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Factors' Assessment Of Effective Agricultural Production Development.

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ABSTRACT

Formation of an efficient and competitive agricultural production, as well as innovative re-equipment of processing organizations is one of the priority directions of development of the agro-industrial complex of our country. The search for effective ways to improve development efficiency depends on the definition and a number of factors that put forward this area of research relevant for the crop and livestock industry in the regional system. The paper proposed a methodical approach to determine the degree of influence of various conditions on the sphere of agricultural production, clarified that it is desirable to evaluate the studied processes by one criterion, since Evaluation with the help of two is reduced to solving a compromise problem, and an increase in the number of parameters makes this task practically unsolvable. The work revealed dominant factors, identified and specified a group of indicators by sphere of influence. The strategic sectors of agricultural production are justified, the effective development of which contributes to maintaining food security at the required level.

Keywords: agricultural production, development efficiency, factor model.

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INTRODUCTION

Agricultural production in many regions of the Russian Federation is a sub-industry that provides profitability, financial stability and the possibility of developing territories and the agro-industrial complex as a whole. Inefficient and unstable business management leads to the release of domestic dairy products that are uncompetitive in price and quality terms and contributes to an increase in imported imports, which makes it difficult to solve the problem of food security of the state.

It is possible to solve the tasks only by significantly increasing the efficiency of agricultural production, which implies an increase in the beneficial effect from the use of production resources and investments with the widespread use of innovative technologies.

MATERIALS AND METHODS

One of the ways to solve this problem is to systematize the factors affecting the efficiency of agricultural production. Analysis of the state of this system will determine the values of individual factors that have a decisive influence on the performance criteria. Such a statement can be called an optimization task; when solving it, the relationships between the parameters of the enterprise's activity – factors $X_1, X_2, \ldots, X_n$ and indicators - responses $Y_1, Y_2, \ldots, Y_n$, characterizing the effectiveness of activities [1; 2; 7].

Considering that the goal of any organization's activity is to obtain the maximum effect with minimum costs, the responses can be considered as optimization parameters. Between the optimization parameters and factors there is a functional relationship, which in general can be described by the equation:

$$Y = \varphi(X_1, X_2, \ldots X_n, \qquad (1)$$

Such an approach was proposed by Yu.P. Adler, E.V. Markova and Yu.V. Granovsky [6] when planning the competitive strategy of the organization, and is considered in detail in the works of E.V. Tyunyukova and P.Yu. Bondarenko [2; 7].

A number of authors suggest using the generalized desirability function of Harrington-Mencher [5; 10], which allows different in physical essence and dimensionality private parameters of efficiency evaluation to translate into a single dimensionless rating scale.

At the first stage, the factors were evaluated by an expert method - performance indicators. The expert group was asked to evaluate in a point form the value of each indicator of the efficiency of milk processing. The consistency of expert opinions and the non-random nature of the agreement were evaluated according to the concordance coefficient*C*and Pearson's statistical criterion χ^2.

Concordance coefficient*C*canchangefrom 0 (in this case there is no link between the rankings) to 1 (if all experts gave the properties the same place). Found valueχ^2compared with tabularχ^2 for significance level α = 0,05. If value χ^2moreχ^2tabular, the hypothesis of a non-random agreement of expert opinions was not rejected. If the coefficient of concordance*C*and Pearson's criterionχ^2had unacceptable values, experts evaluated the criteria for effectiveness again or in another composition [3].

If values*C*and$\chi^2$the researcher was satisfied, the experts' opinion was used to determine a generalized indicator of the efficiency of milk processing.

Further, for each parameter, the average values of the factor level and its significance were determined taking into account the opinion of all experts. The weighting coefficients of the significance of the factors were calculated in the form of Fishburn estimates [3] using the formula:

$$G_i = \frac{2(n-i+1)}{n}, \qquad (2)$$

upon further finding the geometric mean partial efficiency criteria, or

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$$G_i = \frac{i}{2^{i-1}}, \quad (3)$$

with further finding the arithmetic average of particular efficiency criteria, where:

G_i– significance i-th factor;
i – rank importance factor;
n – number of factors in this group.

The numerical preference system presented in Table 1 is a dimensionless desirability scale developed by E. Harrington. The values of this scale have an interval from 0 to 1. The value of the i-th particular optimization parameter, translated into a dimensionless desirability scale, denoted by d_i, called private desirability where i = 1,2,3...n – current parameter number; n – the number of private parameters. Value d_i= 0 corresponds to an absolutely unacceptable level of the i-th parameter. Value d_i= 1 - the best value of the i-th parameter.

