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The Factors Determining Profitability of Grain Production in a Region

Vorobyov Sergei
Department of Economic Theory (of Affiliation)
Altai State University
Barnaul, Russian Federation
servsp@mail.ru

Vorobyova Viktoria
Department of Finance and Credit
Altai State University
Barnaul, Russian Federation
vvvtoria@mail.ru

Shmakov Artem
Department of psychology and management sociology
The Altai Branch of the Russian Academy of National Economy and State Service Under the President of the Russian Federation
Barnaul, Russian Federation
art.schmakow@gmail.com

***Abstract*—The research was conducted in order to determine influence of structural factors on profitability of grain production in the Altai Region, which is one of the main producers of grain in Russia. The influence of specialization and placement on the economic efficiency of grain production in the Altai Region was determined, factors for the formation of financial results and the financial condition of grain-type organizations were revealed. Comparison of agricultural organizations for which grain farming was the main production sector indicates that in case of increase in the cultivation area, the economic efficiency of resource use will be increased, despite higher costs per hectare of grain crops. The variation of organizations in the profitability of production is explained by the imperfection of the management system of the main branches in separate agricultural organizations, including non-optimal production volumes and placement in natural and economic zones. In the largest highly tailored organizations the economic efficiency of the resources used increased in the short-term perspective rose, but risks of its decline are created in the long-term period.**

Keywords – Specialization, grain crops, economies of scale, financial results, Altai Region.

Introduction.

Specialization, production location, production scale, combination of industries, the structure of cultivation areas, the system of crop rotation and other elements of the organization of the production process are interrelated and determine the reserves for improving the economic efficiency of grain production, since they directly determine the productivity of grain crops, laboriousness and production prime cost per unit of output.

Grain field husbandry for the Altai Region is one of the main branches of agricultural production. In the area of grain and leguminous crops the region from 1990 to 2017 always took 1st place in Russia (3393.6-3998.0 thousand hectares for all categories of agricultural producers or 6.34-8.33% of the total cultivation area in a whole of the Russian Federation). The Altai Region is represented by eight natural and economic zones, which differ significantly in climatic conditions, soil quality, agricultural land structure, provision with material and technical resources and labour. Wheat is sown mainly in the western and central parts of the Altai Region, barley – in southern part, buckwheat – in southeast.

The purpose of the study was to determine the influence of the structure of grain production, the specialization of enterprises and their territorial location on the economic efficiency of cultivating of grain crops in the Altai Region. For this purpose an assessment of the efficiency of grain production in agricultural enterprises was made, taking into account their location in the natural and economic zones. A comparison was made between the efficiency of grain-type enterprises with different degrees of specialization.

There is no consensus among economists about the essence of economic efficiency. So, according to Campbell R. McConnell, Stanley L. Brue, economic efficiency affects the problem of "input-output": "… economic efficiency means obtaining a particular output of product with the least input of scarce resources, when both output and resource inputs are measured in dollars and cents" [1]. V.A. Dobrynin defines economic efficiency as "... the ultimate beneficial effect from the use of means of production and live labor, the return of aggregate investments", K.P. Obolensky – as "... acquisition of the maximum amount of agricultural production required by society from every hectare of land, with the least expenditure of social labor – live and materialized – for the production of a unit of production" [2], [3]. However, from our point of view, this method of determining of economic efficiency can be used at the level of the country, region, but at the micro level it is inapplicable. A. Shafronov considers efficiency as "... the ratio of the actual gross income (profit) of the enterprise to the unit of reduced costs (or simply incurred costs) to their planned level", as well as "the degree of utilization of the production potential of the enterprise" [4]. The disadvantage of this approach is difficulty in determining of the production potential of an enterprise in conditions of market situation instability and uncertainty, of assessing the economic efficiency of enterprises characterized by different in terms of

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production and bioclimatic potential, and the level of resource endowment. In addition, in conditions when the planned indicators at the enterprise level have weak economic justification, it is hardly possible to express the efficiency of production by comparing actual and planned results. However, in conditions of the improvement of economic services' organization and the increase of the validity of plans, the use of this approach at practice is quite acceptable. Thus, the general indicator of economic efficiency in agriculture is the level of profitability of production. A number of scientists propose to determine it as a ratio of profits from the sale of products and its full cost price.

