Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 19, Issue 1, 2019
PRINT ISSN 2284-7995, E-ISSN 2285-3952

THE CURRENT STATE OF AND PROSPECTS FOR THE DEVELOPMENT OF GRAIN PRODUCTION IN SIBERIAN FEDERAL DISTRICT

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Abstract

Siberian Federal District (SFD) is located in the center of the Russian Federation, occupying 30% of its territory. Its population is 19,326 thousand people, which constitutes 13.2% of Russia's total population. The district consists of 12 constituent entities, which, to one degree or another, are engaged in agricultural production. Grain crops are grown in each of the SFD regions, with the way being currently led by Altai Krai, Krasnoyarsk Krai, Omsk Oblast, Kemerovo Oblast, and Novosibirsk Oblast, which account for 90% of the district's gross grain output. Most of the district's land under cultivation is sown to wheat (67%). However, due to unstable and low prices for wheat, agriproducers are forced to consider dropping some of the traditional crops and shifting, in accordance with the changing needs of the market, to other – sought-after and more competitive – grain crops. Another major issue in grain production within the district is the relatively low quality of grain, which diminishes its competitiveness in the market, with nearly 60% of all grain being represented by low-protein feeding grain. It may, therefore, be advantageous for Siberian agriculturists to grow grain for livestock farming, and this may require enhancing the actual structure of the land under cultivation and focusing on growing grain crops with the protein component greater than in the 4th class soft wheat. The paper shares some of the findings from an assessment of the region's agro-climatic potential for the period through to 2025.

***Key words*:** *grain farming, Siberian Federal District, indicators of production, agro-climatic potential*

INTRODUCTION

The nation's ability to ensure its food security depends, above all, on the level of development of its grain production sector and its potential for meeting for sure the population's need for wholesome food. Its ability to provide itself with food and guard itself from all manner of natural disasters and emergencies of both an internal and external nature will largely depend on its ability to generate guaranteed volumes of grain [4, 5]. As a result of a series of negative phenomena that plagued Russia's agriculture during the early 1990s, domestic grain producers were faced with a number of issues, some of which are touched upon in this paper. Siberia's land sown to grain has quite a diverse structure, with the major focus being on growing traditional crops, like wheat, rye, barley, oats, corn, buckwheat, and peas. In recent years, the district's agriculturists have been increasingly interested in crops that are not in wide use in Siberia, like triticale, chickpeas, lentil, and soybeans. This may be due to a major portion of the district's crop production being oriented toward livestock farming, with a focus on growing high-protein grain crops.

MATERIALS AND METHODS

The purpose of this study is to develop a set of various indicators of the development of grain production both for the current and future periods. These indicators must serve as guideposts that will be applied in respect of production activity both by state-run and by privately-owned organizations.

The study's theoretical and methodological basis is grounded in scholarly works focused

on the issue under review and publications from research-to-practice conferences.

Depending on their objectives pursued, the authors employ the following methods of research: monographic, abstract/logical, economic/statistical, computational/constructive, and expert assessment.

The study's information basis is relevant methodological and reference materials from the Russian Federal State Statistics Service, statutes and policy papers from public authorities, and reports on the financial/economic status of producers within SFD's agro-industrial complex.

The study's subject is today's economic relationships within SFD's grain complex. Its object is factors and principles influencing grain production in the district.

RESULTS AND DISCUSSIONS

The paper provides a brief characterization of Siberian Federal District (SFD). It analyzes the current state of the district's grain production through the lens of its regions. The study is focused on the time period of 1970–2015. The authors identify a set of factors influencing the development of grain production in the region, as well as a set of trends in its development across a set of key production indicators.

The authors identified some of the key reasons behind declines in the planting of grain crops in the district. They suggest boosting the quality of grain in the region through providing support for regional seed development and breeding work, approaching grain production, harvesting, and processing as a single process with a common flow scheme, and employing monitoring of the quality of grain as a tool for regulating the domestic grain market and developing grain exports.

The paper determines the district's agro-climatic potential through the lens of its regions for the period through to 2025. The authors suggest attaining target indicators through the implementation of the following activities: restoring neglected cultivation areas, building new melioration systems for irrigating grain crops, reviving regional seed development stations, employing cutting-edge technology and machinery, employing mineral fertilizers and integrated protection for plants, and implementing the differentiated deployment of grain crops.

