UDC [631.152:657.471.11]:633.11.002.2

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Cost management of oil products and services payment of the third organisations in wheat production

Scientific problem. A critically low amount of investments into updating of the material and technical base of the agricultural enterprises has exacerbated the problem of timely and qualitative execution of the operations provided by the manufacturing technologies in most spheres. At the same time, reduction of the financial indicators of agricultural enterprises functioning in 2015-2016 significantly limits the possibility of even a simple reproduction of their resource potential. An additional factor that destabilizes functioning of the agro-formations is a permanent increase in energy sources prices, which, together with considerable depreciation of the material and technical base, causes a rapid increase in energy consumption and products self-costs. A possible solution to these problems is partial transfer of the most energy-intensive technological operations to the outside organizations. This allows to improve the quality and efficiency of the technological operations, to download available technical equipment more completely, and to obtain tax preferences even under the conditions of a steady shortage of investment resources. At the same time, significant changes in quantities and the specific weight of the costs of oil products and payment for the services of the outside organizations by individual farms are the result of changing the approaches to organization of the technological process, which necessitates improvement of the approaches to manage these types of the costs.

Analysis of recent researches and publications. The problem of efficiency security of agricultural enterprises functioning constantly comes in sight of the scientist economists. Among the recent publications on this topic the works of V.S. Diiesperov, V.Ya. Mesel-Veseliaka, V.V. Rossokha, L.M. Satyr, A.V. Cherep, D.V.Shyian, O.H. Shpykuliaka, O.V. Shubravska [1-8] should be singled out. At the same time, the issues of modeling and optimization of the cost structure of the agricultural enterprises were illustrated in the works of O.M. Vyshnevska, V.P. Klochan, T.H. Marenych, T.S. Muliar, H.O. Partyn, D.V. Shyian [9-14]. In addition to that, the issue of modeling the share of agricultural enterprises participation in interfarm cooperation is insufficiently studied.

The objective of the article is to present the research results of amount and specific weight cost management for oil products and services payment of the third organizations in wheat production.

The methodology. Economic science operates with a significant arsenal of the methods and techniques of social phenomena and processes research, most of which are based on the results of the researches in the related fields of knowledge, in particular probability theory and mathematical statistics. In turn, the analysis of

the methodical apparatus of most researches devoted to the theory of cost management, showed the typicality of approaches to assess the phenomena and trends in this field with the domination of this grouping method, which was also used in our research. But the use of the correlation and regression analysis gives a more accurate quantification of them despite the availability of this method from the point of view of interpreting assessment of cost interdependence and economic results. At the same time, unlike most authors who form their conclusions based on the linear or single-factor parabolic production functions, the carried out research was based on the function of two variables in the form of a full polynomial of the second order, application of which allows quantifying the individual effect on the resultant change indicator for each researched species of the costs, as well as their simultaneous impact with a fixed value of one type of the costs.

Statement of the main results of the study. The research aimed at improving the approaches to manage the amount and costs structure for production of certain agricultural products at the first stage involves identification of the existing tendencies of the expendable and effective indicators of functioning of the field, which is the object of the research. Therefore, the agricultural enterprises of Kharkiv region, which produced wheat in 2015, were grouped according to their yielding capacity (Table).

This allows to establish a positive correlation of technological and economic efficiency and competitiveness of production in certain groups of the farms. So, if the profit mass per hectare of wheat crops and profitability of its implementation at the agricultural enterprises with the yielding capacity of less than 30 cwt/ha made 0.87 thousand UAH and 17.8 % correspondingly, in the group of the enterprises with the yielding capacity of more than 40 cwt/ha it was 3.54 thousand UAH and 41.6% higher correspondingly. At the same time, if the average sale of wheat in the first group was 1.4 thousand tons, so it was three times larger for the farms with the yielding capacity of more than 40 cwt/ha.