When assessing the influence of the size of a grain-type farm in various countries on the productivity of labor, Sheng Yu., Wang X., Chen Yu., Sui P., Yan P., Yang X., Gao W., Key N., Osaki M., Batalha M.O. revealed that, on the one hand, the profitability of sales of medium and large farms in agriculture is lower than in small farms, but growing production increases the income of agricultural producers [5] – [8]. On the other hand, it is noted that in larger farms there are reserves of increasing both the economic and ecological efficiency of grain production, while in organizations with small production volumes these reserves are exhausted. In addition, when comparing enterprises of different production types, it is noted that grain specialization farms are characterized by lower profitability than farms whose activities are related to the production of livestock products [9].

Materials and methods.

The theoretical and methodological basis of the research was the scientific research of Russian and foreign scientists in the field of identifying factors and assessing their impact on the economic efficiency of agricultural production. In the process of research general scientific (scientific abstraction, inductive, deductive, comparative analysis) and special sub-approaches were used. Special methods: comparison, monographic, balance, normative, economic-statistical (statistical sampling, economic grouping, calculation of statistical indicators, including average, absolute and relative values). To analyze the statistical data, the Microsoft Office software package was used.

Rosstat and its territorial bodies, data of the Ministry of Agriculture of the Altai Region were the sources of statistical information. Data from the online edition "System of Professional Analysis of the Market and Companies (SPARK)", the global reference system for Russian legal entities and entrepreneurs "Rusprofile.ru", the network edition "Center for Disclosure of Corporate Information" were sources of statistical information about the financial and economic activities of agricultural enterprises.

When constructing of analytical (factorial) statistical groupings, in account was taken the typicality in the creation of groups, the sufficiency of units in individual groups, the need to distribute units into groups in accordance with the law of normal distribution.

The grouping of enterprises on the basis of influence of the productivity of grain crops on the financial and economic indicators of enterprises of the grain type was carried out according to the hydrothermal coefficient of the Altai Region territories, which was settled by the climatologist G.T. Selyaninov and shows the level of moisture supply or moisture insufficiency of the territory. As a basis for determining the hydrothermal coefficient, the ratio of the amount of precipitation during the growing season to the sum of temperatures above 10 ° C, reduced in 10 times, is taken.

The direction of activity of organizations was determined by the structure of commodity output of agricultural enterprises of the Altai Region. There were identified 30 production types of enterprises, the grain type is the most numerous among them. The following division of organizations into three groups was taken for classification: *highly specialized* with a specific weight of one type of production of not less than 50.0% of revenue; *specialized* enterprises, in which each of the two industries occupies 33.3-50.0%, or each of the three industries occupies 25.1-33.3%; *non-specialized* (multisectoral) farms with four or more branches with a specific weight of incomes less than 25.1%.

Results and discussion.

Altai Region according to the hydrothermal coefficient (hereinafter – HTC), which reflects the ratio of the sum of active temperatures to the sum of precipitation for a certain period, is represented by eight natural and economic zones with an HTC of 0.6 (insufficient humidification) to 1.2 (optimum hydration) and 1.6 (excessive moistening). The production of grain of various crops is represented in all natural and climatic zones with varying degrees of concentration. More than 84.5% of wheat is sown in the western and central parts of the Altai Region, buckwheat prevails in the southern and southwestern part of the region, barley is grown almost evenly.

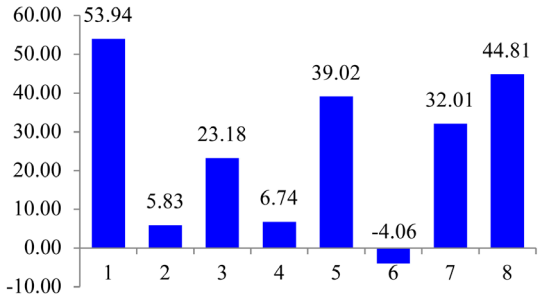
According to the planting acreage of grain and leguminous crops, the region in 1990-2017 has always occupied the first place in Russia (3393.6-3998.0 thousand hectares or 6.34-8.33% of the total planting acreage in Russia as a whole). The main grain producers in the region in 2016-2017. were agricultural enterprises receiving 2.88-3.00 million tons of grain or 60.3-61.4% of the total gross harvest, as well as peasant (farm) enterprises – 1.86-1.90 million tons or 38.6-39.7%, respectively (for the majority of farms grain specialization is decisive, especially in the steppe and forest-steppe parts of the region).