Characteristics of SFD

SFD covers an area of 5,145 thousand square kilometers (30% of Russia's territory). As of early 2017, its population is 19,326 thousand people (13.2%). By area, SFD is Russia's second largest federal district (after Far Eastern Federal District), and by population it is the nation's third largest district (after Central Federal District and Volga Federal District) [16]. Table 1 lists SFD's 2016 rankings among the constituent entities of the Russian Federation based on agricultural production.

In 2016, the district produced 12% of Russia's total Gross Regional Product. The region ranked 4th nationally in grain production, accounting for 16% of Russia's total grain crop output. SFD consists of 12 constituent entities.

These regions are contributing to the district's grain production sector differently. The largest relative share of the area sown to grain is held by Altai Krai, Krasnoyarsk Krai, Omsk Oblast, Novosibirsk Oblast, and Kemerovo Oblast. These five regions account for 90% of all of the district's land under grain crops and nearly 93% of its gross grain output [17].

Based on soil/climatic conditions, SFD is divided into eight major zones. Each zone is characterized by a distinct system of arable farming and livestock farming of its own. The district's sum of positive temperatures (above 10°C) increases north to south from 1,350° to 2,450°C, while, conversely, its annual precipitation decreases from 550 mm to 200 mm. Depending on the region, the district's accumulated precipitation varies from 700–650 to 300–350 mm [7].

Table 1. Rankings of the regions within SFD Based on agricultural production in 2016

Regions within SFD	Gross grain output	Gross potato output	Gross vegetable output	Production of livestock and poultry for slaughter	Milk production	Egg production
SFD's rank among the constituent entities of the Russian Federation	4	3	5	3	3	3
Altai Republic	11	11	11	10	11	11
Republic of Buryatia	10	9	9	9	8	9
Tuva Republic	12	12	12	12	12	12
Republic of Khakassia	8	10	8	11	9	8
Altai Krai	1	2	3	1	1	3
Zabaykalsky Krai	9	8	10	8	7	10
Krasnoyarsk Krai	3	1	4	4	2	6
Irkutsk Oblast	6	5	6	5	5	4
Kemerovo Oblast	5	4	2	6	6	2
Novosibirsk Oblast	4	6	6	3	4	1
Omsk Oblast	2	3	1	2	3	5
Tomsk Oblast	7	7	7	7	10	7

Source: Altaikraistat, 2017 [3]

SFD's land under cultivation

The district's agricultural lands are located in areas where the sum of positive temperatures (above 10°C) ranges from 1,400°C to 1,950°C. This makes it possible for SFD regions to grow both regular (wheat, rye, peas, oats, and barley) and heat-loving grain crops (grain maize, buckwheat, sunflower, and millet) [8].

Today, the district's grain crop producers depend less on such a key factor as the natural/climatic factor.

The use of new machinery and intensive technology and the conduct of meaningful plant-breeding work are helping minimize the impact of the natural factor, but this is being offset by declines in the use of mineral fertilizers and chemical crop protection products, spikes in the cost of combustibles and lubricants, as well as declines in the use of irrigation systems for grain crops [14].

Another indicator that has an effect on the district's gross grain output is the size of land under cultivation (Table 2).

The largest areas sown with grain and grain legume crops were registered in 2015 in Altai Krai (36.7%), Omsk Oblast (21.7%), and Novosibirsk Oblast (15.4%).

The lowest indicators – less than 1% – were posted by the Altai Republic and the Tuva Republic.

Declines in the planting of grain crops are due to not only a plethora of technical/technological and economic reasons, but oftentimes are caused by a lack of funding for cultural control activities [18].

Dynamics of grain crop yield

The region's grain crop yield is not sufficiently high. Evidence from practice indicates that most of today's agricultural organizations have yet to exploit the potential of Siberia's cropland to the fullest. In the period of 1990–2015, the lowest crop yield across the district's regions – 5.8 dt/ha – was registered in 1995 in the Tuva Republic and in 2005 in the Republic of Khakassia, while the highest one – 22.0 dt/ha – was posted by Krasnoyarsk Krai in 2015 (Table 3).

In the 25-year period, the district's average crop yield varied between 11.4 and 15.0 dt/ha.

