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**FACTORS OF GROWTH OF EFFICIENCY OF GRAIN  
PRODUCTION IN THE NIZHNY NOVGOROD**

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***Abstract***

The purpose of the study is to assess the impact of factors of intensive growth on improving the economic efficiency of grain production in the Nizhny Novgorod region. The development of grain economy in the region is determined primarily by the gross grain production, which depends on both extensive and intensive factors of production. According to the territorial branch of state statistics of the Nizhny Novgorod region, factor analysis was done, which allowed determining the impact of extensive and intensive factors on grain production in the region. Mainly grain yield depends on the quality of use of available resources. Modern development of the material and technical base in the Nizhny Novgorod region is characterized by increasing rates of renewal of tractors, combine harvesters and plows. The second important aspect of yield growth is to improve the quality of soil. Having considered the factors of intensive growth of gross grain harvest in the Nizhny Novgorod region, it was determined that their impact on its production will be gradually reduced in the near future. In modern conditions, the economic efficiency of grain production determines the development of intensive and extensive factors. The reduction in the pace of development of the material and technical base is primarily due to the lack of funds for serious technical re-equipment. The impact of organic fertilizers will also be reduced, as the saturation of soil with humus in some areas will reach the limit, which confirms the law of diminishing returns.

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**Keywords:** Grain, grain production, intensive factors, Nizhny Novgorod region, economic efficiency.



## 1. Introduction

Increasing of the economic efficiency of production activity of enterprises of the grain sub-sector of the country is the main condition for the formation of the food security of the country as a whole and food independence of the regions in particular. Therefore, it is necessary to pay attention to the peculiarities of the functioning of the grain economy at the regional level, taking into consideration the specifics of individual territories, their resource potential for grain cultivation, and also the main directions of its consumption. Natural and climatic conditions of the Nizhny Novgorod region make it possible to be one of the leading agricultural regions of the Russian black soil region. The elongation of the territory of the region from North to South significantly affects the internal natural differences, and its southern part, as if it is compared to the North, is not so much warmer but less humid, which makes it the main “breadbasket” of the region.

The issues of statistical evaluation of economic efficiency in the grain sector are considered in the works of M. A. Yost, N. R. Kitchen, K. A. Sudduth (Yost et al., 2007); S. Blackmore, R. J. Godwin, S. Fountas (Blackmore et al., 2003); S. Ayaz, B. A. McKenzie, G. D. Hill (Ayaz et al., 2004). The research works devoted to grain markets are also noteworthy E. N. Krylatyh, T. N. Belova (Krylatyh & Belova, 2018); W. M. Liefert, E. Serova, O. Liefert (Liefert, 2010; Liefert, 2002); G. Clark (Clark, 2015); V. N. Bateman (Bateman, 2011). Great attention to grain legumes are paid in the works of P. Zander, T. S. Amjath-Babu, S. Preissel (Zander et al., 2016); G. Duc, H. Agrama, S. Bao (Duc, 2014); F. Mahmood, H. Belhouchette, W. Nasim (Mahmood et al., 2017). The issues of the transformation of agriculture and grain sub-branch in the modern conditions are reflected in the works by G. Visioli, A. Galieni, F. Stagnari (Visioli et al., 2016); A. S. Davis, J. D. Hill, C. A. Chase (Davis et al., 2012); Y. Griewald (Griewald, 2016); J. Chavas (Chavas, 2001).

The problem of increasing economic efficiency in the grain sector is now sufficiently studied at the macro level. However, the volume of research at the regional level in the Russian Federation remains insufficient.

## 2. Problem Statement

In the XXI century, the Nizhny Novgorod region is among the leading economically developed regions of the Russian Federation. In the last decade, the region's economy has been developing steadily, and formed 1.7 % of the total gross regional product of the country's regions. The region's economy has been increasing in the conditions of absence of all raw materials. The Nizhny Novgorod region has unique natural geographic characteristics, logistic peculiarities and economic condition of development. However there is a problem in the grain sub branch concerning favorable conditions that are constrained by a low level of intensification of grain production, which makes the study relevant. For development of the regional grain production and solving the problem, a necessity to asset the influence of intensive factors on the grain production dynamics arises.

