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## **FORMATION OF SUNFLOWER PRODUCTION EFFICIENCY IN THE AGRICULTURAL ENTERPRISES**

*The concept of sunflower production efficiency is specified and the indices system of its evaluation at the agricultural enterprises is generalized. The main tendencies of sunflower production in domestic agriculture and in agricultural enterprises activity of the oblast` are revealed. The conceptual principles of sunflower production efficiency increase at the agricultural enterprises with ecological standards adherence on the basis of ecological coefficient which takes into consideration the factors of the area under crop and the level of soil fertility renovation are proved. The method of determining this factor was approved as an example of specific farms. Dependence of sunflower production efficiency on the level of production concentration is investigated. The methodological approaches to efficiency evaluation of the certain expenses elements.*

**Key words:** *production efficiency, sunflower, production concentration, intensity, ecological production.*

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## **ФОРМУВАННЯ ЕФЕКТИВНОСТІ ВИРОБНИЦТВА СОНЯШНИКА В СІЛЬСЬКОГОСПОДАРСЬКИХ ПІДПРИЄМСТВАХ**

*Обґрунтовано концептуальні засади підвищення ефективності виробництва соняшника в сільськогосподарських підприємствах з контролем дотримання екологічних вимог на основі застосування коефіцієнта екологічності, який ураховує фактори структури посівних площ і відтворення родючості ґрунтів. Установлено залежність ефективності виробництва соняшника від рівня концентрації виробництва. Удосконалено методичні підходи до оцінки ефективності окремих елементів витрат.*

**Ключові слова:** *ефективність виробництва, соняшник, концентрація виробництва, інтенсивність, екологічність виробництва.*

**Introduction and review of literature.** The organization of agricultural production in a market economy is a complex and multifaceted process in which, on the one hand, the owner is interested in receiving revenues from economic activity, and on the other, it is necessary to provide the population with quality and affordable food and processing industry – with raw materials. One of the key products in such

conditions for agricultural producers of Ukraine is the sunflower seeds. In recent years, domestic agricultural producers have the leading positions in sunflower production. By the area of crop and sunflower production volume in 2008–2012 Ukraine is the first in the world. In 2012 it's share in the domestic crops of cultivated area was reached 18.7 %. The share of sunflower seed production in Ukraine in the world market was increased from 11.3 % (1990) to 25.0 % (2012). At the same sunflower production causes a number of problems, the main one of which is the reduction in soil fertility and monocultivation of production. Therefore, research on effective organization of sunflower seed under the protection of national interests in the current market conditions is crucial for economic science.

