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Impact of Agricultural Climatic Potential on Development of Regional Grain Market

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***Abstract*—The Nizhny Novgorod region is one of the leading economically developed areas of the Russian Federation with high potential for the development of agriculture. The purpose of the study is to assess the impact of agricultural climatic features on the development of grain farming in the region. The article includes the official data taken from the Nizhny Novgorod region Territorial body of state statistics concerning indicators characterizing the amounts of grain sales. As a result, the main features of grain sales are revealed within seven agricultural climatic areas – North-Eastern, Central left-bank, Riverine soil protecting, Suburban, Central right-bank, South-Western, South-Eastern. The revealed trend of the market contraction leads to the greater aggravation of competition. At the same time, the withdrawal of less competitive agricultural organizations from the market will lead to a decrease in the food independence of the region.**

Keywords—agricultural climatic area, grain, competitiveness, food security, economic efficiency, efficiency

I. INTRODUCTION

The Russian Federation is a unique country in terms of the agrarian potential. It has more than a half of chernozemic soils, about 1/5 reserves of the world fresh water owns, 9 % of the world arable land. Nevertheless, the availability of such a rich natural resource base, unfortunately, does not allow Russia to take the leading place in world agrarian economy.

The main factor of ensuring food security is creation of competitive agrarian economy. The fact that 8.5 % of gross domestic product and also over 45 % of retail commodity turnover fall to the share of the Russian agrarian and industrial complex also confirms the need of its providing.

In complex economic conditions of the Russian Federation, the control of various economic mechanisms moves to the forefront. The strategic need of development of competitive agriculture demands creation of the accurate system based on understanding of the needs of participants of the market and the state.

The growth of competitiveness of the agricultural organizations which are engaged in production of grain is possible at improvement of the state support, accounting of climatic conditions and a geographical location, recurrence of the production and financial activity, maximizing the return from investments of money, decreasing the monopolization degree in the regional grain market.

The current stage of development of Russia requires the agro-industrial complex to be treated as a strategic industry because it is connected with priority tasks: ensuring the health of the nation and solving social and demographic problems of the state, which is the basis of national economic security [1].

Among all field cultures, grain crops, which main product is grain, have the greatest value for people. They include such crops as wheat, rye, barley, oats, triticale, rice, millet, corn, sorghum and buckwheat.

Grain farming is a strategically important direction of development of national agriculture for most countries, which makes the research related to the economy of the grain industry very relevant nowadays.

Grain crops are cultivated practically everywhere and occupy a principal value for the population across all regions of the globe. Therefore, in the world agriculture, they take the main place due to their unique value and possible use for various purposes. Grain value is determined by the fact that it contains many necessary nutrients for activity – proteins, carbohydrates, fats. Grain crops are necessary not only for people, but they are also widely used in livestock production as the concentrated forage in the form of grain (barley, oats, corn) and bran (grain processing waste). For feeding animals, by-products such as straw and chaff are also used. Grain is also necessary for many industries.

The condition of grain farming and its situation in the world grain market are accepted as key indicators of food security in the world and in each certain country. Also, it is difficult to overestimate the value and the role of grain as goods in the economy of each state. So, for example, Article 1 of the federal law "About Grain" accurately says: "Grain is a national property of the Russian Federation, one of the major factors of the stability of its economy."

Increasing of the grain production will allow one to solve the problem of security of the population with necessary food, to increase efficiency of livestock production and to create strategic state food reserves. The following factors promote an increase in grain production: use of the high-performance equipment, application of the necessary amount of mineral and organic fertilizers, use of pesticides. In total, all these factors will allow one to increase production of grain crops, in particular, such necessary ones as wheat of firm and strong grades and buckwheat.

Meanwhile, the grain market largely determines the solutions of a whole range of development issues at the level of the national economy because it occupies one of the first places in terms of trade turnover and money assets among the food markets [2].