## 3. Research Questions

The agro-industrial complex (AIC) is one of the largest and vital sectors of the Russian economy, accounting for 8.5 % of gross domestic product; it forms more than 45 % of retail trade. More than 50

branches of the economy are associated with the agricultural field (Altuhov, 2008). Stability of grain production is the basis of development of agriculture in AIC. Feed grain, being the basis for the production of livestock products and animal feed, forms inter-sectoral proportions in agricultural production, determines the development of the entire grain market and has a high socio-economic importance, both for the country and for its individual regions regardless of whether they are producers or consumers of feed (Altuhov & Vinnichek, 2013).

The development of grain farming in this region is determined by the gross grain production, which depends on both extensive factors of production (increase in acreage for grain crops), as well as intensive (by increasing crop yields), determined by the development of the material and technical base, the level of fertilization and others.

#### **4. Purpose of the Study**

The purpose of the study is to assess the impact of factors of intensive growth on improving the economic efficiency of grain production in the Nizhny Novgorod region.

#### **5. Research Methods**

In this article, the authors used data on the state of the material and technical base, as well as fertilizer application in the grain sector for the period of 2012-2016 in agricultural organizations of the Nizhny Novgorod region. The territorial coverage of the study includes grain producers in the Nizhny Novgorod region. The study of the data in the dynamics allowed determining the stable trends of changes in the intensive factors of increasing the economic efficiency of grain production in the region. Submitted by the territorial branch of state statistics of the Nizhny Novgorod region, factor analysis was carried out, which allowed determining the impact of extensive and intensive factors on grain production in the region.

#### **6. Findings**

The main index that reflects the quality of the land used for sowing grain crops is the yield as an intensive factor of grain production, which characterizes the gross yield of grain crops from 1 ha of the cultivated area.

For determining the degree of influence of intensive factors on the gross grain harvest in the Nizhny Novgorod region, the authors used a factor analysis, which result found that a yield influences on the increase in production in the region. In the whole grain and leguminous crops increase, yields of only 2 t/ha contributed to the growth of the gross grain harvest in Nizhny Novgorod region by 1166 thousand centners, whereas the putting into circulation of 46.9 thousand hectares resulted in the increase in gross collection by 830.13 thousand centners of grain.

Grain yield largely depends on the quality of use of available resources. Their rational use leads to an additional competitive advantage over other farmers in the grain market.

There are several factors directly contributing to the increase of grain yield, namely the development of material and technical base and fertilizer application.

The first aspect is the modern development of material and technical base in the Nizhny Novgorod region which is characterized by increasing rates of renewal of tractors, combine harvesters and plows.

Nevertheless, the taken measures of technical re-equipment of production remain insufficient as the load of works on the available agricultural machinery considerably grows. The state of the material and technical base in the Nizhny Novgorod region is presented in table 01.

**Table 01.** The state of the material and technical base in the Nizhny Novgorod region, 2012–2016

Index	2012	2013	2014	2015	2016	Growth rate 2016 to 2012, %
Tractors	5334	5054	4759	4079	3945	74.0
Cultivators	1770	1625	1531	1297	1224	69.2
Combine harvesters	1385	1274	1216	1012	979	70.7
Plows	1725	1594	1522	1297	1255	72,8
Number of tractors per 1000 ha of arable land, pcs	3.8	3.7	3.5	3.1	3	78.9
Area of arable land per 1 tractor, ha	261	266	287	325	335	128.4
Area of crops per combine harvester, ha	291	316	307	354	368	126.5

Source: it was compiled by the authors according to the territorial branch of state statistics of the Nizhny Novgorod region.

Over the past five years, there has been a marked reduction in the availability of basic equipment used in grain production. The reduction in the availability of tractors, cultivators, combine harvesters and plows in the agricultural organizations of the region was 25-30 % for five years in different categories.

In the structure of the park of combine harvesters, the largest share belongs to ‘Don’ and ‘Acros’ – 29 %. ‘SK-5 Niva’ and ‘Vector’ account for 27% of the structure, 23 % – for ‘Yenisei’ and only 15% of the park are import combine harvesters. In agricultural organizations, most of the available combine harvesters are obsolete and require urgent quality updates.

The second important aspect of yield growth is the improvement of soil quality. The ability to increase grain production without expanding the acreage gives an additional competitive advantage to agricultural organizations, which is manifested in savings and profit from the sale of additional harvest. In agricultural organizations, maximum harvest is achieved in areas where the soil is more fertile. The main direction of increasing soil fertility is to increase the content of nutrients in humus by applying mineral and organic fertilizers.