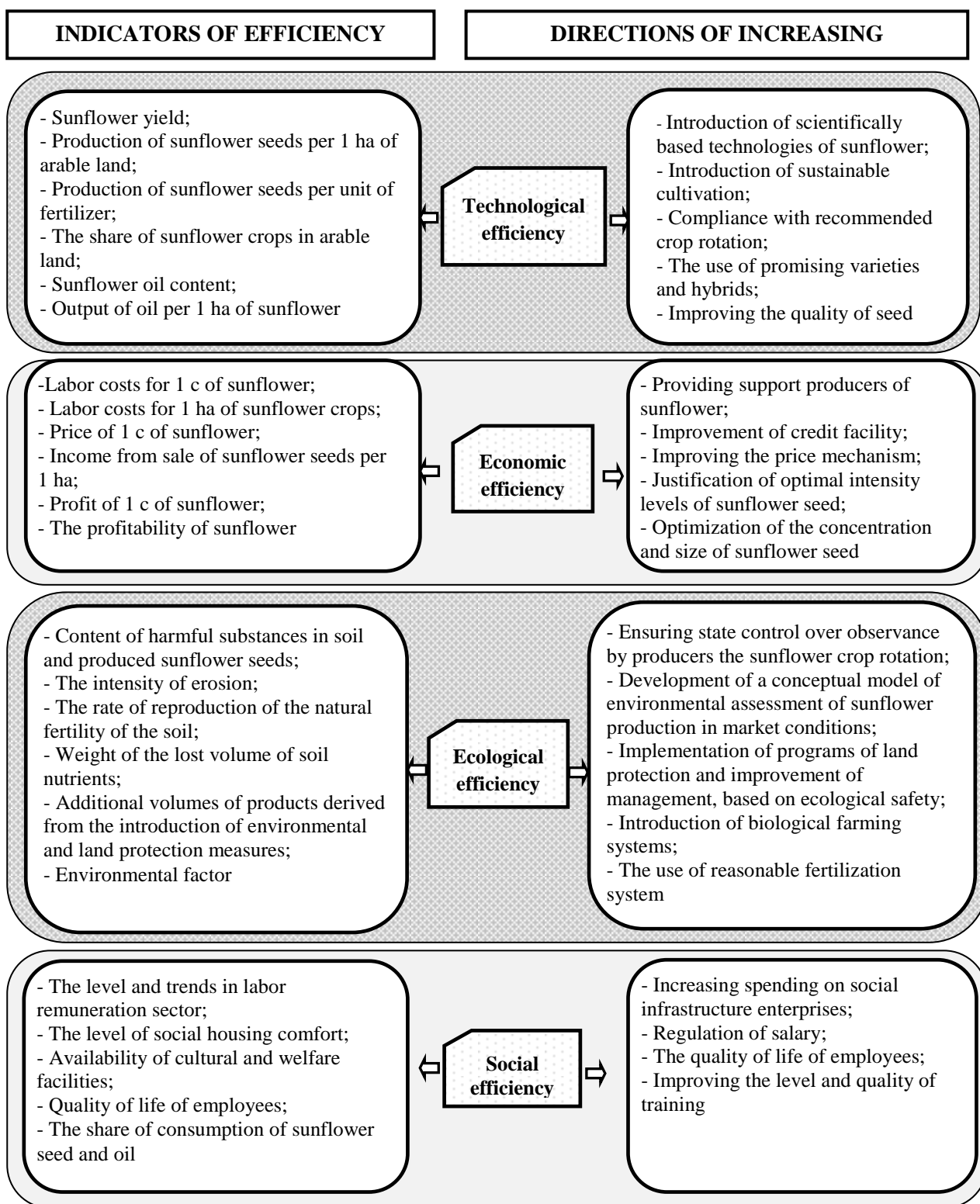
Theoretical and practical aspects of sunflower efficiency were investigated by famous domestic and foreign economists: M. Kalinchyk [1], V. Perebiynis [2], O. Pityk [3], M. Tonyuk [4], O. Ulianchenko [5], I. Chekhova [6], M. Külekçi [7], I. Peretyat'ko [8], J. Katore [9], S. Todorović [10] and others. Research of scientists focuses on the questions of improvement of economic relations between the product sub-components, particularly in the production and sale of sunflower; development of mechanisms of state regulation; development of a market economy; formation of market agro-food products; selection of channels for implementation and evaluation of marketing; pricing of oil and sunflower seeds. However, in the current conditions of the national economy it is necessary deeper study of problems of production efficiency due justification of sunflower optimal intensity levels of its production, with a combination of environmental and economic aspects of the economic activity of agricultural enterprises. Also it is not investigated regularities of concentration on the efficiency of this culture.

**The purpose of the article** is to prove the theoretical and methodological aspects and develop proposals to improve the efficiency of sunflower production in the agricultural enterprises considering environmental factors.

**Results and discussion.** The market economy requires a special approach from entrepreneurs – their activities must be the most effective. Efficiency – is an economic category, reflecting the ratio between the obtained results and spent resources for their achievements. Research of scientific-theoretical foundations of production efficiency showed that the assessment of the effectiveness of sunflower production is based on an integrated approach to the determination of results, taking into account the involved resources and the extent of their use.

Systematics of existing approaches to evaluating the effectiveness of sunflower makes it possible to identify the technological, economic, ecological and social efficiency of its production (Fig. 1). In modern economic activity sunflowers are one of the leading crops of Ukraine and major oilseeds. In recent years Ukraine has tended to increase in sunflower production. If in 1990 the agricultural enterprises harvest of this crop was 2.5 million tons, in 2000 – 3.0 in 2010 – 5.6, in 2012 was increased to 7.1 million tons. The expansion of the cultivated area in 2012 to 5.5 million hectares contributed to this, that 3.2 times higher than crops of sunflowers in 1990 and 76 and 14 % respectively in 2000 and 2010 together with the expansion

Sunflower production efficiency – the ratio between results and costs in technological, economic, ecological, social context that was emerged in the enterprise as a result of this culture



**Fig. 1. Key indicators and areas of efficiency of sunflower production in the agricultural enterprises**

Source: it was formed by author.

of the area of increased productivity. In 2012 the average yield of sunflower was 16.5 c/ha, which is 4 % higher than in 1990 and 4.3 and 1.5 kg/ha – indicators of 2000 and 2010. High profitability of sunflower culture contributes to mass cultivation. Although in 2012 the profitability of sunflower was decreased five times compared to 1990 and amounted to 45.8 %, though this figure is quite high for the agricultural sector of Ukraine.