The conception of the mid-term development of the grain market in Russia of the Russian grain union specifies that the grain production has been historically a basis of steady functioning of the national agrofood sector, is backbone for other branches of the national economy, determines the level of food security of the population and serves as a peculiar indicator of economic wellbeing of the state. A strategic objective of the development of the grain market in the Russian Federation is the most effective use of natural potential, steady ensuring of internal needs for food and fodder grain, strengthening of positions of Russia in the world agrofood market on the basis of formation of the effective market of grain.

Ensuring of the dynamic development of the grain market in the Russian Federation is accompanied by a number of risks. The Russian grain union marks out macroeconomic, tactical, climatic, technological, agroenvironmental, trade and economic and political hazards.

The production of grain in the Russian Federation is much higher than its consumption, and such positive dynamics stimulate the development of other directions of production ensuring of food security such as livestock production, deep processing of raw materials. However, this also leads to the imbalance on the regional grain markets.

Grain crops are cultivated almost everywhere and are very important for the population of the globe, so they are in the first place in world agriculture because of their unique value and possible use for various purposes.

The efficiency of grain farming largely depends on the state of livestock farming and the basic domestic food products supply of the population [3]. Increasing grain production is possible in two ways – expansion of acreage and increase in yield [4].

An important competitive advantage for agricultural organizations engaged in the production of grain is the availability of agricultural climatic resources which has a significant impact on the stability of the regional grain market.

Many agricultural economists paid attention to the peculiarities of grain economy and its instability. P. Zander, T. S. Math-Baby, S. Preissel [5] reviewed the grain production in Europe. G. Duc, H. Agrama, S. Bao [6] studied the conditions of the grain production transformation to stabilize agriculture. F. Mahmood, H. Belhouchette, W. Nasim [7] simulated the impact of grain production on the economy of the macro region of the country. A. I. Altuhov [8] showed in his study the impact of grain production on food security. N. Y. Kovalenko [9], I. A. Minakov [10] and I. S. Sandu [11] studied the economic efficiency of grain production and sales.

The purpose of the study is to assess the impact of agricultural climatic features on the grain farming development in the region. Grain production is subject to strong influence of natural and climatic factors, like the production of any other agricultural product.

II. METHODS

The study uses the data on the amount of grain sales in the Nizhny Novgorod region over the recent 5 years. The territorial coverage of the study includes grain producers in the Nizhny Novgorod region in the context of agricultural climatic areas and their municipalities. The sources of analytical materials for the calculations are the data of the Nizhny Novgorod region Territorial body of state statistics.

Agricultural organizations are the main productive force in the grain subsector in the Nizhny Novgorod region. In 2016, they produced nearly 90 % of all the regional gross collection. The forming conditions in the production and selling of grain of the agricultural organizations require ensuring their competitiveness as the grain subsector is a basis to all agrarian and industrial complex. This determines the need of studying such a competitive advantage as a territorial feature. For this purpose, we will consider selling of grain by the agricultural organizations in a section of an agroclimatic area of the Nizhny Novgorod region. Therefore, the object of the study is directly agricultural organizations as the main productive force of grain in the region.

Also, more than 300 grain producers in the region were examined and a number of statistical indicators were collected. The necessary indicators in the study are the following: the total

amount of grain sales, grain sales per agricultural organization, the number of agricultural organizations engaged in grain production, the share of agricultural organizations in the total amount of grain sales.

III. Results and Discussion

Crop production has always depended on weather conditions and natural features of the territory. Advantageous natural and climatic conditions are important in the formation of effective grain production. They also can be considered as a serious competitive benefit in this economic sphere. Agricultural climatic differences among the regions are more clearly seen in the areas extending from North to South. The southern regions have a higher humus content in soils, which contributes to high yields. Equalization of natural and climatic discrepancies within the Russian Federation territories is possible only with the improvement of technologies used for grain crops cultivation and application of appropriate technical equipment.

