

## The problems of soy market development in the far east and the ways of their solutions

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### ABSTRACT

Soybean production is the main branch of specialization of agriculture in the south of the Far East, which is due to the unique natural advantages associated with favorable climatic conditions for the cultivation of this crop. In Russia, soybean as an agricultural crop has not historically found wide distribution, which is due to the exacting nature of this plant for various factors of production, the undeveloped culture of consumption of soy products in the diet of the population. Therefore soybeans were more used as technical raw materials for the production of the most important products of its processing - oil and meal. The purpose of this study is to identify trends in the soybean seeds market in the Far East and develop recommendations for improving the efficiency of its functioning in modern conditions. The methodology of soybean market research is based on the synthesis of economic analysis and applied methods developed in mathematical statistics. The scientific value of the results of the study is to identify the development trend of the soybean market localized in the Far East of Russia and to develop practical recommendations that complement the main provisions of the theory of spatial development and institutional configuration of market structures in the agrarian sphere.

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## 1. INTRODUCTION

Soybean production is a promising and dynamic direction of agricultural development in many countries of the world. The universality of soy as an agricultural crop causes its multiple application for a variety of purposes: food, fodder, technical and agrotechnical. The greatest application in the world practice soybean seeds found in the production of oil, and the resulting meal and cake are used for feed purposes as valuable high-protein additives to mixed fodders.

Studies on the functioning of the soybean market are centered on the analysis of global leaders, which determine the conjuncture of its development on a global scale. Particular attention is paid to forecasting gross production, sown areas, yields and prices. For this purpose, various econometric methods and models are used that allow us to establish patterns that determine the prospects for the production and consumption of soybean seeds (Masuda and Goldsmith 2008, Ahumada and Cornejo 2016, Arnade et al. 2017, Ruiqing et al. 2016, Mekbib et al. 2016).

In recent years, research has seen an increase in interest in Russia, its role in world agricultural markets. It is noted that Russia is a country with large untapped agricultural potential, the use of which will significantly save arable land and reduce the average world prices for products (Deppermann et al. 2018).

Prospects are also associated with allowing the use of genetically modified seeds, which can provide additional benefits for producers of agricultural products (Chetvertakov et al. 2016).

In the conditions of increasing the volume of soybean production in Russia, competition in the market is growing, the inter-regional and transnational market of soybean seeds is formed. The development of a modern sales system, the strengthening of vertical and horizontal integration, the introduction of advanced soy processing technologies lead to the transformation of the soybean market of the Far East (Gorlov and Gorlova 2017, Antonova and Sinegovskiy 2016). The purpose of this study is to identify trends in the market of soybean seeds in the Far East and to develop recommendations for improving the efficiency of its functioning in modern conditions.

## 2. METHODS

The methodology of soybean market research is based on the synthesis of economic analysis and applied methods developed in mathematical statistics. The soy market is part of the market of agricultural products, raw materials and foodstuffs, which represents the sphere of circulation or the economic form of bringing the results of production to consumers in terms of commodity relations.

The study of the soybean market included: analysis of the degree of market competitiveness, institutional and functional market structure, market equilibrium conditions and market performance. In particular, we studied the volume, level, structure and dynamics of the market, its regional features.

## 3. DATA, ANALYSIS, AND RESULTS

In modern conditions, soy production is characterized by a high concentration on a world scale. More than 80% of world production of soybean seeds falls on three states: the USA, Brazil and Argentina. In these countries, 70.9% of the acreage of this crop is located. The yield of soybeans in the leading countries is 29-35 c / ha. Soybean production in the world in 2016 as shown in Table 1.