Production of sunflower is one of the main directions of development of agriculture in Kharkiv region. During the period 1990–2012 it was increased 2.7 times (Table 1).

*Table 1*

**Effectiveness of sunflower production in the agricultural enterprises  
in Kharkiv region 1990–2012**

Indicator	Year						2012, % to 2010
	1990	1995	2000	2005	2010	2012	
Yield, c/ha	17.6	18.3	15.7	12.3	17.1	22.6	132.2
Gathered area, ths. ha	138.2	154.4	178.5	138.7	291.3	289.6	99.4
Gross yield, ths. c	2422	2814	2589	1702	4980	6539	131.3
Costs: on 1 kg, UAH	12,28*	6.13	27.46	96.68	157.96	201.62	127.6
on 1 ha, UAH	256.0*	112.73	400.00	1186.42	2700.28	4552.34	168.6
Price of 1 c of production, UAH	44.31*	23.84	52.07	141.21	321.08	356.26	110.9
Profit: on 1 c, UAH	31.83*	16.44	22.26	29.11	121.78	134.63	110.6
on 1 ha, UAH	488.12*	174.74	289.90	266.19	2175.21	3370.32	154.9
Profitability, %	255.2	221.7	74.7	26.0	61.1	60.8	on -0,3

\* In karbovanets.

*Source:* it was calculated by the author according to of the data of form # 50 s.-g. «The main economic indicators of work of agricultural enterprises in the Kharkiv region».

In modern terms sunflower production is mainly carried out through extensive technology by increasing acreage. Thus, during the 1990–2012 the sown area of sunflower in agricultural enterprises of the Kharkiv region was increased annually by an average of 172.7 hectares. Compared with 1990 in 2012 plantings of crops were increased twice in the structure of arable land and were occupied 22.6 %. In the structure of gross plant production (at constant prices in 2010) in agricultural enterprises of the Kharkiv region the share of sunflower was 28.2 %.

It should be noted that the production of sunflower is costly. Research results indicate that over 2010–2012 in general, in the farms in sunflower production it was allocated 24.5 % of production costs. It ensures sunflower farms more than 33 % of the proceeds from the sale of crop production in 2010–2012 and it is the most profitable crop.

During the period 1990–2012 the income from its sale was constantly growing and in 2012 amounted to 134.63 UAH/c, which is 10.6 % above the level of 2010. Sunflower production costs in 2012 were increased by 27.6 % compared with 2010. The largest share in the total expenditure for the period 2008–2012 in studied enterprises were the cost of seed (15.0–18.7 %), petroleum products (11.3–12.7 %)

and fertilizers (4.7–24.8 %). Realization price during the research period also grew steadily and in 2012 was amounted to 356.26 UAH per 1 kg. Profitability of sunflower during the period 1990–2012 exceeded general economic indicator in 2,64–3,47 times and average crop – in 2,29–2,62 times.

Sunflower – thermophilic culture, which is demanding to light, moisture, soil and climatic growing conditions. Zonal peculiarities of its production depends on location by agroclimatic subzones of area. The main production of sunflower is formed in III (South) agro-climatic subzone of the Kharkiv region, where are favorable climatic conditions. The largest producers are Lozova and Balakliya areas. In the first (northern) subzone bulk of the gross harvest of agricultural enterprises is formed in Velykoburlutsk and Vovchansk areas in the II (central) subzone – farms of Chuguevsky area.

An important factor in the increasing yield is the yield of sunflower. During the period 1990–2012 fluctuations in this index had a very cyclical character. The lowest level of sunflower yield was in 2005, that was directly associated with adverse weather conditions. Peak of yield came in 2012 – 22.6 c/ha, which is 5 kg higher than in 1990.

The main direction of increasing the yield of sunflower in modern conditions is the introduction of intensive technologies, based on the performance of complex manufacturing operations in a timely manner by carefully agronomic requirements. Important components of the intensity of sunflower seed production are the use of high-performance varieties and hybrids. In 2011–2012 in studied farms in the Kharkiv region it was used hybrids: Mehasan (yield of 37.2 c/ha), Opera PR (33.1 c/ha), KVS Helium 06 (32.8 c/ha), Noah (24.3 c/ha), Kharkiv 58 (19.5 c/ha) and others.