In the structure of sales of grain and leguminous crops in 2016-2017 wheat grain prevailed (63.5-65.9%), buckwheat was 10.3-11.9%, oats was 8.2-8.9%, which indicates a lack of diversification of grain production, a significant effect on the profitability of products of price volatility of wheat and oats. The share of production of highly profitable crops – millet, maize, peas – is insignificant and in total does not exceed 4.0-6.1% (Table 1).

TABLE 1.
THE STRUCTURE OF SALES AND PROFITABILITY OF GRAIN PRODUCTION IN AGRICULTURAL ENTERPRISES OF THE ALTAI REGION, %

Grain and leguminous crops	Share in the structure of the volume of sold grain, %				Level of profitability of grain production, %			
	2010	*2015*	*2016*	*2017*	*2010*	*2015*	*2016*	*2017*
Wheat	70,5	61,3	65,9	63,5	19,9	37,6	32,2	15,3
Rye	3,9	2,5	2,2	1,7	-20,5	35,6	29,6	6,7
Millet	0,6	0,7	0,6	1,0	56,0	67,2	44,4	7,7
Buckwheat	4,9	8,9	10,3	11,9	169,1	91,6	130,3	35,9
Corn	0,0	0,1	0,2	0,4	-6,4	45,3	78,4	46,9
Barley	6,7	9,9	7,9	7,9	31,7	30,0	25,2	2,2
Peas	3,7	3,0	3,2	4,7	47,0	57,3	66,4	32,6
Oats	8,4	12,1	8,2	8,9	11,1	2,0	31,8	18,1
Other grain and leguminous crops	1,3	1,6	1,7	-	8,5	67,5	125,3	x
Average	x	x	x	x	33,2	42,4	49,4	15,3

The financial results for the whole agricultural sector of the region depend significantly on the situation in the grain market, since in the structure of agricultural enterprises of the Altai Region in 2013-2017 grain-type organizations prevailed (up to 58.9% of the total number of enterprises) with a share of revenues from grain sales exceeding 50.0%. The level of profitability of production in the group was from 20.9% to 53.9% (Figure 1), however 17.9-21.8% of grain specialized organizations were unprofitable.



1 – grain field crop cultivation; 2 – grain field crop cultivation, dairy cattle breeding; 3 – dairy cattle breeding, grain field crop cultivation; 4 – grain field crop cultivation, growing and fattening of cattle; 5 – growing and fatteningof cattle, grain field crop cultivation; 6 – grain field crop cultivation, cultivation of sunflower for oilseeds; 7 – cultivation of sunflower for oilseeds, grain field crop cultivation; 8 – grain field crop cultivation, dairy cattle breeding, cultivation of sunflower for oilseeds

Fig. 1. The level of profitability of production in agricultural enterprises, depending on the combination of grain field crop cultivation with other industries (Altai Region, 2016), %

The profitability of the production of grain as a whole is determined by the total volume, structure, specific prime cost of grain and selling price, which in turn depend on the system of regulated (the system of farming and industry, management functions, etc.) and unregulated (price conjuncture, state regulation of agro-industrial production, etc.) factors. For the period of 2010-2016 the level of profitability of grain production increased from 33.2% to 49.4% or 16.2 percentage points due to the positive impact of sales prices and the total amount of production that, in terms of aggregate influence, exceeded somewhat the negative influence of the grain sales structure (if in 2016 only the structure of sold grain had changed, and its total quantity, prices and prime cost had remained at the level of 2010, the profitability would have decreased by 6.4 percentage points) and its unit cost. In 2017, the profitability of grain production decreased from 49.4% to 15.3%, or by 34.1 percentage points, mainly due to a decrease in prices (if in 2017 only the prices of sold grain had changed but the total quantity, structure and the cost price remained at the level of 2016, then the profitability would have decreased by 40.1 percentage points), as the change in structure and unit cost positively influenced on the change in profitability. The decrease in prices was observed on average for all grain crops: for wheat, rye, barley, peas, oats – in 1.12-1.19 times, for mais and buckwheat – in 1.73 and 2.09 times respectively.