Table 1. Soybean Production in the World in 2016

Country	Crop area		Gross yield		Productivity, c / ha
	thous. ha	%	thous. ha	%	
World	121532	100.0	334894,1	100,0	27.6
USA	33482	27.6	117208	35.0	35.0
Brazil	33154	27.3	96297	28.6	29.0
Argentina	19505	16.0	58799	17.6	30.0
India	11500	9.5	14008	4.2	12.2
China	6641	5.5	11966	3.6	18.0
Paraguay	3370	2.8	9163	2.7	27.2
Canada	2191	1.8	5827	1.7	26.6
Russia	2120	1.7	3135	0.9	14.8
Ukraine	1859	1.5	4277	1.3	23.0
Bolivia	1336	1.1	3205	1.0	24.0

Source: FAO

The production of soybean in Russia in modern conditions is the most important direction of the development of agriculture. In this industry it was possible to achieve significant results, both by expanding the acreage and gross harvest, and by intensifying production and increasing yields. Despite this, on a global scale, the Russian Federation occupies a modest position, it accounts for only 1.7% of the acreage and 0.9% of soybean production.

The sown areas occupied by soy in the Russian Federation have increased more than threefold since 1990. Among the regions, the largest share of soybean crops is concentrated in the Far Eastern Federal District (56.9%), the leader here is the Amur Region (40.1% of the total Russian indicator).

It should be noted a significant increase in soybean acreage in the Central Federal District. On a countrywide scale, the share of soybean acreage in the Central Federal District has increased to 27.5% with a five-fold increase in absolute terms. Among the regions of the Central Federal District, the greatest growth of soybean crops was observed in the Belgorod region, the Kursk region, the Voronezh region, the Orlov region and the Tambov region. Soybean production in Russia as shown in Table 2.

Table 2. Soybean Production in Russia

Region	Crop area		Gross yield		Productivity, c / ha
	thous. ha	%	thous. ha	%	
Russia	2228.49	100.0	33431.27	100.0	15.8
Amur Region	893.53	40.1	9771.89	29.2	11.8
Primorsky Territory	243.53	10.9	2942.78	8.8	13.5
Belgorod Region	210.38	9.4	5152.78	15.4	24.5
Krasnodar Territory	156.28	7.0	3305.57	9.9	21.5
Kursk Region	136.08	6.1	3249.27	9.7	23.9
Jewish Autonomous Region	104.68	4.7	993.72	3.0	10.0
Voronezh Region	77.8	3.5	1211.45	3.6	15.8
Oryol Region	51.39	2.3	1013.76	3.0	19.8
Lipetsk Region	49.66	2.2	930.24	2.8	18.8
Tambov Region	49.03	2.2	874.71	2.6	18.1

Source: Single Interdepartmental Information and Statistical System (Federal State Statistics Service of Russia Federation)

According to the sown areas and the volume of soybean production, the regions of the Central Federal District surpassed the Southern Federal District, whose share was reduced to 8.2%. Sown areas of soybean in the Southern Federal District remain stable and not subject to sharp fluctuations.

The concentration of soybean production is typical for the world scale and takes place in Russia, 80% of soybean production and sowing areas are concentrated in seven regions: the Amur Region, the Belgorod Region, the Krasnodar Territory, the Kursk Region, the Primorsky Territory, the Voronezh Region, the Oryol Region. In terms of the level of soybean yield, sub-projects of the western part of the Russian Federation are leading.

Demand in the soybean market is formed by consumers of soybean seeds, taking into account the need for raw materials and current prices. As consumers, they are:

- a) Enterprises of oil and fat industry (oil extraction plants, fat and oil plants);
- b) Livestock and poultry enterprises;
- c) Feed mills.

The demand for soybean seeds is dependent, since it is determined by the need for higher-level products, in relation to which soy is an integral part (butter, meal, flour, etc.). In addition, many soy products are substitutes for goods in relation to traditional goods. For example, in the production of feed soybean meal is interchangeable with products such as fish and bone meal, lysine, corn gluten, so the demand for such products will vary depending on the price situation.

Soy products are consumed mainly in Russia. At the same time, the demand of the Russian market is constantly growing.

In Russia, a specific territorial structure of distribution of soybean processing capacities has been formed. The Siberian Federal District does not have significant soybean acreage, but is in second place in terms of soybean processing for the production of soybean oil and ranks first in Russia for the production of soybean flour. The leading enterprise in the region is OAO Irkutsk Oil and Fat Plant, and the main source of soybeans is the Far Eastern Federal District.