Agricultural zones are the natural basis of zonal specialization of agricultural production and have a great influence on its efficiency, including the efficiency of grain production. Therefore, agricultural zoning is based on natural and economic zoning. In addition, agricultural zoning takes into account differences in economic conditions [12].

The main feature of the climate in the Volga region is the instability of weather conditions which significantly reduces its agricultural potential. Therefore, an increased attention has always been paid to the study and evaluation of this phenomenon [13]. The Volga Federal district has a significant impact on providing the Russian Federation with grain and products of its processing. It forms almost a quarter of its national gross harvest – 22.6 %. It is located in the Central and Eastern part of European Russia and consists of 14 subjects of the Federation: Republic of Bashkortostan, Republic of Mari El, Republic of Mordovia, Republic of Tatarstan, Udmurt Republic, Chuvash Republic, Perm region, Kirov region, Nizhny Novgorod region, Orenburg region, Penza region, Samara region, Saratov region, Ulyanovsk region.

According to the principles of the All-Russian Central Executive Committee III session regarding the state planning, N. N. Kolosovsky believes that an area should be allocated on the economically complete territory which would be one of the links in the overall chain of the national economy (thanks to natural features, cultural heritage of the past population as for preparing for production activities) [14].

For qualitative assessment of the agricultural climatic conditions impact on areas such as the Nizhny Novgorod region, there is a need to divide it into areas similar in natural and climatic characteristics. It will allow us to distinguish more clearly the contrast of market differences in the region. This approach was suggested already in the Soviet Union.

The authors identified the agricultural climatic areas being “granaries” of the Nizhny Novgorod region taking into consideration the existing agricultural climatic features. The authors also revealed those producing little grain for various reasons. Assessment of the agricultural climatic areas division in the Nizhny Novgorod region (both in terms of grain sales and per agricultural organization in average) will determine the contribution of agricultural areas to the regional grain market expansion.

The Nizhny Novgorod region is the region in which production of both crop production and livestock production is equally developed. However, it should be noted that in the structure of revenue of separate types of products of agricultural production, the total sales proceeds from sales of the products of the livestock production are 77.5 %, whereas the crop production account for only 22.5 %.

This ratio is a result of the fact that the Nizhny Novgorod region is in a zone of high-risk agriculture. The southern and southeast municipal districts of the region have advantage in relation to the others in production of crop production. This geographical division is caused by the fact that the northern border of the Russian chernozemic soils passes across their territories. The left-bank low part of the region is generally covered with the woods and has arable lands, small in relation to the Right bank, that complicates growing up the main crops for realization. These natural factors also had a decisive impact on the placement of the agricultural organizations and formation of proceeds from sales of separate types of products of agricultural production in total sales of the agricultural organizations in the Nizhny Novgorod region.

In the Nizhny Novgorod region there are seven agricultural climatic areas – North-Eastern (I), Central left-bank (II), Riverine soil protecting (III), Suburban (IV), Central right-bank (V), South-Western (VI), South-Eastern (VII).

The North-Eastern (I) and Central left-bank (II) areas are colder than others because of their geographical location. The North-Eastern (I) agricultural climatic area includes Vetluga, Tonkino, Tonshaevo Sharanga, Uren and Shakhunya districts. Varnavino, Voskresenskoye, Gorodets, Kovernino, Krasnye Baki, Semenov, Sokolskoye and Chkalovsk districts are in the Central left-bank (II) area.

The suburban (IV) agricultural climatic area is located near the major industrial cities of the Nizhny Novgorod region. The suburban (IV) agricultural climatic area includes the territory of Arzamas, Balakhna, Bogorodsk, Bolshoye Murashkino, Bor, Volodarsk, Dalneye Konstantinovo, Dzerzhinsk and Kstovo districts.

The main problems in the Central right-bank (V) agricultural climatic area are a high degree of soil contamination and water scarcity in summer. This area consists of Buturlino, Vad, Diveevo, Knyaginino, Lukoyanov, Perevoz and Shatki districts.