The precondition of the highest profit margin of implementation for the farms of the third group was the highest sale price of one cwt of wheat. Thus, at the farms with the yielding capacity of less than 30 cwt/ha, the average sales price amounted to 249,8 UAH/cwt, at the agricultural enterprises with the yielding capacity of more than 40 cwt/ha it was 19.2 % higher. Besides, the latter was determined by higher concentration of production to a great extent. Thus, the average area under wheat cultivation at the agricultural enterprises with the yielding capacity of more than 40 cwt/ha was 70,7 % higher than at those which had the yielding capacity of less than 30 cwt/ha. In its turn, the higher selling price of wheat in the first group encouraged them to increase the intensity of production; as the result of this, the specific consumption was 53.9% higher than in other groups. The latter provided the farms of the third group with wheat productivity 87.8 % higher comparing to the first one, which insured the level of production cost of 1 cwt of grain to 18.0% lower in the first group comparing to the others.

The intensity and efficiency of wheat production at the agricultural enterprises of Kharkiv region in 2015

Indicators	Groups of the farms according to wheat yielding capacity, cwt/hectare			in total (on average)
	less 30,0	30,1-40,0	more 40,0	
Number of the farms in a group, unit	58	123	128	309
For one enterprise: harvested area, ha	614,9	943,4	1 049,6	925,7
Gross yield, t	1 610,1	3 293,4	5 157,2	3 749,5
Volume of sales, t	1 415,7	2 800,3	4 172,2	3 108,7
Production costs, thousand UAH/ha	5,18	6,50	7,97	7,03
Including oil products	0,84	0,76	0,91	0,84
Payment for the services of the third organizations	0,35	0,54	0,76	0,62
Production cost price 1 cwt, UAH	197,8	186,2	162,2	173,5
Sales price 1 cwt, UAH	249,8	270,3	297,8	283,8

Continued tab.

Profit, thousand UAH/ha	0,87	0,63	4,41	2,43
Profitability level, %	17,8	8,5	59,4	34,3
Yielding capacity, cwt/ha	26,2	34,9	49,1	40,5
Specific weight (%) of total costs for: oil products	6,2	11,6	11,4	11,9
Payment for the services of the third organizations	6,7	8,2	9,5	8,8

The source: the author's own calculations on the basis of the statistic reporting forms of 50 agricultural enterprises of Kharkiv region in 2015.

In order to determine the ground of higher technological production efficiency on the farms of the third group the quantities of the unit costs for the agricultural enterprises of this and the other two groups were compared clause-by-clause. Their greatest differentiation for the costs to pay for the services of the third organizations was established. Thus, at the enterprises with the yielding capacity up to 30 cwt/ha the latter was 350 UAH/cwt and at the farms with the yielding capacity of over 40 cwt/ha, it was 2.2 times more. As a result, the specific weight of the costs of the first mentioned in total was 2.8% lower than of the others. In its turn, it has led to lower values of the unit costs for oil products and the share of the latter in the total amount of the costs of the first mentioned in comparison with the others by 7.9 and 4.8% correspondingly.

So, it should be assumed that a saving of the costs for oil products due to transference of some technological operations execution of a contract organization became one of the grounds of higher competitiveness and economic efficiency of production on the farms of the third group. Although it should be mentioned that the level of technological production efficiency was also influenced by the systems of fertilization and plant protection, seed quality and soil fertility, crop rotations arrangement, differences in production conditions at the agricultural enterprises of different natural and climatic zones etc. Though the latter ones both increased and leveled the effect of participation in the industrial cooperation, therefore the conclusion about the achievement of higher technological production efficiency on the farms of the third group at the costs of wider involvement of the contract organizations only needs additional verification by localization of factor estimates.

This provides for the exclusion from the enterprises that differ in more than one option or elimination of influence of other factors by constructing a production function. Despite the multiformity of the conditions of agricultural enterprises functioning, which complicates the formation of representative selection, the second approach is typically used in economic studies. Besides the main problem is the choice of the production function, which firstly would allow to assess the impact on technological and economic efficiency of wheat grain production with the exclusion of the changes in the unit costs for oil products and payment for the services of the third organizations, and secondly could be used to determine the optimal proportion of the shares of those costs in their total volume that ensure maximum production efficiency.