Organic fertilizers enrich the soil with nutrients, improve its physical properties, water and air regimes, reduce the harmful effect of soil acidity on plant growth and the vital activity of microorganisms, and improve the supply of plants with carbon dioxide (Popov, 1990).

Special attention must be paid to the fact that the carbon dioxide formed as a result of the disintegration of organic fertilizer is an indispensable source for breathing the root system of grain crops.

A significant difference between mineral fertilizers and organic fertilizers is that nutrients are served as mineral salts. Accumulating in the upper layers of the soil, they are absorbed by plants, improving its vital characteristics (increase weight, add yield, improve the process of photosynthesis and assimilation of organic substances).

The dynamics of fertilizer application in agricultural organizations of the Nizhny Novgorod region is presented in table 02.

**Table 02.** Fertilizer application in agricultural organizations of the Nizhny Novgorod region

Index	2012	2013	2014	2015	2016	Growth rate 2016 to 2012, %
Application of mineral fertilizers, total, thousand tons	26.9	25.9	24.3	20.1	21.5	79.9
Application of mineral fertilizers on one hectare of grain crops (without corn), kg	40	38	41	34	38	95.0
Application of organic fertilizers, total, thousand tons	1627	1449	1494	1658	1721	105.8
Application of organic fertilizers on one hectare of grain crops (without corn), t	2.8	2.3	2.4	2.5	2.7	96.4

Source: it was compiled by the authors according to the territorial branch of state statistics of the Nizhny Novgorod region.

During the study period in the Nizhny Novgorod region the application of mineral fertilizers significantly reduced. In 2016 21.5 thousand tons of mineral fertilizers was brought which is only 79.9% of the 2012. During the analyzed period the application of organic fertilizers increased by 5.8%. In 2016, only 38 kg of mineral fertilizers were applied per hectare of grain crops (without corn), which is lower than the level of 2012 by 5%, and organic – 2.7 tons, which is lower than the baseline level by 3.6 %.

It should be noted that region in modern conditions, the development of both intensive and extensive factors should be a priority for the Nizhny Novgorod because the improvement of the above areas largely determines the economic efficiency of both production and sales of grain. The influence of extensive and intensive factors of economic activity development is largely reflected in the financial results of agricultural organizations (table 03).

**Table 03.** Economic efficiency of grain production in agricultural organizations of the Nizhny Novgorod region

Index	2012	2013	2014	2015	2016	Growth rate 2016 to 2012, %
Sold grain, thousand tons	513.6	398.5	499.7	556.3	535.1	104.2
Total cost, million rubles	2765.6	2470.1	2 979.0	3868.6	3 693.1	133.5
Revenue from sales, million rubles	3147.1	2735.6	3 241.6	4836.9	4 358.7	138.5
Profit, million rubles	381.5	265.4	262.6	968.3	665.6	174.5
Average selling price, rubles/t.	6127.5	6864.7	6486.6	8694.7	8145.6	132.9
Average cost, rubles/t.	5384.7	6198.5	5961.1	6954.1	6901.7	128.2
Production profitability, %	13.8	10.7	8.8	25.0	18.0	130.6

Source: it was compiled by the authors according to the territorial branch of state statistics of the Nizhny Novgorod region.

In 2016, agricultural organization of the Nizhny Novgorod region received a total profit of \$665.6 mln. In the reporting year, the organizations of the region as a whole show the value of profitability of production at the level of 18% and sales – at 15.3 %. The fixed profit growth is the result of an outstripping increase in comparison with the average cost of sales price by 32.9 %, which in 2016 amounted to 6 901.7 rubles/t. The volume of grain sales for five years has changed slightly and amounted to 535.1 thousand tons in 2016. Low indices of profitability of grain production have a significant impact on the withdrawal from the market of a large number of grain producers.

## 7. Conclusion

Having considered the factors of intensive growth of gross grain harvest in the Nizhny Novgorod region, we conclude that their impact on its production in the near future will be reduced. Thus, the reduction in the rate of development of the material and technical base is primarily due to the lack of funds for serious technical re-equipment. The impact of organic fertilizers will also be reduced, as the saturation of soil with humus in some areas will reach the limit, which confirms the law of diminishing returns..

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