The South-Eastern (VII) agricultural climatic area can rightly be considered as the granary of the Nizhny Novgorod region. It provides most of the gross grain harvest in comparison to other agricultural climatic areas and includes most of the major grain producers of the market. The South-Western (VI) agricultural climatic area includes Ardatov, Voznesenskoe, Vyksa, Kulebaki, Navashino, Pervomaisk and Sosnovskoe districts. The South-Eastern (VII) agricultural climatic area consists of Bolshoye Boldino, Gagino,

Krasnooktyabskiy, Pilna, Pochinki, Sergach, Sechenovo and Spasskoye districts.

In 2016, an average of 14501.7 C was sold per agricultural organization of the Nizhny Novgorod region, which is almost a third higher than in 2012 (Table I).

TABLE I. DIVISION OF AGRICULTURAL CLIMATIC AREAS OF THE NIZHNY NOVGOROD REGION ACCORDING TO THE AMOUNT OF GRAIN SALES IN 2016

Agricultural climatic area	**Amount of grain sales**	
	Total amount of grain sales, C	***Average grain sales amount per agricultural organization, C***
North-Eastern (I)	60483	1234.3
Central left-bank (II)	233119	5067.8
Riverine soil protecting (III)	456767	14734.4
Suburban (IV)	948658	14594.7
Central right-bank (V)	1494823	24505.3
South-Western (VI)	266938	14829.9
South-Eastern (VII)	1890340	19094.3
Total	5351128	14501.7

A similar growth trend is observed in all agricultural climatic areas except the North-Eastern one. The halving in the sales amounts in the North-Eastern agricultural climatic area was primarily caused by the withdrawal of the most competitive organizations from the grain market (Fig. 1).

The total amount of grain sales in the South-Western agricultural climatic area increased more than twice, where an average amount per organization is 14829.9 C. The total amount of sales of almost all right-bank area of the Nizhny Novgorod region increased by more than 6 % for the presented period of time, which made a significant contribution to the expansion of the regional grain market.

Next, it is necessary to assess the degree of presence of agricultural organizations in the regional grain market, which will allow evaluating the competition aggravation between grain producers in the Nizhny Novgorod region. To solve this problem, it is necessary to determine the share of agricultural organizations in the total amount of grain sales within agricultural climatic areas, as well as to trace those areas with the largest withdrawal from the grain market in the Nizhny Novgorod region.

Considering the share of agricultural climatic areas in the total amount of sales, we can see the dominant position of the South-Eastern area in the regional grain market (35.3 % of the total sales), but over the past five years its presence is slightly reduced (Table II).

It should also be noted that in this agricultural climatic area, 25 agricultural organizations engaged in the production and sales of grain, left the market and were liquidated during the study period due to acute competition. In 2016, agricultural organizations of other agricultural climatic areas significantly increased their presence in the regional grain market, with the exception of the North-Eastern, Central left-bank and South-Eastern areas (Fig. 2).

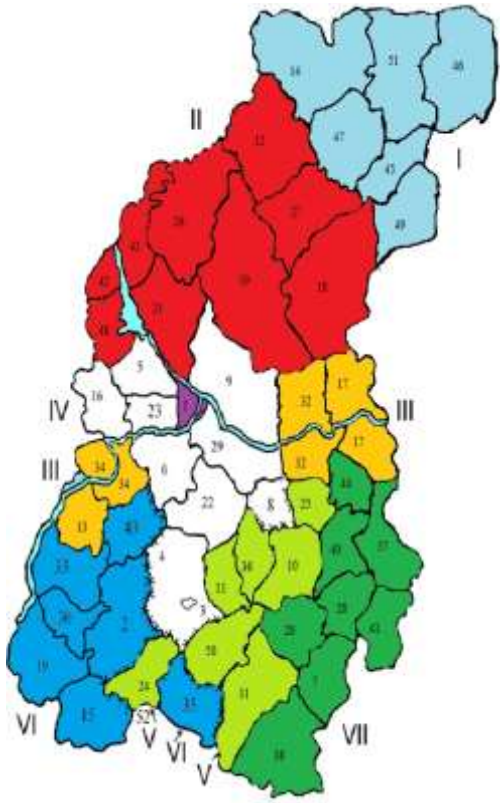

Fig. 1. Division of agricultural climatic areas according to their agricultural organizations withdrawal from the grain market.