To solve this task by means of the correlative and regressive analysis the equation of wheat yielding capacity dependence (Y, cwt/ha) on the unit costs for oil products (x_1 , thousand UAH/ha) and payment for the services of the third organizations (x_2 , thousand UAH/ha) at the agricultural enterprises of Kharkiv region in 2015 was defined:

$$Y = -1,09x12 + 3,77x1 - 0,38x22 + 6,07x2 + 0,41x1x2 + 31,63. \quad (1)$$

Its graphical interpretation shows the dependence of the resulting function of diminishing returns effect (Figure 1).

On this basis it is possible to determine the quantity of the unit costs for oil products and payment for the services that ensure maximization of the function (1).

For the sake of this it was differentiated with the help of the variables x1 and x2:

$$\frac{dY}{dx_1} = -2,18x_1 + 0,41x_2 + 3,77 \quad (2)$$

,

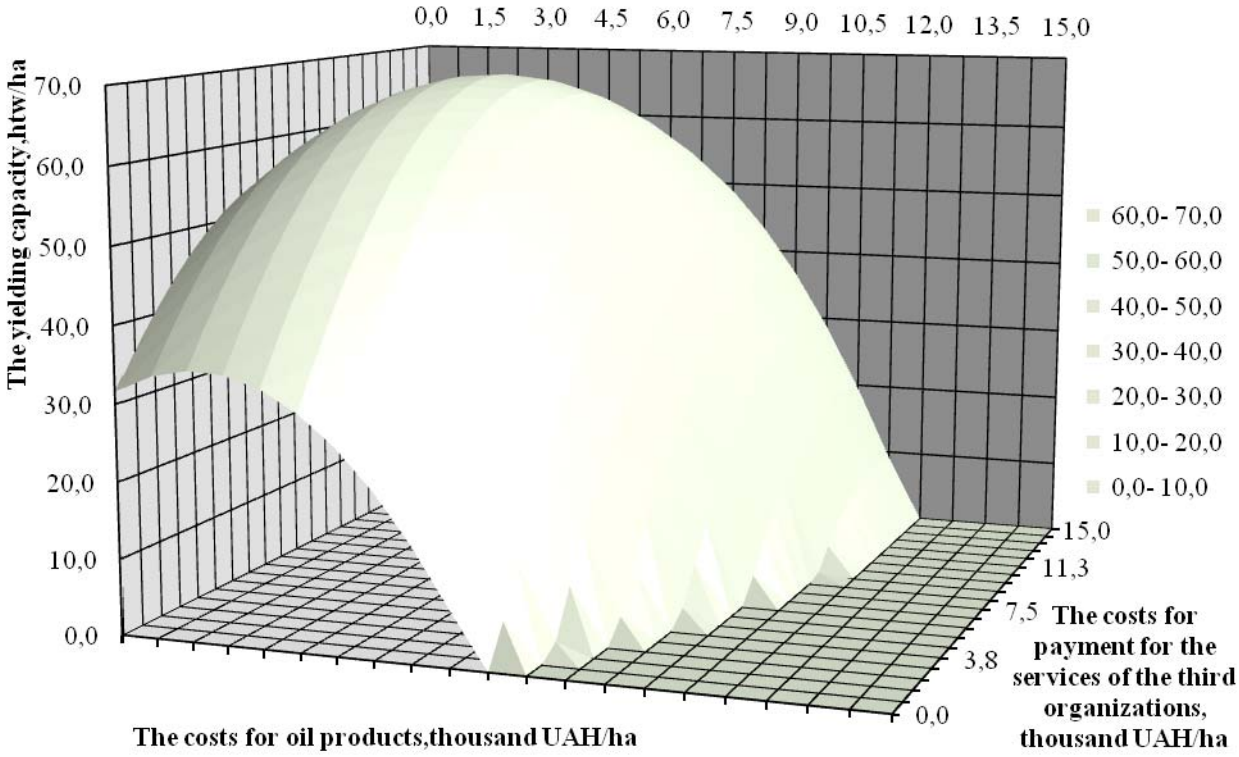

Figure 1. Wheat yielding capacity dependence on the specific costs for oil products and payment for the services of the third organizations at the agricultural enterprises of Kharkiv region in 2015