Table 2. Land under cultivation, including land sown with grain crops across the regions within SFD (in holdings of all categories), Thousand ha

Regions within SFD	All land under cultivation			Land sown to grain crops		
	2005	2010	2015	2005	2010	2015
SFD	15,258.6	14,555.4	15,026.7	10,224.0	9,484.6	9,883.3
Altai Republic	103.4	103.3	108.3	16.5	9.2	6.5
Republic of Buryatia	221.8	192.8	154.0	120.2	107.0	85.5
Tuva Republic	38.4	27.8	27.2	26.0	18.1	6.1
Republic of Khakassia	199.5	222.8	240.4	97.3	90.9	92.7
Altai Krai	5,191.3	5,149.3	5,394.3	3,609.2	3,393.6	3,632.1
Krasnoyarsk Krai	1,608.0	1,461.1	1,538.1	999.9	977.5	1,043.4
Zabaykalsky Krai	278.8	217.2	208.2	213.2	152.1	139.7
Irkutsk Oblast	715.4	639.0	675.3	426.3	358.0	410.5
Kemerovo Oblast	1,065.3	1,037.1	971.7	697.5	683.7	605.8
Novosibirsk Oblast	2,536.6	2,326.2	2,339.9	1,703.0	1,560.7	1,517.6
Omsk Oblast	2,911.8	2,797.5	3,029.4	2,069.7	1,893.5	2,146.0
Tomsk Oblast	388.4	381.3	339.9	245.1	240.4	197.6

Source: Russian Federal State Statistics Service, 2016 [16]

Table 3. Dynamics of grain crop yield (in weight after processing) in SFD (in holdings of all categories), DT/ha

Regions within SFD	1990	1995	2000	2005	2010	2015
SFD	11.6	12.3	15.0	11.9	14.5	14.4
Altai Republic	10.9	7.8	13.8	13.1	13.1	10.9
Republic of Buryatia	14.9	9.4	12.3	8.8	12.7	7.7
Tuva Republic	8.5	5.8	9.1	6.2	9.9	8.2
Republic of Khakassia	10.2	9.8	7.9	5.8	14.6	13.0
Altai Krai	8.7	9.6	13.8	8.8	12.8	11.0
Zabaykalsky Krai	12.1	8.1	10.8	14.5	13.4	11.1
Krasnoyarsk Krai	16.5	16.1	18.6	16.2	21.3	22.0
Irkutsk Oblast	11.2	13.8	14.3	15.3	15.6	16.4
Kemerovo Oblast	15.3	15.0	14.6	15.0	17.3	17.1
Novosibirsk Oblast	12.1	14.2	17.0	10.9	15.1	14.5
Omsk Oblast	11.2	13.3	15.3	13.9	12.1	15.5
Tomsk Oblast	12.1	15.1	14.2	14.0	15.1	15.3

Source: Russian Federal State Statistics Service, 2016 [16]

Dynamics of gross grain output and its structure in SFD

SFD is located in a risky arable farming zone. The area's natural/climatic conditions are having a significant effect on key production indicators of grain production in the district. The largest volumes of gross grain output (in weight after processing) were recorded during the period of 1971–1975 (the most successful for agriproducers) – 18,639 thousand tons of grain, while the smallest volumes were posted between 1996 and 2000 – 11,024 thousand tons (Table 4).

Table 4. Dynamics of gross grain output (in weight after processing) in SFD (in holdings of all categories), Thousand tons

Regions within SFD	1971–1975	1976–1980	1981–1985	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010	2011–2015
SFD	18,639	17,077	16,074	17,568	14,040	11,024	13,296	14,522	13,149
Altai Republic	35.7	36.3	29.2	47.7	24.0	12.0	17.5	13.9	8.1
Republic of Buryatia	480.5	278.0	427.5	501.4	317.0	240.4	105.0	85.0	87.7
Tuva Republic	130.2	105.7	105.9	135.6	89.4	23.7	19.2	12.4	12.2
Republic of Khakassia	377.4	257.5	348.0	377.1	243.4	145.5	96.1	94.1	144.1
Altai Krai	5,865.3	5,043.9	4,257.0	5,051.5	3,506.0	2,918	3,836	4,389	3,719.5
Krasnoyarsk Krai	2,490.8	2,194.2	2,513.2	2,431.7	2,325.0	1,762	1,826	1,979	2,164.5
Zabaykalsky Krai	941.4	824.4	861.6	1,113.3	625.1	263.9	220.2	194.6	153.7
Irkutsk Oblast	1,192.4	1,067.5	1,175.7	1,207.2	985.8	694.2	563.3	757.8	681.3
Kemerovo Oblast	1,146.3	1,034.5	1,008.0	1,203.4	931.3	738.1	968.4	1,357	908.3
Novosibirsk Oblast	2,753.0	2,539.4	2,327.4	2,504.0	2,255.0	1,982	2,370	2,475	1,993
Omsk Oblast	2,810.9	3,284.7	2,626.8	2,564.3	2,352.0	1,930	2,904	2,899	2,990.1
Tomsk Oblast	414.7	411.2	393.3	431.3	386.6	315.5	338.5	357.5	276.2