TABLE II. SHARE OF AGRICULTURAL CLIMATIC AREAS OF THE NIZHNY NOVGOROD REGION IN THE TOTAL AMOUNT OF GRAIN SALES MADE BY AGRICULTURAL ORGANIZATIONS

Agricultural climatic area	**The share of agricultural climatic areas of the Nizhny Novgorod region in the total amount of grain sales**	
	Number of agricultural organizations	***The share of agricultural organizations in the total amount of grain sales, %***
North-Eastern (I)	49	1.1
Central left-bank (II)	46	4.4
Riverine soil protecting (III)	31	8.5
Suburban (IV)	65	17.7
Central right-bank (V)	61	27.9
South-Western (VI)	18	5.0
South-Eastern (VII)	99	35.3
Total	369	100

The specialization in the livestock industry has a great influence on the reduction of the shares of the North-Eastern and Central left-bank agricultural climatic areas. The minimal withdrawal of agricultural organizations from the grain market is observed in the Suburban agricultural climatic area.

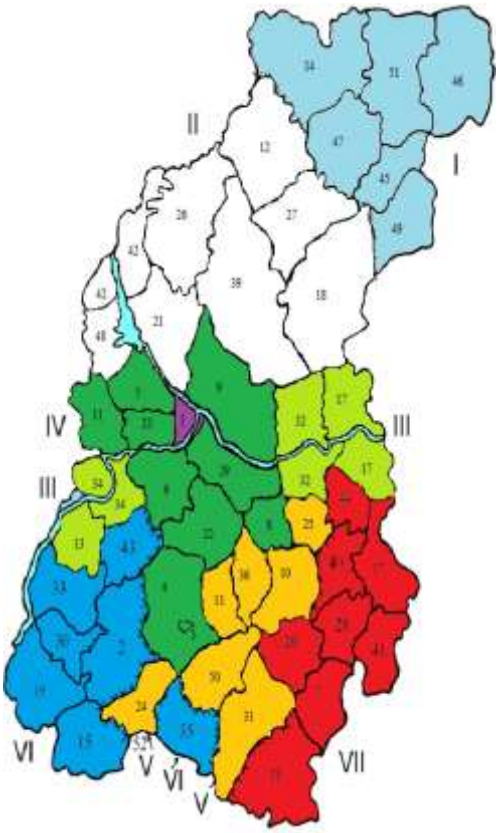

Fig. 2. Division of agricultural climatic areas according to the share in the total amount of grain sales by agricultural organzations.

IV. Conclusion

To sum up, it should be noted that the climatic differences of individual territories in agriculture have a significant impact on the development of markets in the region, including grain.

The study of the competitive environment of the grain market of the Nizhny Novgorod region confirmed the idea that different agricultural markets are characterized by certain features of both perfect competition and monopoly. Moreover, the model features of monopolistic competition are manifested in certain market segments.

An important element of improving economic efficiency (in agricultural organizations and in particular individual grain producers) is not only the ability to retain and increase market shares and to meet the consumer demand at a favorable price, but also an effective economic activity expressed in receiving profit and an acceptable level of profitability of production and sale of goods.

Currently, the Russian grain industry has reached such a level of production, when it is practically possible to ensure the gross harvest of grain crops in the amount of up to 100 million tons per year. The scale of grain production highlights the issues of the grain market monitoring and regulation and accurate assessment of the potential demand for grain [15].

Also, an important direction to achieve high results in the production of grain is the further improvement and introduction of modern technologies of crops cultivation [16].