At the same time, agricultural producers are not materially motivated to improve the quality of grain. The profitability of wheat production of grades 1 and 2 at the level of 19.7% was significantly lower than the profitability of food and feed grain (31.9-32.9% in 2016), as a result, the share of strong wheat in the structure of sales in 2016 did not exceed 1.5%. In 2017, the price of wheat below grade 3 significantly decreased compared to 2016, as a result, for the first time in many years, the profitability of high-quality grain was higher than the profitability of lower-quality grain (Table 2).

TABLE 2. THE LEVEL OF PROFITABILITY OF WHEAT PRODUCTION IN AGRICULTURAL ENTERPRISES OF THE ALTAI REGION BY ITS QUALITY GRADES, %

Quality grades of wheat	Price per 1 t., Rub.			Structure of sale, %			Level of production profitability, %		
	2010	*2016*	*2017*	*2010*	*2016*	*2017*	*2010*	*2016*	*2017*
1st and 2nd grades	4021	7847	7915	2,3	1,5	1,7	29,9	19,7	22,6
3rd grade	4393	9037	6775	35,1	43,7	70,7	37,5	31,9	9,7
4th grade	3585	8527		62,6	54,9		9,9	32,9	
Lower than 4th grade	-	-	6963	-	-	27,5	-	-	9,9
Average	3878	8733	6846	x	x	x	19,9	32,2	10,0

Similar trends are observed in Russia as a whole. As A.I. Altukhov notes "the share of 1st and 2nd grades in the total volume of grain sales ... does not exceed 2%, and the 3rdclass varies between 19-22% [10]. Quality is also changing due to the "inconsistency" of the economic interests of individual ... participants in the grain market, the absence of a clear policy of pricing for high-quality wheat." In these conditions many scientists suggest improving the price measures of state regulation for wheat of the 1st and 2nd grades by establishing minimum guaranteed prices with a profitability of at least 25.0% and compensatory payment when the market prices fall below the normative ones, providing a break-even management [11], [12].

Our economic evaluation of the location of grain field crop cultivation testifies to its profitability in all the natural and economic zones of the Altai Region: in 2016 the level of profitability of grain production varied on average from 27.5% to 78.1% (in 2017 from 9.5% to 26.5%), including wheat from 21.2% to 42.0% (in 2017 from 7.6% to 13.3%), buckwheat from 101, 2% to 159.1% (in 2017 from 18.1% to 62.4%) (Table 3). The economic evaluation of the effectiveness of the location of grain field crop cultivation on the level of profitability indicates the presence of competitive advantages in the development of grain production in natural economic zones with a higher hydrothermal coefficient (the acreage of buckwheat is concentrated there).

TABLE 3. THE LEVEL OF PROFITABILITY OF GRAIN PRODUCTION ACCORDING TO THE NATURAL AND ECONOMIC ZONES OF THE ALTAI REGION, %

Grain crops	**Year**	**Hydrothermal Coefficient***						
		0,6	***0,7***	***0,8***	***0,9***	***1,0***	***1,1***	***1,2 and more***
Wheat	2016	28,5	37,0	34,8	21,2	27,3	32,6	42,0
	2017	10,1	7,6	9,8	13,3	11,8	11,3	9,3
Buckwheat	2016	130,5	100,3	124,1	101,2	138,2	113,8	159,1
	2017	62,4	31,5	32,1	19,2	18,1	27,7	50,9
On average for all cereals and legumes	2015	23,9	41,6	35	31,5	42,3	53,8	60,4
	2016	34,5	41,1	45,8	27,5	50,6	61,1	78,1
	2017	17,2	9,5	12,7	12,5	15,0	15,8	26,5

* at HTC less than 0.5 humidification is weak, less than 1.0 – insufficient, from 1.0 to 1.5 – optimal, over 1.6 – excessive.

At the same time, the change in the productivity of grain crops is the determining factor in the cost-effective cultivation of these crops. So, in 2017, with a productivity of more than 25 c/ha (32 organizations), the average profitability of grain production was 38.3%, with a productivity of 12-25 c/ha (344 organizations), ranging from 8.0% up to 19.6%, with productivity below 10 centners per hectare (195 organizations) was negative (returns on investment did not exceed 91.1-97.1% (Table 3.) The change in the productivity of grain crops also determines laboriousness of grain production (the dependence is inversely proportional).