Sources: State Statistics Committee of the Russian Federation, 2003 [21] and Russian Federal State Statistics Service, 2016 [16]

The largest amount of grain is currently produced in Altai Krai, Krasnoyarsk Krai, Novosibirsk Oblast, and Omsk Oblast. The smallest amount of grain is produced in the Altai Republic and the Tuva Republic, which are characterized by natural/climatic conditions that are unsuitable for growing grain crops and where local holdings are gradually reducing the area sown to grain crops and shifting to other types of agricultural production [21, 12, 15]. It may help to not only focus on boosting gross grain output but reconsider the actual crops that are grown. It may be worth focusing on growing high-protein grain legume crops in the district. Decreases in the district's land under grain cultivation are directly associated with decreases in cattle stock, as nearly 60% of produced grain is used for feeding purposes [6, 10, 11].

The district's agro-climatic potential and key indicators of its development

The authors have computed a set of indicators of grain production across SFD, based on the area's special characteristics.

Table 5. Indicators of the agro-climatic potential and crop yield of grain crops across the regions within SFD

	Agro-climatic potential of grain crops, thousand tons		Indicator of crop yield, dt/ha	
	2015	2025	2015	2025
SFD	13,803.6	22,704.0	14.4	22.9
Altai Republic	7.0	11.0	10.9	17.0
Republic of Buryatia	21.4	136.8	7.7	16.0
Tuva Republic	3.2	7.3	8.2	12.0
Republic of Khakassia	115.6	194.7	13.0	20.0
Altai Krai	3,940.4	8,172.2	11.0	21.0
Krasnoyarsk Krai	2,253.9	2,931.9	22.0	27.0
Zabaykalsky Krai	62.8	238.9	11.1	17.1
Irkutsk Oblast	551.7	985.2	16.4	24.0
Kemerovo Oblast	1,034.1	1,665.9	17.1	27.5
Novosibirsk Oblast	2,196.5	3,551.2	14.5	23.4
Omsk Oblast	3,316.7	4,334.9	15.5	20.2
Tomsk Oblast	300.3	474.2	15.3	24.0

Source: Russian Federal State Statistics Service, 2016 [16].

Agro-climatic potential across SFD's natural regions varies between 9 and 45 dt/ha. Table 5 lists indicators of grain crop yield and the lands' agro-climatic potential for the period through to 2025.

Based on the authors' estimates, grain production in the district is projected to increase to 22,704.0 thousand tons, with SFD's average crop yield expected to rise to 22.9 dt/ha [2].

Focus areas for the development of grain farming in the region

One of the most promising areas for boosting the region's gross grain output is seed farming. It is impossible to overestimate the role of seed farming in enhancing and boosting grain farming in the district as a whole or any individual region within it in particular. Even when there are delays or a total lack of compensation on seed variety upgrades, investment in this activity is known to pay off within a year's time. Seed farming is gradually recovering in the region. If just 10 years ago the sector was running mainly based on enthusiasm, right now things have improved substantially, with domestic released varieties with improved characteristics increasingly entering the market [9, 20]. These include the following varieties of wheat: Siberian 17, Omsk 38, Novosibirsk 31, Novosibirsk 44, Bagan 95, and Ob 2; oats: Sig, Orion, Irtysh 22, and Rovesnik; barley: Omsk naked, Sibirsky Avangard, Biom, and Tanay.