Constant fluctuations in the yield of sunflower occurred due to lack of fertilizers. Thus, on 1 hectare of sown area of sunflower in 1990 there were made 137 kg of mineral fertilizers. Due to the economic crisis of the 90's in 2000 for 1 ha of sunflower it was made only 2 kg of mineral fertilizers.

Since 2001, there had been a positive trend, and in 2012 the number of fertilizer made under the harvest of sunflower was already 45 kg on 1 ha. The formation of sunflower harvest it made from the soil with nitrogen: in the whole of the Kharkiv region – 50 kg per 1 ha; in JV agricultural firm «Hliborob» – 47; LLC «Agricultural Investment Company «Balinvest» – 40; Ltd. Agricultural firm «Borshchivske» – 55 kg per 1 ha. Number of exchangeable potassium, which is needed during the growing season of sunflower reaches respectively 210; 200; 170 and 230 kg per 1 ha. With the harvest is made only 9 % of potassium and 91 % – for stubble. If these crop residues are plowed into arable layer, in the process of mineralization nutrition will eventually return to the soil.

During assessing the degree of compliance with the agronomic requirements and conditions of sunflower production in JV agricultural firm «Hliborob» of Volchansk district, Ltd Agricultural company «Borshchivske» and LLC «Investment agrarian company «Balinvest» of Balakliya district of Kharkiv region it was used evaluative-

situational approach that was an expert evaluating performance on a five point scale, determining the accuracy of estimates, the average assessment of compliance with the requirements, indicators of the quality factor.

As a result of the calculations of JV agricultural firm «Hliborob» average rating of conditions for sunflower production was 4.26 (in 2011) and 3.30 points (2012), the quality factor respectively 0.858 and 0.660. That is the necessary conditions on the farm – 85.8 (in 2011) and 66.0 % (2012); in Ltd. in the Agricultural firm «Borshchivske» – by 87.8 and 71.1 %; in LLC «Agricultural Investment Company «Balinvest» – 86 and 73.4 %. We should also note the reduction of the necessary conditions for sunflower production in 2012 (agricultural firm JV «Hliborob» – 19.8; Ltd Agricultural company «Borshchivske» – 16.7, LLC «Agricultural Investment Company «Balinvest» – 12.6 %). These changes were primarily due to deterioration in the quality of technical support farms.

During the study, 467 agricultural enterprises of the Kharkiv region over 2012 it was determined that one of the elements characterizing the concentration of production, is the value of gross yield of sunflower. Gross fees largely characterize the level of intensity, as related to the level of productivity of this crop. Results of the study indicate that the value of achieving gross fees of 20 thousand of metric center there is a clear trend in increasing yields.

The highest yield was in the group with gross collection more than 30 thousand of metric center. The average area of planting sunflowers in these enterprises was amounted 740.6 hectares. It was noted in this group the largest value of the cost of 1 ha of cultivated area and, consequently, one of the outputs of marketable products. The biggest profit was obtained in the group with gross 15.1–20.0 thousand of metric center. This group is characterized by one of the highest rates of profitability (72.9 %).

The total intensity of production consists of individual cost elements, each of which affects the final performance. By analyzing the costs of seeds, fertilizers and petroleum products methodical approach was used, the essence of which is to determine the effect of each item of expenditure, which was obtained by multiplication of the profits from sales of sunflower and the proportion of each cost element in their overall value. On the example of the agricultural enterprises of the Kharkiv region it was defined relationship between selected elements of cost and profit margin of 1 ha, which was nonlinear and described a parabola of 2<sup>nd</sup> order:

- by cost of seeds per 1 ha:

$$y = -20.718 + 1.1626x - 0.0002x^2 \quad (t_f(2,62) > t_f(1,65)); \quad (1)$$

- by cost on fertilizers per 1 ha:

$$y = 41.076 + 0.954x - 0.0002x^2 \quad (t_f(5,22) > t_f(1,65)); \quad (2)$$

- by cost of petroleum products:

$$y = 82.233 + 1.0462x - 0.0003x^2 \quad (t_f(3,90) > t_f(1,65)). \quad (3)$$

All dependences were tested using Student's test (t), which made it possible to ensure their reliability. Based on the study of functions it was defined optimal value of overall level of intensity and major cost elements that for seed was

2906.50 UAH/ha; mineral fertilizers – 2385; oil – 1743.67 UAH/ha. These values make it possible to find out the average level of efficiency in the existing level of management in the region.