TABLE 4. CORRELATION OF PRODUCTIVITY OF GRAIN CROPS AND PROFITABILITY OF GRAIN PRODUCTION IN THE ALTAI REGION

Productivity, c/ha	**Number of organizations in the group, pcs.**		**Production expenditures, Rub./ha**			**Level of production profitability, %**		
	2015	***2017***	***2015***	***2016***	***2017***	***2015***	***2016***	***2017***
Less than 5	62	16	3513	4271	3981	-7,9	31,0	-8,9
From 5 до 10	297	179	5114	5445	5079	31,2	28,6	-2,9
From 10 to 12	139	124	7202	6974	6900	39,2	39,5	9,4
From 12 to 15	137	160	8505	8264	7852	45,3	46,5	8,0
From 15 to 20	90	135	10466	10396	11094	43,7	52,2	19,6
From 20 to 25	20	49	13637	14643	15465	61,8	54,2	11,5
More than 25	11	32	16349	17431	16453	88,6	89,7	38,3

The economic efficiency of specialization in grain field cultivation is influenced not only by the location of grain production, but also by the level of concentration of production. The conducted research testifies the achievement in specialized enterprises the optimal structure for the use of arable land with significantly higher productivity than on the average in the region or in non-specialized enterprises [13]. Increase in the size of production in grain field crop cultivation in 2013-2017 allowed to reduce laboriousness of the goods produced, and to raise the level of its profitability (Table 5).

TABLE 5. THE INFLUENCE OF THE SPECIALIZATION LEVEL ON THE ECONOMIC EFFICIENCY OF THE USE OF RESOURCES IN GRAIN FIELDING, 2017

Groups of farms with share of grain in the structure of commercial output, %	**Production laboriousness, man hours**		**The level of profitability of grain production, %**
	for 1 ha of crops	***for 1 c of grain***	
Up to 25,1**	7,0	0,49	11,0
Up to 33,3**	5,6	0,38	2,6
Up to 50,0**	5,5	0,38	15,3
including 10 of the smallest	8,6	0,68	26,9
the rest	6,0	0,44	16,3
10 of the biggest	4,1	0,27	12,2
More than 50,0**	6,6	0,46	19,7
including 10 of the smallest	11,0	1,25	4,3
the rest	6,8	0,49	15,2
10 of the biggest	4,8	0,27	50,4
Average	6,4	0,45	15,4

The use of scientifically grounded and regionally adapted systems for the cultivation of grain crops facilitated the production of higher productivity. In 2016-2017 in the Altai Region, taking into account the conditions of each of the natural and economic zones, the introduction of resource-saving technologies continued, the main elements of which were technical and technological modernization in the organization of production processes, the use of high-productive varieties and hybrids, and a plant protection system. The organization of innovative processes in the production of crops was carried out on an area of more than 3.8 million hectares, including strip-till technology – 15.0 thousand hectares, no-till technology – 350.0 thousand hectares. The application of these technologies allowed OOO KH "Partner" of the Mikhailovskiy District (HTC is at the level of 0.6, which indicates a lack of humidification of the territory) to obtain productivity of spring crops of 18.3 centners per hectare, and for OOO "AF Goodwill" of the Sovietskiy District to reach the productivity of winter wheat on the level of 64-80 c/ha in 2016.

Conclusions.

The conducted research allowed to identify the main patterns of changes in the profitability of grain production in the Altai Region under the influence of structural factors, mainly related to price volatility in the market. Grain crops of various types were unevenly distributed across the natural and economic zones of the region: wheat prevailed in steppe and forest-steppe territories, buckwheat – in more wetted areas. This fact directly affected the change in the yield of grain crops and indirectly on the profitability of their cultivation: when the grain yield was higher 25 hwt/ha, the profitability of grain production was 38.3%, with a yield of 12–25 hwt/ha –8.0–19.6%, with a yield below 10 hwt/ha was negative. The deepening of specialization with an increase in the size of production raised the efficiency of the used resources, despite the higher material and cash costs per hectare of grain crops. These farms had the maximum profitability of the products produced (50.4%). It allowed them to continue carrying out expanded reproduction on an innovative basis. A further increase in the size of production in such organizations is inexpedient, since it creates the risks of breaking the systems of crop rotation and reducing the yield of grain crops. In non-specialized enterprises labor costs per hectare of sowing were significantly higher than the average costs – it was determined by the use of labor-intensive technologies.

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