The Far Eastern Federal District, the Central Federal District and the Southern Federal District, being the main soybean producers in Russia, also seek to develop its processing. But due to limited soybeans base and not developed logistics infrastructure, these regions are not able to provide comparable scales of production of soy products. The Far Eastern Federal District has the least favorable position on the all-Russian scale.

Given the large territory of Russia, it can be argued that the production and processing of soybeans in our country is of a local nature. At the present time relatively independent territorially isolated regional soy subcomplexes have formed, which have their own specific features. These include three federal districts - the Far Eastern, Central and Southern, having a production focus (mainly the production of soybeans) and two federal districts – the North-West and the Siberian, with a developed system for processing soybeans.

The Far Eastern Federal District has an advantage over the sown areas and the gross harvest of soybeans, but is inferior in terms of yield and price. Prospects for the development of soy production in the Far Eastern Federal District should be related to the solution of the problem of increasing the yield and with the expansion of the sales market.

The offer of soybeans on the market is formed by sellers who have the desire and the physical ability to sell this product at an affordable price. As sellers of soybean seeds are:

- a) Agricultural organizations;
- b) Peasant (farm) farms.

The share of agricultural organizations is 85% of sold soybeans. Peasant (farm) farms and individual entrepreneurs realize 15% of soy. The supply of soybeans is determined by the volume of their production within the country, which depends on the size of the acreage, yield and gross harvest, and also on imports from abroad.

The demand for soybean seeds is more stable than their supply. Fluctuations in demand occur under the influence of changes in the population and customers, their purchasing power, tastes and preferences for individual products, prices of competing products, and economic expectations of buyers.

The proposal follows demand, but there are either more or less demand and does not cover it mathematically. Moreover, in agriculture, due to its specific characteristics, the offer itself not only follows demand, is oriented towards it, but it is also unstable and can not be changed until the production cycle is completed, even if demand has increased or decreased.

The pricing system for soy is quite complex, as it must take into account the interaction of the markets for soybean seeds, meal, soybean isolate, soy flour and oil. Since these are different products, the prices for them, although they depend to some extent on each other, but are determined in different ways. Soybean oil is a basic and much more speculative commodity than soybean meal. Since there are many substitutes for soybean oil on the world market, its price is determined by the residual principle. In addition, it is necessary to take into account the dynamics and correlation of prices for various agricultural products, which may lead to a change in the structure of production in favor of more profitable crops (Suh and Moss 2018).

The market of soybean seeds in Russia, as it develops and integrates into the world agri-food market, becomes dependent on its conjuncture. According to research, the global soybean market is largely determined by the state of markets in the US, Brazil and China (Li and Hayes 2017).

By the order of the Government of the Russian Federation dated October 28, 2015 No. 2193-r, the "Concept of development of the border territories of the constituent entities of the Russian Federation that are part of the Far Eastern Federal District" was approved. The Concept states that "the Far Eastern border territories are the most important resource of the country, the development of which is not only related to the domestic policy of the Russian Federation, but also to the special geopolitical position of these territories, the specifics of international relations and cross-border cooperation." This document focuses attention on the fact that agriculture is one of the main branches of the economy of the Far Eastern border areas. Within the framework of the state policy in the sphere of development of the Far Eastern border territories, the task is to increase the capacity of agricultural land use and sustainable development of agricultural production.

The implementation of measures to create conditions for economic development and sustainable development of agricultural production in the border regions will contribute to the formation of cross-border markets, including the ranking of agricultural products and raw materials. In fact, this process has already begun, for example, from September 1, 2015, export customs duties on soybeans were nullified, in accordance with the commitments undertaken by our country in accession to the World Trade Organization (WTO), which led to a significant increase in the volume of soybean exports from the Amur Region, one of the main producers of soybean in Russia. The buyer of Amur soy is the People's Republic of China, which borders on this region (Table 3).