Table 1: Standard Markings on the Harrington Desirability Scale

Empirical preference systems (desirability)	Numerical preference system (system of psychological parameters)
Very good	1,00 - 0,80
Good	0,80 - 0,63
Satisfactorily	0,63 - 0,37
Poorly	0,37 - 0,20
Very bad	0,20 - 0,00

To assess factors of different dimensions and order, the effectiveness criteria were brought $x_i$to the values of the parameters X_i desirability functions d_i. To do this, by known values X_i and x_i on the boundaries of the intervals of the desirability function and at its nodal points, an approximating function was constructed and its coefficients determined. The simplest is a linear function of the form [4]:

$$X_i = ax + b, \quad (5)$$

or exponential:

$$X_i = e^{ax}, \quad (6)$$

a, b –approximation coefficients.

After obtaining the parameters, which, according to experts, were decisive for assessing the efficiency of milk processing, and transforming them into the d scale, they were made up of these various d_i generalized desirability index D, which was the geometric mean of particular desirability functions:

$$D = \sqrt[n]{\prod_{i=1}^{n} d_i}, \quad (7)$$

excluding weighting coefficients of significance, or

$$D = \sqrt[n]{\prod_{i=1}^{n} d_i^{G_i}}, \quad (8)$$

taking into account the coefficients of significance G_i.

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The goal of our research was to develop a methodology for evaluating the effectiveness of the criterion, which should represent a certain function of a variety of initial data, have a quantitative expression and be measured at any selected levels of factors [2].

RESULTS AND DISCUSSION

Studies have shown that the efficiency of production of the livestock industry depends on many factors (Figure 1).

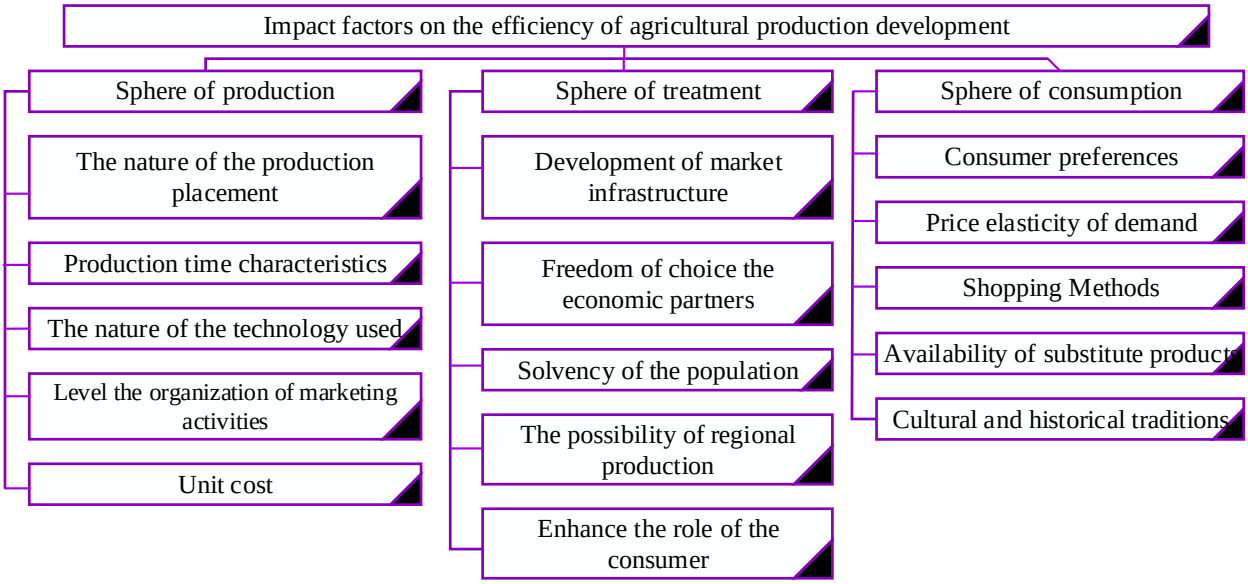

Figure 1: Classification of efficient agricultural production factors by manifestation areas

During the study, it was also established that in the livestock industry, the main factors for increasing the efficiency of agricultural production are the breed composition of the herd, production costs and annual feed consumption per cow. In turn, these indicators are in direct connection with the production technology and the quality of feed rations. For the practical implementation of this model, we will make calculations for the dairy product subcomplex, the importance of which for ensuring the food security of the country's regions is obvious.

After studying the paired correlation coefficients, the following factors were selected for analysis:

X_1 - the average annual yield, c/head.;
X_2 - annual feed consumption per 1 cow, c/feed. unit;
X_3 - the proportion of concentrated feed in the structure of the diet,%;
X_4 - direct annual labor costs per cow, man-hours;
X_5 - payment for 1 person-hour in dairy production, rubles;
X_6 - the share of milk in the proceeds from the sale of livestock products,%.