Having carried out the analysis of the current state of grain farm in the Nizhny Novgorod region, it is possible to draw the following conclusions:

1) the region is in a zone of risky agriculture that is shown in unstable harvests which complicate the formation of food independence of the region;

2) the market of grain in the region is unstable which is confirmed by the high number of the liquidated agricultural organizations.

In the developed economic situation, the state has to become one of the guarantors in ensuring of competitiveness and increase in cost efficiency of domestic producers and in particular, the industries strategically important for survival. The grain subsector serves as a basis of all the agro-industrial complex of the Russian Federation. One of the main ways of ensuring of competitiveness of grain producers is effective state support.

The introduction of technologies to neutralize the impact of agricultural climatic conditions on grain production in the region should be considered one of the priorities of the grain sector in the Nizhny Novgorod region.

The trend of the market contraction leads to an even greater aggravation of competition. At the same time, the withdrawal of less competitive agricultural organizations from the market will lead to a decrease in the food independence of the region. Therefore, the government of the Nizhny Novgorod region should monitor the economic efficiency of individual organizations economic activities and develop measures to ensure their survival in the market.

References

[1] A. V. Gorbatov and O. A. Krioshina, “Production and export of the Russian grain in the system of ensuring food security,” Management of economic systems: online scientific magazine, No. 10, pp. 37, 2018.

[2] V. A. Fishchenko, “Stavropol territory: grain, prices, problems research of market condition of grain of Stavropol Krai,” Russian business, No. 7-1, pp. 179-184, 2010.

[3] N. G. Tuktarova, “Production grains of winter grain crops in the Udmurt Republic,” News of the Orenburg state agricultural university, No. 3, pp. 24-26, 2017.

[4] A. Sizov, “Production of grain in Russia. What to wait to processors of grain for?” Bakery products, No. 12, pp. 10-11, 2011.

[5] P. Zander, T. S. Amjath-Babu and S. Preissel, “Grain legume decline and potential recovery in European agriculture: a review,” Agronomy for sustainable development, vol. 36, No. 2, pp. 26, 2016.

[6] G. Duc et al., “Breeding Annual Grain Legumes for Sustainable Agriculture: New Methods to Approach Complex Traits and Target New Cultivar Ideotypes,” Critical reviews in plant sciences, vol. 34, No. 1-3, pp. 381-411, 2015.

[7] F. Mahmood et al., “Economic and environmental impacts of introducing grain legumes in farming systems of Midi-Pyrenees region (France): A simulation approach,” International journal of plant production, vol. 1, No. 1, pp. 65-88, 2017.

[8] A. I. Altuhov, “Grain farm and food security of Russia,” Agrarian and industrial complex: Economy, management, vol. 1, pp. 3–12, 2009.

[9] N. Y. Kovalenko, "Rural economics: the textbook for students of higher educational institutions," Moscow: Yurkniga, 2004.

[10] I. A. Minakov, "Economy of branches of agrarian and industrial complex," Moscow: Koloss, 2004.

[11] I. S. Sandu, "Efficiency of agricultural production (methodical recommendations): Collective monograph," Moscow: Vniiesh, 2005.

[12] R. U. Gusmanov and S. S. Nizomov, "Grain production in agricultural zones of the Republic of Bashkortostan," Nikonovsky readings, No. 8, pp. 126-129, 2015.

[13] N. G. Levitskaya, O. V. Shatalova and G. F. Ivanova, "Droughts to the Volga region and their influence on production of grain," Agrarian bulletin of the Southeast, No. 3-4, pp. 71-74, 2010.

[14] N. N. Kolosovsky, "To a question of economic division into districts," Spatial economics, No. 1, pp. 102-123, 2009.

[15] A. V. Ovchinnikov, "Grain production: growth potential," Rural economics of Russia, No. 6, pp. 37-42, 2011.

[16] M. A. Taranov, "Resource-saving production technologies of grain in the conditions of insufficient moistening in the territory of the Rostov Region," Herald of agrarian science of Don, No. 1, pp. 15-25, 2011.