Table 3. Export of Soybean Seeds to the PRC from the Regions of the Far Eastern Federal District

Region	Year 2014			Year 2015			Year 2016		
	Sold soybean seeds		Share of exports in sales,%	Sold soybean seeds		Share of exports in sales,%	Sold soybean seeds		Share of exports in sales,%
	Total	including for export		Total	including for export		Total	including for export	
Far Eastern Federal District	357987	21549	6.0	430014	86824	20.2	407285	69416	17.0
Primorye Territory	81609	14906	18.3	43834	2940	6.7	59204	10415	17.6
Amur region	263337	6643	2.5	367537	83884	22.8	328498	58332	17.8

Source: calculated on the basis of data Bulletins on the state of agriculture (Federal State Statistics Service of Russia Federation)

China is the leader in the import of soybean seeds in the world market. Soybean production in China is concentrated in the northeast of the country, which borders on the Russian Far East. Sown areas in this region of China are already oversaturated with soybean (Mingming Liu and Dongmei Li 2010). Therefore, interest in the Far Eastern soybeans will only increase in the future.

The sale of soybean seeds in the Far Eastern Federal District increased by 13.8% over the period under review, of which for export in 2016 it was sent 3.2 times more than in 2014. The Amur Region increased the export of soybean seeds to the PRC in 8.8 time. In recent years, not only the export of soybean seeds, but also the products of their processing, in particular soybean oil, which is in demand in China, is developing.

The dynamics of the development of export demand for soybeans, domestic consumption for developing processing capacities testify to the need to increase soybean production in the Amur Region. Components of soybean production increase are varieties and technological and technical systems for their cultivation.

The expansion of soybean crops in the Amur Region and the increase in its yield due to the use of new varieties remain the main and most effective reserve for increasing the volumes of its production. Currently, most of the soybean crops of the Amur Region are occupied by the selection varieties of the Federal State Budget Scientific Institution "All-Russian Scientific Research Institute of Soybeans" (VNIIs soyi).

Over the years of activity of the Federal State Budget Scientific Institution "All-Russian Scientific Research Institute of Soybeans" (VNIIs soyi), its scientists have deduced more than 60 varieties of soybean of various ripening groups that combine features that make it possible to widely apply them both in the Amur Region and in other regions of Russia. In 2017, 35 varieties of soybean were sown in the Amur Region, most of the soybean cultivation is occupied by varieties of VNIIs soyi breeding. The leading place is occupied by varieties Dauria, Lydia, Harmony, Lazurnaya. For the last five years prospective varieties Alena, Nega, Umka are zoned. Potential yields are in the range of 3.3-4.2 t / ha. Characteristics of the Leading Varieties of Soybean Selection in the VNIIs soyi as shown in Table 4.

Table 4. Characteristics of the Leading Varieties of Soybean Selection in the VNIIs soyi [7]

Soybean varieties	Height of bean attachment, cm	Share in the structure of crops, %	Content, %		Potential yield, c / ha (VNIIs soyi)	Based on the results of the state variety testing	Taking into account the realization of the potential of the variety
			fat	protein			
Dauria	10-12	33.7	19.9-21.9	37.3-40.3	36.4	28.7-36.4	30.940
Lazurnaya	13-18	14.2	19.4-20.9	38.7-41.4	36.4	31.2-36.4	30.940
Alena	18-32	9.8	18.0-19.9	38.1-38.7	39.0	35.6-39.0	33.150
Nega	15-23	9.4	19.0-21.9	38.6-39.6	34.3	32.9-34.3	29.155
Lydia	13-18	9.3	20.3-21.8	39.3-41.1	30.5	30.5	25.925
Garmoniya	13-16	7.5	19.3-22.0	37.5-39.6	37.7	26.9-37.7	32.045
Umka	13-17	0.4	22.6-22.8	38.8-41.1	38.4	30.0-38.4	32.640

Source: Catalog of varieties of soybean selection of the All-Russian Research Institute of soybean

An important requirement of production is the height of the attachment of beans. Soybean selection is aimed at increasing it. In prospective varieties, it is from 13 to 32 cm, which significantly reduces crop losses from incision of beans during harvesting.