The source: the author's own calculations on the basis of the statistic reporting forms of 50 agricultural enterprises of Kharkiv region in 2015.

$$\frac{dY}{dx_2} = -0{,}76x_2 + 0{,}41x_1 + 6{,}07 \quad (3)$$

Hereafter by equaling the equations (2) and (3) to zero and solving the obtained system of the linear equations as to x_1 and x_2, it was established that maximum of yielding capacity at the average level of the unit costs for other items, which was equal to 68,0 cwt/ha, is achieved at the unit costs for oil products and payment for the services of the third organizations – 3.55 and 9.79 thousand UAH/ha correspondingly. Hereby, the element of the function (1), which characterizes the influence on yielding capacity of the first degrees of the included factors indicates that the achieved results are optimal both from the point of view of maximization of yielding capacity and from the structural side [5]. In particular, having summed up the obtained values of the unit costs for oil products and payment for the services of the third organizations and having specified their share in the obtained integral indicator, we have found out that with yielding capacity of 68,0 cwt/ha the optimum proportion of apportionment of the costs according to these items will be 26 to 74 %.

At the same time, it should be noted that the priority for the greatest part of the agricultural enterprises is to maximize economic production efficiency. This causes the changes in approaches to determination of the optimal levels of the costs for oil products and payment for the services and transformation of the yielding capacity function into such one which characterizes dependence from the analyzed types of the costs of the margin profit from wheat sale. To this effect the right part of the formula (1) was multiplied by the average sales price of wheat investigated by the agricultural enterprises of Kharkiv region, which was 258,7 UAH/cwt in 2015 and the value of the unit costs for oil products (x_1) and payment for the services of the third organizations (x_2) was subtracted from the obtained result:

$$Y_1 = (-1{,}09x_1^2 + 3{,}77x_1 - 0{,}38x_2^2 + 6{,}07x_2 + 0{,}41x_1x_2 + 31{,}63) \times 0{,}26 - x_1 - x_2, \quad (4)$$

where 0,26 is the average sales price of 1 cwt of wheat of the investigated agricultural enterprises of Kharkiv region in 2015, UAH/cwt.

Along with this, the margin profit is quite acceptable from the point of view of direct costing. Hereafter the function (12) was differentiated with the help of variables x_1 and x_2:

$$\frac{dY_1}{dx_1} = (-2{,}18x_1 + 0{,}41x_2 + 3{,}77) \times 0{,}26 - 1 \quad (5),$$

$$\frac{dY_1}{dx_2} = (-0{,}76x_2 + 0{,}41x_1 + 6{,}07) \times 0{,}26 - 1 \quad (6).$$

After that, having equaled the functions (5) and (6) to zero and having solved the obtained system of the equations as to x_1 and x_2 , it was defined, that assuming the sales price of wheat of 258,7 UAH/cwt, the average level of the unit costs for other items and absolute marketability of production the maximum value of the profit margin, which was equal to 9.1 thousand UAH/ha, is achieved when the unit costs for oil products and payment for the services of the third organizations are 0,54 and 3.16 thousand UAH/ha correspondingly. In this case the expected yielding capacity is equal to 49.4 cwt/ha, and the optimal distribution proportion of the integrated resources to finance expenses for oil products and payment for the services of the third organizations will be 15 for 85 %.

The analysis of the achieved results suggests that increase of values of the unit costs for oil products and payment for the services of the third organizations to the levels which provide maximum yielding capacity at such price and average levels of the unit costs for other items will determine the decrease in margin profit up to 4.34 thousand UAH/ha. So, the gap in the levels of production intensity, which ensure maximization of technological and economic efficiency of production, should be mentioned. The growth of prices will provide reduction which confirms positive correlation of price dynamics and intensity of production (Table).