The level of cost efficiency by mineral fertilizers with calculating the break-even cost point using the graphical method. For this purpose, by dividing the average cost of fertilizers per 1 ha in money in average number of their application in kind, it was calculated the average price of 1 kg of mineral fertilizers, which accounted for 14.56 USD. Next, it was calculated the amount of normative expenditure of fertilizers per 1 hectare by multiplying the price of fertilizer to 120 kg (by the standards of the NSC «Institute of Agrarian Economy») and received 1747.2 UAH. On the next step of calculation the cost on mineral fertilizers for each of the enterprise was compared with the norm and in case of differences it was corrected to a given value. Thus, this value cost of mineral fertilizers was taken as fixed cost. Taking this into account, it was determined that under these conditions the break-even level of production will be 12.4 c.

Compliance with regulatory requirements for fertilization in sunflower will promote the creation of environmental assessment mechanism of production of this crop by calculating the relevant factor, which is determined by searching the square root of the product of the coefficient of restitution of nutrients and coefficient of the using areas under sunflower:

$$Ke = \sqrt{Krn \cdot Kalu} , \quad (4)$$

where  $Ke$  – coefficient of environmental production;  $Krn$  – coefficient of restitution of nutrients;  $Kalu$  – coefficient of arable land usage.

$$Krn = 2 - Nmf : Nof , \quad (5)$$

where 2 – conditional value, which indicates that the coefficient of restitution of nutrients will be equal to the unit if the amount of actual fertilizers matches the normative or exceeds it;  $Nmf$  – the number of actual mineral fertilizers, kg;  $Nof$  – standard for application of fertilizers (120 kg).

By the calculation of the coefficient of restitution of nutrients we based on the fact that the standard value of fertilizer of 120 kg per 1 ha was set by the need to restore the entire removal of nutrients. The higher figure of actually made fertilizers would be closer to the standard value, the more the coefficient of restitution of nutrients will be close to one.

$$Kalu = 1 + Aa : Al - 0.1. \quad (6)$$

where 1 – conditional value, which shows that the coefficient of arable land usage will be equal to the one in case where the specific weight of sunflower in arable land structure is 10 %;  $Aa$  – actual sunflower sowing area, ha;  $Al$  – area of arable land in the enterprise; 0.1 – the specific weight of sunflower in the structure of arable land.

The total value of environmental coefficient should take into account both its elements that are suggested to determine. This ratio reveals troubled economy: those who made under sunflower fertilizers, less than the standard value; those with a share



of sunflower in the structure of arable land over 10 %. Practical use of coefficient may be associated with the development of the state strategy concerning control policy for compliance of arable lands and reproduction of soil fertility.

As a result of environmental coefficient calculations for all enterprises of Kharkiv region it was received value in the range of 0.399 to 1.95. In the studied enterprises the coefficient was: in JV Agricultural firm «Hliborob» – 1.24; in LLC «Investment Company «Balinvest» – 1.36; Ltd. Agricultural firm «Borshchiv» – 1.63. That is the ecological coefficient in the studied farms is within the value received in the whole from the agricultural enterprises of the Kharkiv region, confirming the correctness of the made calculations.

**Conclusions.** It was systematized indicators and criteria that characterize the effectiveness of sunflower production based on reasonable mechanism of formation of technological, economic, environmental and social effects. Methodical approach to evaluating the effectiveness of certain cost elements of agricultural enterprises was improved, which determines the share of net income caused by these costs, and their optimum value per unit of land area. It was found that the optimal value of expenditures on seed in agricultural enterprises of the Kharkiv region in 2012 was 2906.50 UAH/ha; mineral fertilizers – 2385; petroleum products 1743.67 UAH/ha. There was determined the dependence of efficiency on the concentration of sunflower production based on statistical indicators proving of materiality differences for various groups of enterprises, that were systematized by different criteria of concentration. It was substantiated conceptual bases of increasing efficiency of sunflower production in the agricultural enterprises with control of compliance with environmental requirements on the basis of environmental coefficient, which takes into account factors of arable lands structure and reproduction level of soil fertility. A calculation of environmentally friendly coefficient of sunflower production was proposed, which also takes into account the level of performance of each enterprise of standards to restore nutrients in the soil and sunflower share in the structure of arable land. As a result of the definition of common environmental coefficient of the sunflower production according to appropriate method it was detected: the higher coefficient from zero, the higher level of abuse of technological and environmental conditions under the production of sunflower. Calculations showed that this coefficient, in all enterprises of the Kharkiv region has a value between 0.399 to 1.95. Testing methods on the example of the agricultural enterprises of the Kharkiv region found that the smaller the environmentally friendly environmental coefficient, the greater amount of profit and sunflower yields were obtained by enterprises.

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