Under Resolution of the Government of the Russian Federation No. 1432, in force since 2013, agriculturists can get 15–20% off when purchasing machinery manufactured domestically, which has helped drive the demand for domestic machinery up significantly in recent years. In addition, in 2016 the Russian government signed into law 'The Strategy for the Development of Russia's Agricultural Machinery Industry for the Period through to 2030', which means there will be state support for enterprises operating within the sector [19].

SFD possesses unique genetic reserves of grain crops which are among the world's greatest, which makes it possible for holdings in just about any of its regions to produce grain of the highest quality. Having said that, the current volumes of production of the first-class and second-class grain are not too large. For the most part, the fourth- and fifth-class wheat is grown. There are various causes behind declines in the planting of strong varieties of grain crops, including the technological, economic, and organizational factors. To enhance the quality of grain, the government may need to provide support for regional seed development and breeding work across the district, approach grain production, harvesting, and processing as a single process with a common flow scheme, and employ monitoring of the quality of grain as a tool for regulating the domestic grain market and developing grain exports [13].

To attain target indicators, the following key activities may need to be carried out:

(i)Restoring neglected cultivation areas to plant grain crops on them and making changes to the structure of land under grain by reference to the region's agro-climatic potential;

(ii)Renewing and continuing work related to building new melioration systems for irrigating grain crops;

(iii)Reviving regional seed development stations and encouraging the use of superior-generation released seeds of Russian design;

(iv)Employing cutting edge technology and machinery by reference to the region's natural/climatic characteristics;

(v)Employing integrated protection for plants by reference to the latest solutions designed to boost the effect of applying mineral fertilizers and agrichemicals.

(vi)Implementing the differentiated deployment of grain crops by reference to the region's specialization and natural potential, which will have a direct effect on the quality of grain.

(vii)Employing the latest technology for harvesting, drying, and storing grain to enable preserving the quality of grain (gluten and protein).

Right now, of added relevance is the issue of grain exports. In modern economics, the export of grain is testimony to stability within the nation, which is able to provide with food not only its own population but also make

steady shipments to the external market. During the period between the late 19th and early 20th centuries, Russia was a key supplier of grain in the world market, while in the late 20th century it was importing grain. During the early 2000s, the nation's grain policy underwent radical changes, as a result of which as early as in 2005 the nation's grain exports exceeded 10 million tons, and in 2014 Russia ranked among the world's top grain exporters. In 2017, after achieving a record grain harvest of 137.2 million tons, the Russian Federation became the world's top grain exporter. With wheat currently being a staple of the nation's grain exports, Russia also exports barley, corn, soybeans, and rye. In 2017, barley exports increased 2 times, and corn exports rose 12 times [1]. The amount of grain shipped from SFD is not too large at the moment – around 3%. It is mostly supplied to the country's northern regions. To further develop its export potential, the region will need to not just boost its grain output but improve on its key performance indicators, as well as focus on advanced grain processing.

CONCLUSIONS

SFD is Russia's second largest federal district by area and third by population. It is Russia's fourth largest grain producer, contributing to 16% of the nation's total grain production.

The largest grain planting acreages are in Altai Krai, Omsk Oblast, and Novosibirsk Oblast. The least amount of acreage – about 1% – is supplied by the Tuva Republic and the Altai Republic.

In the 25-year period of 1990–2015, the average crop yield across the district ranged between 11.4 and 15.0 dt/ha. In the above period, the greatest grain crop yield was recorded in Krasnoyarsk Krai – 22 dt/ha, and the lowest one in the Tuva Republic and the Republic of Khakassia – 5.8 dt/ha. SFD's average gross grain output ranged between 11,024 and 18,639 thousand tons. The greatest amount of grain is currently produced in Altai Krai, Krasnoyarsk Krai, Novosibirsk Oblast, and Omsk Oblast.

One of the potential areas for boosting the region's gross grain output is seed farming, with a focus on shifting to domestic released varieties with improved characteristics.

Due to natural/climatic factors, a portion of grain farming in the Siberian region is focused on feeding grain, which is used for livestock breeding.

Therefore, it may help to not just focus on boosting the region's crop yield and gross grain output but reconsider the actual crops that are grown. It may be worth growing sought-after crops and high-protein grain legume crops.

If new technology is used, the regions' agro-climatic potential could help increase its crop yield to 22.9 dt/ha and its gross grain output to 22,704.0 thousand tons by the year 2025.

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