Hereby it should be noted that modeling of the levels of the unit costs which ensure maximization of productivity and margin profit establishes the grounds to solve the strategic objectives – to ensure the highest efficiency of functioning of an agricultural enterprise. However in the original edition its decision did not provide restrictions of the financing sources. At the same time in practical activity of agricultural enterprises management one should act in the conditions of their limitations. And that is why the further search was aimed at justification of the approaches to determine the values of the unit costs for oil products (x_1) and payment for the services of the third organizations (x_2), which provide the maximization of yielding capacity with a fixed amount of the financial resources.

The basis to solve this task is presence of the production function (1) of one global and a number of conditional extremums in the form which was chosen. In this case the prerequisite of their existence is the equality between the derivative functions for each variable [15]. At the same time the practical solution of the problem is based on the presence of the variables x_1 and x_2 in the formulas and that allows to determine the pairs of their values which allow to define the extremum of the function under the conditions of the limitations of the integral values of expenses according to the fixed value of one of them by choosing the quantity of the other. The practical implementation of this approach involves the substitution of the change of the variable x_2 in the equations (2) and (3) by the expression:

$$x_2 = m - x_1, \quad (7)$$

where ***m*** *is the integral value of the resources of an agricultural enterprise, directed on costs financing for oil products and payment for the services of the third organizations, thousand UAH/ha;* $\boldsymbol{x_1}$ *is the unit cost for oil products, thousand UAH/ha*

Then, taking into account the requirement of values equality of the first derivatives (2) and (3), the analytical form to calculate the variable x_1 was determined:

$$x_1 = 0{,}31m - 0{,}61 \quad (8).$$

Hereafter, taking into account (7) and (8) the absolute values of the costs for oil products and payment for the services of the third organizations and their relative shares in different amounts of the resources which are directed on their financing that secure the conditional extremum are defined. The graphical illustration of the achieved results showed the increase of

value and share of the costs for oil products in proportion to their integral indicator (Figure 2).

So, as the technological operations of the own forces is not economically inexpedient for the enterprises with the unit integral costs up to 2 thousand UAH/ha, in the future, in order to increase the level of intensity from 2 to 20 thousand UAH/ha, the share of the costs for oil products will increase from 0.0 to 19.0%. Even so the growing intensity of production causes a nonlinear change of yielding capacity. Thus, in case of the unit integral costs from 0.0 to 13.3 thousand UAH/ha the expected yielding capacity ranged from 31.6 to 68.0 cwt/ha. The further increase of the unit integral costs has led to the decline of wheat yielding capacity.

Some differences in the changing trends of cost shares for oil products and payment for the services of the third organizations defined while grouping and economical and mathematical modeling were observed. So, if the first ones indicate decrease of costs shares for oil products and increase of production intensity, the second ones indicate the opposite that is the consequence of nonoptimal ratio of the analyzed cost types in the examined agricultural enterprises of Kharkiv region.

