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Analytical assessment of sunflower production in ukraine

Abstract. The article considers the current state of sunflower production in Ukraine. The main indicators of the industry, the dynamics of changes in the area of sunflower crops, yield and profitability are analyzed. The main factors influencing the production of sunflower using index analysis have been studied. The regional structure of sunflower production is considered with the separation of groups of enterprises by organizational form. Ukrainian enterprises are provided with proposals to increase the level of industry development and production.

Key words: sunflower, production, area, yield, market, profitability, index analysis

Introduction

Oilseeds are an important part of the economy of many countries. The world market of oilseeds is represented by three main crops: soybeans, rapeseed and sunflower[1]. Ukraine retains the status of the world's largest producer and exporter of sunflower oil. With regard to unrefined sunflower oil, its production was one of the fastest-growing segments of the Ukrainian agricultural market last year. 25% of world production of sunflower or 60% of world export of sunflower oil belongs to Ukraine[2]. Ukraine's position on the world market of oilseeds is characterized by growing production rates, increasing processing capacity, rapid modernization of technological processes.

However, sunflower production in Ukraine in 2020 decreased by almost 15%. At the same time, there is a significant increase in exports of raw materials while increasing the price of it. The profitability of sunflower in 2020 was 34.4% and became the highest in recent years.

The purpose of the article is to monitor the production and sale of sunflower production in Ukraine, study the main problems, determine further prospects for development in the context of European integration.

[1] OECD-FAO Agricultural Outlook 2020-2029, http://www.oecd.org, access: 12.09.2021.
[2] I. Chekhova: World trends of oil market development 2020, HTTP://REP.BTSAU.EDU.UA/BITSTREAM/BNAU/5579/1/ED_ISSUE_3_2020_NEW.PDF#PAGE=54, ACCESS: 12.09.2021.

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Research methods

The following general and special methods of cognition were used during the research: system approach - to determine the object and subject of research; logical analysis – to study the role of sunflower production in the economy of Ukraine; abstract--logical – in the theoretical generalizations of the works of scientists; method of statistical grouping and index analysis - to divide the set of agricultural enterprises – sunflower producers into typical groups in order to comprehensively characterize their condition, the relationship between factors and resultant signs; graphic and tabular - while providing clarity of the research material.

Research results

The agro-industrial complex in general and the domestic oil and fat industry in particular are a functional part of the entire national economic complex. It has significant resources to increase the efficiency of socio-economic development of the country by encouraging investment, creating new jobs, providing social guarantees to employees, introducing innovations, producing raw materials for the development of other industries, providing foreign exchange earnings and forming a positive image of Ukraine as the world's largest exporter of sunflower oil[3].

The main oilseeds in Ukraine are sunflower, rapeseed and soybeans. Other crops – spring rape, oil flax, dye safflower, red, mustard, make up a small proportion and not all are reflected in the statistical accounting. The main oil crop grown in Ukraine is sunflower, which accounted for 71% of the gross harvest in the structure of oilseeds in 2020 (Fig. 1).

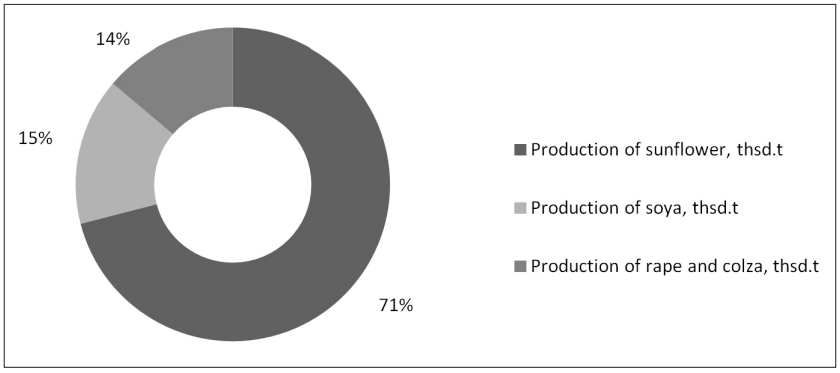

Figure 1. The structure of oilseeds production of 2020 in Ukraine, thsd. t

Source: calculated on the basis of State Statistics Service of Ukraine, http://www.ukrstat.gov.ua, access: 12.09.2021.

