2016 in the Russian Federation indicated that there was an increase in the soybean acreage of foreign varieties^[23]. A total of 60.7 thousand t out of 196.59 thousand t of standard soybean seeds in Russia were occupied by the foreign varieties (Table 8). In the Central Federal District, the proportion of sown seeds from foreign breeding was 56.3% and 43.8% in the Southern and Volga Federal

Districts. The financial advantages of foreign companies, in comparison with Russian scientific institution-origimators of varieties, allowed them to carry out strain testing of their varieties in all Russian regions, and then they engaged in soybean cultivation with further distribution in 5-6 regions of Russia. The above data indicated that foreign seed companies developed locally produced soybean seeds that were bred outside the country and effectively introduced them into production not only in the main Russian regions but also in areas that were just starting to cultivate soybean.

Table 8 Share of Russian and foreign soybean varieties in 2016

The Russian Federation and its districts	Sown soybean seeds in total	Standard soybean seeds					Substandard soybean seeds
		Subtotal	Domestic varieties		Foreign varieties		
	Amount	Amount	Amount	Percentage	Amount	Percentage	Amount
	/(Thousand t)	/(Thousand t)	/(Thousand t)	/%	/(Thousand t)	/%	/(Thousand t)
Russian Federation	245.9	196.59	135.89	69.1	60.7	30.9	49.31
Central Federal District	74.5	73.3	32.0	43.7	41.3	56.3	1.2
Southern Federal District	16.0	16.0	9.0	56.3	7.0	43.8	–
North Caucasus Federal District	2.8	2.8	1.7	60.7	1.1	39.3	–
Volga Federal District	10.8	9.4	4.6	48.9	4.8	51.1	1.4
Urals Federal District	0.20	0.19	0.19	100	–	0	0.01
Siberian Federal District	5.9	3.4	3.2	94.1	0.2	5.9	2.5
Far Eastern Federal District	135.7	91.5	85.2	93.1	6.3	6.9	44.2

7 Prospect of soybean industry in Russia

The Russian Federation has rich natural resources, sufficient scientific potential and advanced expertise. All these allow the country not only to increase soybean production but also to increase soybean demand in order to fully ensure the needs in the future for environmentally friendly soybean and exporting it at favourable prices to European countries. Although Russia does not have the leading position in the world's soybean production, nevertheless, it has continued movement with the worldwide trend and has gradually increased the volume of soybean production^[24-25]. In addition to the development of soybean cultivation in the traditional Far Eastern and Southern regions, soybean production began to spread in the European part of Russia, the south of Western Siberia and the Urals. The Russian soybean demand for raw materials will increase to 13.2 million t by 2020, of which 9.5 million t will be provided for fodder purposes, 3 million t for food and 500 thousand t for seed purposes. According to information

from the Federal Customs Service, 2 million t of commodity soybean and 228 thousand t of soy meal were imported to the Russian Federation, for a total sum of more than 1 billion \$ in 2016. To implement the strategic tasks in the Doctrine of Food Security of Russia, it is necessary to increase soybean production dramatically to fully meet the needs not only for the population of Russian Federation but also for contribution to the export of soybean.

Conclusions

In the Russian Federation, soybean is becoming a promising crop for the growing domestic and surrounding countries' demands during recent years. The Amur Region of Far Eastern District is the major soybean producing and variety breeding area in Russia, and there has been a sharp increase in soybean exports to China in this region due to its geographic advantage. Predictably, the soybean industry of Russia will be developed greatly for considerable benefit and the huge domestic and international demands for soybeans in the future.

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