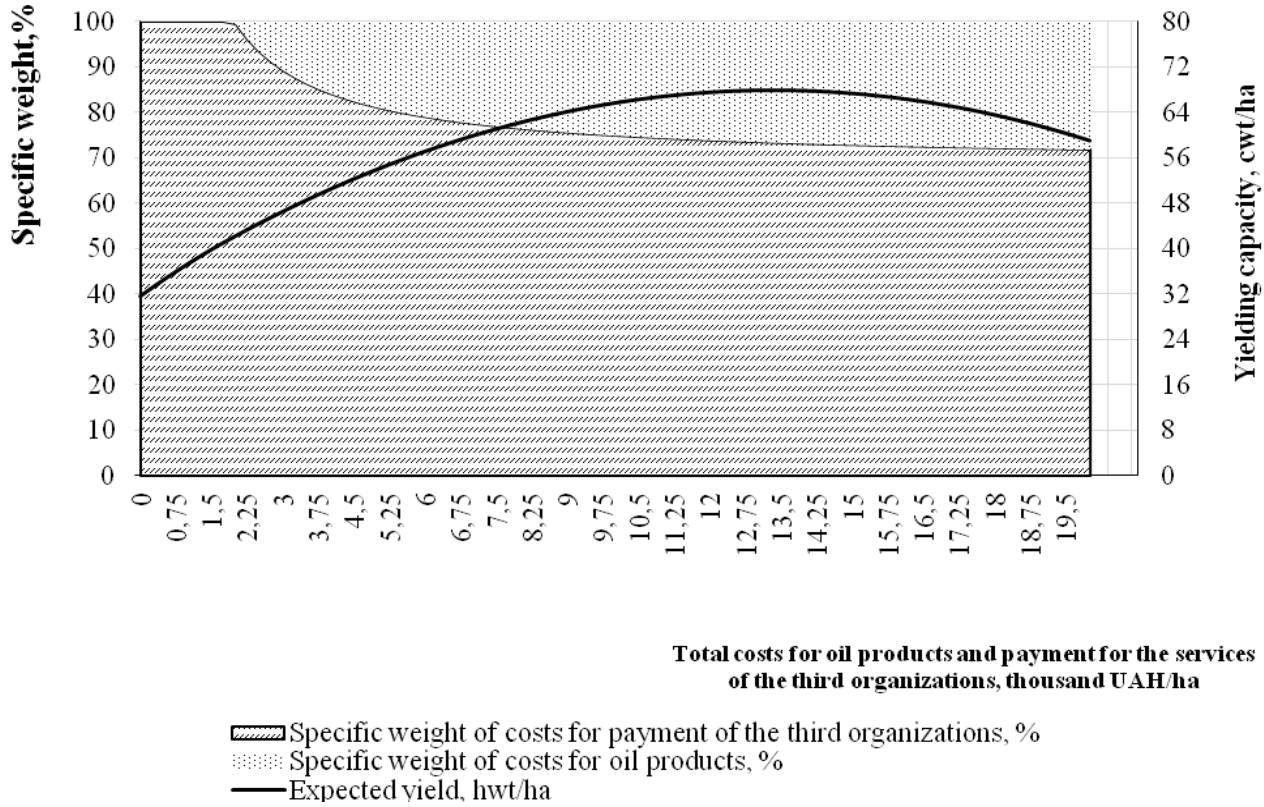

Figure 2. Optimal structure of the costs and expected yielding capacity at different total costs for oil products and payment for the services of the third organizations at the agricultural enterprises of Kharkiv region in 2015

The source: the author's own calculations on the basis of the statistic reporting forms of 50 agricultural enterprises of Kharkiv region in 2015.

Further, on the basis of the above defined pairs of the values x1 and x2 which ensure the achievement of the conditional extremum of the function (1) by using the formula (4) the profit margin of a fixed integral index was calculated (Figure 3). The analysis of dependence of the received indicator on the value of the integral cost indicator showed that both the yielding capacity curve and the profit margin graph are subordinated to the effect of the decreasing return. However, if achievement of maximum yielding capacity foresees increase of the total costs for oil products and payment for the services of the third organizations up to 13.3 thousand UAH/ha, the marginal value will be the greatest at 3.8 thousand UAH/ha.