The mathematical model obtained as a result of the approximation is as follows:

$$y_c = 1552{,}4 - 6{,}654X_1 - 1{,}007X_2 - 1{,}741X_3 + 0{,}067X_4 + 0{,}129X_5 - 0{,}081X_6,$$
$$(9) \quad (13{,}20) \quad (3{,}68) \quad (2{,}72) \quad (2{,}74) \quad (1{,}99) \quad (2{,}01)$$
$$\alpha = 0{,}05;\ t_{kp} = 1{,}97;\ R = 0{,}89;\ R_2 = 0{,}79;\ F = 107{,}2;\ F_{kp} = 2{,}14.$$

The linear equation for the studied aggregate of agricultural organizations in the Krasnodar Territory explains 79% of differences in the cost of production of milk by the influence of the factors included in it. Regression coefficients are statistically significant at a significance level of α = 0.05. They show how much the unit price changes when each unit of each factor changes by one.

The absolute sum of elasticity coefficients shows that with an increase in all the factors included in the model, the cost of milk production decreases by 1% to 0.346%. Moreover, an increase in the average annual milk yield, the annual feed consumption per cow, the proportion of concentrated feed in the diet structure and the share of milk in the revenue from the sale of livestock products by 1% leads to a decrease in cost, respectively, by 0.275; 0.040; 0.045 and 0.001%. And the growth of direct annual labor costs per cow and payment for 1 man-h in dairy production is accompanied by an increase in cost by 0.006 and 0.010%.

The mathematical model of the influence of factors on milk yield in agricultural organizations of the Krasnodar Territory has the following form:

$$y_y = -2280{,}42 + 105{,}85X_1 + 2{,}06X_2 + 58{,}21X_3 + 14{,}01X_4 + 0{,}77X_5,$$
$$(10) \quad (40{,}54) \quad (3{,}98) \quad (5{,}60) \quad (5{,}50) \quad (1{,}98)$$
$$\alpha = 0{,}05;\ t_{kp} = 1{,}97;\ R = 0{,}97;\ R_2 = 0{,}94;\ F = 633{,}7;\ F_{kp} = 2{,}16,$$

Y - average annual yield, kg/head;
X_1 - production costs per cow, thousand rubles;
X_2 - direct annual labor costs per cow, man-hours;
X_3 - annual feed consumption per 1 cow, c/feed. unit;
X_4 - the proportion of concentrated feed in the structure of the diet,%;
X_5 - the share of milk in the proceeds from the sale of livestock products,%.

Linear equation (2) explains 94% of differences in cow productivity by the influence of factors included in it. The value of the coefficient of multiple correlation R = 0.94 indicates the presence of a fairly close relationship between the selected factors and the result. The value of the F-criterion is more critical, which confirms the statistical significance of the equation.

All regression coefficients are statistically significant at a significance level of α = 0.05.

The study of paired correlation coefficients made it possible to determine that the annual consumption of feed per cow and the average annual milk yield have the greatest influence on the cost of milk production.

The elasticity coefficients show that with an increase of 1% in production costs, labor costs, feed consumption per cow, the proportion of concentrated feed and the share of milk in the revenue from the sale of livestock products, milk yield increases, respectively, by 0.80; 0.15; 0.18; 0.25 and 0.11%.

Analysis of β-coefficients showed that production costs per cow, annual feed consumption per cow and the proportion of concentrated feed in the diet structure have the greatest influence on the resultant factor.

According to the analysis of statistical groupings and the results of the correlation and regression analysis, the optimal parameters of the intensification of dairy cattle breeding in the Krasnodar Territory in 2017 were established.

- the optimal annual costs per cow are in the range of 85-95 thousand rubles;
- feed consumption per cow - 70-80 centners feed units

At lower costs and feed consumption, animal productivity decreases, and the increase in costs and feed consumption above the specified range is not effective, because leads to higher costs and lower profitability.

CONCLUSION

Currently, the decline in the livestock subcomplex of the Russian Federation is suspended. However, despite all the positive transformations taking place in the Russian Federation, in most regions of the country agricultural production remains low-income.

It can be argued that with the current attitude of the state to the sub-sector, it is not necessary to wait for revolutionary shifts and successes in the development of dairy farming. Moreover, the situation may worsen in a number of circumstances, the inability to quickly adapt to the conditions of the WTO and the creation of the Common Customs Space. It remains to hope that the state aid measures laid down in the "State Program for the Development of Agriculture and Regulation of Agricultural Products Markets for Foods and Food for 2013-2020" will lead to a planned increase in milk production and will help fill the domestic market with domestically produced milk products.

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