Taking into account the appointment of soybean seeds as an oilseed and protein culture, the indices of the content of fat and protein in seeds are important. As a result of a complex qualitative assessment of varieties, the Lydia grade is characterized by the highest protein content, 39.3-41.1%, but it is inferior to other varieties in terms of yield. Technological evaluation of soybean varieties as shown in Table 5.

Table 5. Technological Evaluation of Soybean Varieties

Soybean varieties	Yield, c / ha	Output from 1 hectare, centner		Rank		
		Fat	Protein	by yield	by fat	by protein
Dauria	30.940	6.47	12.00	4	3	5
Lazurnaya	30.940	6.23	12.39	4	5	3
Alena	33.150	6.28	12.73	1	4	2
Nega	29.155	6.09	11.40	6	6	7
Lydia	25.925	5.35	10.42	5	7	6
Garmoniya	32.045	6.62	12.35	3	2	4
Umka	32.640	7.41	13.04	2	1	1

The variety of soya Alea is distinguished by the highest yield, but is inferior to the leading varieties in terms of fat and protein content. As a result, the performance indicators of technology and quality do not match.

The interest of the soybean producer, of course, in the yield level and the height of attachment of the bob, ultimately affects the cost of growing soybeans, and for the processing enterprises - in the content of fat and protein. Therefore, the evaluation of the effectiveness of soybean cultivation, in our opinion, should be conducted taking into account the quality characteristics of varieties.

Technical and technological systems of soybeans contain technologies of cultivation and a complex of machines they realize. An important moment in the growth of soybean production is the introduction of innovative technologies and machine complexes. The market offers many such. How to choose the best? In this case, it is advisable to carry a lot of complex variant evaluation in order to select the best of a range of indicators.

The market of agricultural machinery receives a lot of analogues of machines, the choice of which at the initial stage is expedient to carry out by the method of rapid assessment of agricultural machinery. The method makes it possible to conduct operational technical and economic assessment and reasonably choose from among many analogs technological units that meet the requirements of agricultural enterprises, by design, productivity, economy (Churilova and Torgunakova 2011).

For a comprehensive assessment, the technique of economic support of a system of technologies and machines can be successfully used. The methodology allows for a comprehensive assessment and structural analysis of existing and planned technical and technological systems, based on the actual annual load, optimizing the volume, composition, structure of the Machine and tractor fleet, crop rotation, specialization and placement of crop production in the agricultural zones, taking into account the natural and climatic conditions, selection of the level of resource consumption, varieties, the development of standards for the need for technological and technical resources for the declared areas of specialization and levels of intensification. The methodology has information support, which includes a database in the environment of a specific target Microsoft Access database in the form of Automated information system in the form of workstation (Churilova et al. 2016).

The results of a comprehensive assessment of varieties, taking into account the recommendations of the technical and technological systems used, show that the most costly of technological and technical systems are the domestic machinery complex. Mixed crop rotation, which includes fodder crops in the crop rotation, is the most costly due to the use of specialized equipment for harvesting fodder crops. Soy and grain crop rotation uses a unified technique for cultivating grain crops and soybeans, where the cost per hectare is 12,851 rubles, with the use of the domestic machine complex, costs are increased by 49.9%. The role is played by the level of fuel consumption, the productivity of the units, the reliability of machinery (Tikhonchuk et al. 2016). Rating evaluation of technological and economic indicators of soybean cultivation as shown in Table 6.