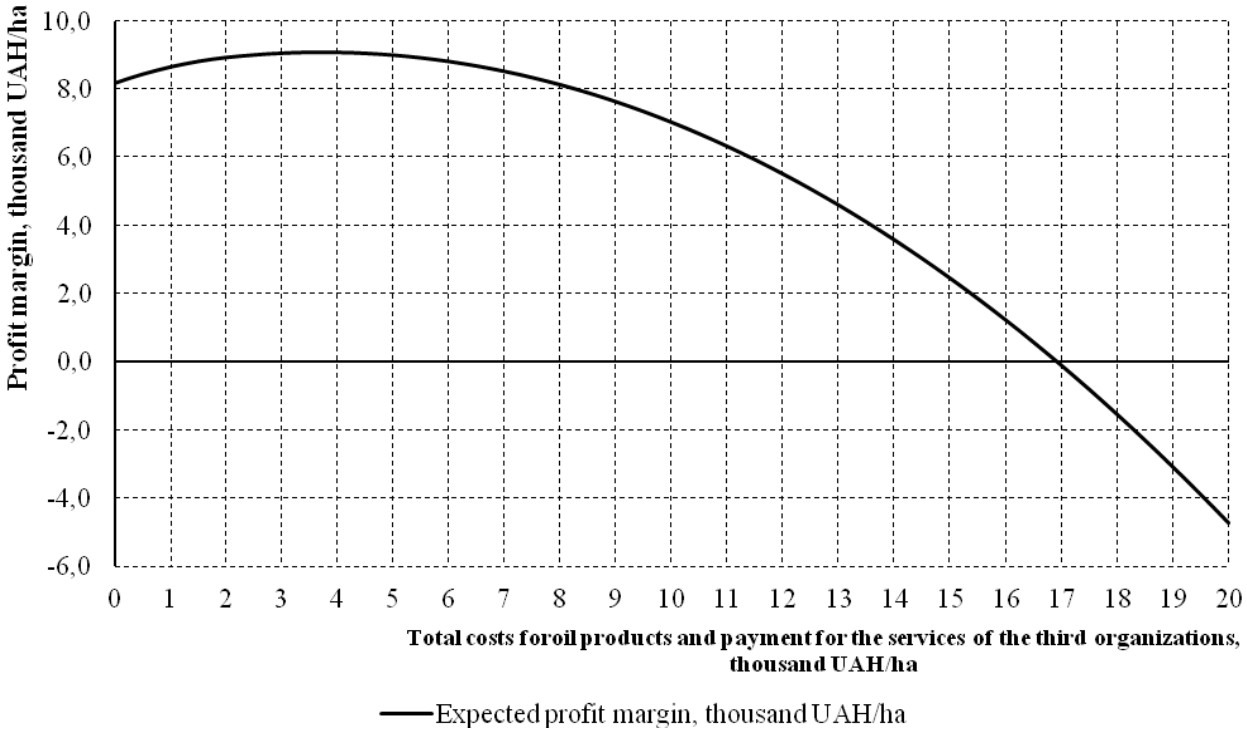

Figure 3. Economic efficiency of wheat production from the total costs for oil products and payment for the services of the third organizations at their ratio that ensures maximization of productivity at the agricultural enterprises of Kharkiv region in 2015

The source: the author's own calculations on the basis of the statistic reporting forms of 50 agricultural enterprises of Kharkiv region in 2015

Conclusions. The tendency of cross-reduction of cost share for oil products and its increase of the costs for payment of the services of the third organizations in proportion to increase of intensity and concentration of production in grain industry is set up. Thus, it is determined that, on the basis of the ratio of the prices of oil products and tariffs on the services, advancing the costs for buying the latter ones and their expenditure in the production process at the total costs for these items up to 2 thousand UAH/ha, which were recorded at the majority of the examined agricultural enterprises is economically inexpedient. At the same time, most of them have the fleet of agricultural vehicles which allows to perform the greatest part of technological operations on their own, causes the deviation of the actual cost structure from the optimal one and, as a result, reduces the production efficiency of wheat. The solution of the specified contradiction can be possible on account of increase of the integral cost index for oil products and payment for the services of the third organizations up to 3.8 thousand UAH/ha, which will ensure maximization of margin profit at the level of 9.1 thousand UAH/ha. The achievement of such result will include growth of the loading level of its own machine and tractor fleet production, which will cause increase of the costs for oil products up to 540 UAH/ha. Besides, an economically justified share of the costs for oil products in the integral expenditures will reach 15 %, while the specific weight of the costs to pay for the services of the third organizations will not exceed 85 %.

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The article has been received 01.12.2017

Revision: 05.12.2017

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