Table 6. Rating Evaluation of Technological and Economic Indicators of Soybean Cultivation

	Mixed crop rotation		Soybean-grain crop rotation		Soybean-grain crop rotation		Yield of soy, c / ha
	Imported complex of agricultural machinery		Domestic complex of agricultural machinery		Imported complex of agricultural machinery		
	Fat	Proteins	Fat	Proteins	Fat	Proteins	
Structure of energy intensity,%	38.1	34.2	38.1	34.2	38.1	34.2	
Production costs per hectare, rubles	13209		19264		12851		
	Rating by cost						
Dauria	5	5	5	5	5	5	4
Lazurnaya	4	4	4	4	4	4	4
Alena	7	7	7	7	7	7	1
Nega	2	2	2	2	2	2	6
Lydia	3	3	3	3	3	3	5
Garmoniya	6	6	6	6	6	6	3
Umka	1	1	1	1	1	1	2

As a result of complex economic assessment in terms of the cost of obvious discrepancy between the results of evaluation of the cost of oil, protein and soy harvest. Thus, the variety Alena has the lowest cost index of grain and is attractive for soybean producers. Perspective variety Umka occupies the second place in terms of yield, surpasses the Alain variety and the yield of 1 hectare of fat and protein and their cost price, and this variety is more attractive for soybean processing enterprises.

#### 4. DISCUSSIONS

Soy as a commodity is a unique product with high consumer properties as raw materials for processing industries and high cost. The study of the economic evaluation of the complex of technical and technological, quality and economic indicators shows that the interests of producers and the market needs of soybean raw materials do not coincide, which requires new approaches to pricing the soybean seeds, forming them taking into account the fat and protein content, which will stimulate the supply on the market of soybean seeds meeting the requirements of the main consumers. These recommendations can be used in forecasting prices based on existing models (Ahumada and Cornejo 2016).

The soybean market is part of the agricultural raw materials and food market, which, in turn, is part of the agrarian (agro-food, agro-industrial) market. The formation and development of this market is a new phenomenon for the Russian economy, which is associated with a significant increase in the production and consumption of soybeans in our country. Currently, the soybean market is at the stage of formation, while demonstrating a high growth dynamics. The Russian soybean market is increasingly dependent on the world market due to the expansion of the participation of Russian companies in the world trade in this product, which should be taken into account when studying the prospects for its development (Deppermann et al. 2018).

The soy market operates and develops according to general economic laws, but has its own specifics, due to the peculiarities of the product itself. The market for soybean seeds develops under the influence of features characteristic of agriculture as a whole. As a result, general economic laws are refracted under the action of natural laws. The Far East is located in the zone of risky farming, floods are possible due to the spill of large rivers, so models that take into account these features should be used to forecast economic processes, for example, the approach based on the ARIMA model (Masuda and Goldsmith 2008) has proved to be very successful.

Agriculture is characterized by its conservatism and inelasticity, inadequate response to the conditions and demands of the market. So, with the increase in demand for agricultural products, the features of agricultural production do not give an opportunity to react quickly and increase output. There are a number of restrictions on increasing the growth rates of agricultural production. Considering the forecasts of demand for different crops and their profitability, as well as predecessors, it is required to optimally plan soybean acreage. It is necessary to consider the possibility of increasing the export of soybean seeds to the Chinese market, whose needs far exceed the available production capabilities (Mingming Liu and Dongmei Li 2010).

#### 5. CONCLUSION

The scientific value of the research results is to identify the development trend of the soybean market localized in the Far East of Russia and to develop practical recommendations that complement the main provisions of the theory of spatial development and institutional configuration of market structures in the agrarian sphere.

The concrete increment of scientific knowledge in the studied subject area is as follows:

- a) It is revealed that the Russian soybean market is increasingly dependent on the world market.
- b) The soy market operates and develops according to general economic laws, but has its own specifics, due to the peculiarities of the product itself.
- c) Soybean production in Russia has a high level of territorial concentration.
- d) The implementation of measures to create conditions for economic development and sustainable development of agricultural production in the border regions of the Russian Far East contributes to the formation of a cross-border market for soybean seeds.
- e) It is proved that the interests of producers and market needs for soybean raw materials do not coincide, which requires new approaches in pricing for soybean seeds.
- f) The need to improve Russian agricultural machinery to the level of world standards has been proved.

The conclusions and recommendations formulated in the article make a definite contribution to understanding the processes of transformation of the Russian soybean market at the present stage of its development.

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