[3] V.F. Petrychenko, I.S. Voronetska: Oilseed production in Ukraine: current challenges and prospects 2017, http://www.eapk.org.ua/sites/default/files/eapk/2017/10/eapk_2017_10_p_32_40.pdf, access: 12.09.2021.

The peculiarities of sunflower cultivation are that it is a completely export-oriented crop with high profitability. Sunflower production has been growing steadily since the 1990s (Fig. 2).

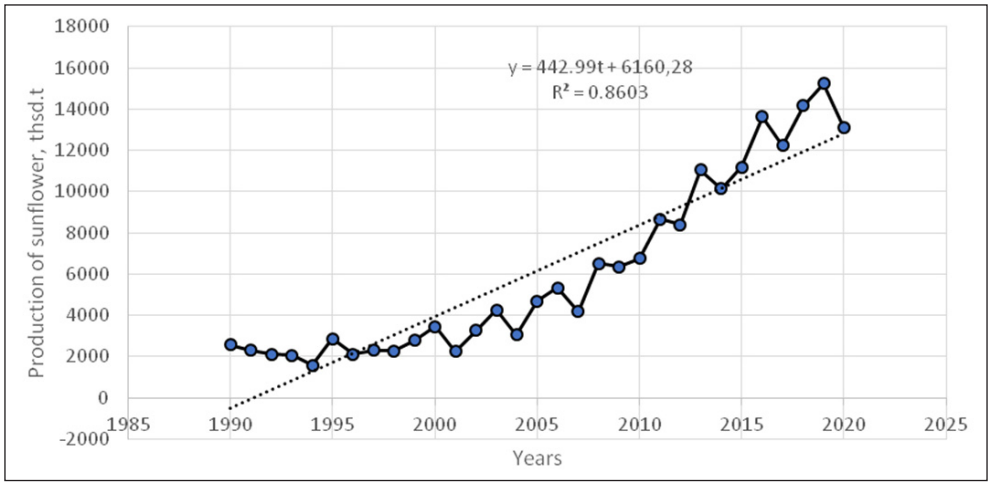

Figure 2. Dynamics of production of sunflower, thsd. t.

Source: calculated on the basis of State Statistics Service of Ukraine, http://www.ukrstat.gov.ua, access: 12.09.2021.

Despite small fluctuations in sunflower production in Ukraine, there is a stable trend towards increasing its production capacity. In 2020, sunflower production increased by 10,539.6 thousand tons compared to 1990 and by 9,653 thousand tons compared to 2000.

We evaluated the dynamics of production using the method of economic-mathematical modeling was used – analytical alignment of dynamic series. In practice, such alignment is carried out by the least squares method, the essence of which is to find such a line, the ordinates of which points would be closest to the values of the actual dynamic series. In this case, the model will look like this:

$$y = a + bt$$

where:
y – aligned levels of the dynamic times;
a – Aligned averages in zero year (provided that t = 0);
b – average annual increment;
t – segments, or moments of time.

Based on the analysis, it was found that on average during the study period, sunflower production increased annually by 442.99 thousand tons.

The main indicators of production and profitability of sunflower are given in table 1.

Table 1. Dynamics of indicators of production and profitability of sunflowers in Ukraine, 2018-2020

Indicator	2018	2019	2020	Growth rate for 2018–2019, %	Growth rate for 2019–2020, %
Sown area under sunflower, thousands hectares	6117	5928	6457	96.91	108.92
Production of sunflower, thousands tonnes	12193.6	13088.6	11492.9	107.34	87.81
Yield of sunflower, centners per hectare of the harvested area	23	25.6	20.2	111.30	78.91
Profitability level of sunflower in enterprises, per cent	32.5	23.5	39.4	72.31	167.66

Source: calculated on the basis of State Statistics Service of Ukraine, http://www.ukrstat.gov.ua, access: 12.09.2021.

Table 1 shows that the growth rate of the area under sunflower was 96.91% in 2019 compared to 2018 and 108.92% in 2020 compared to 2019. Areas under sunflower exceed the norms recommended by scientists, which is due to the high profitability of its cultivation. Accordingly, it causes soil depletion and the need for additional fertilizers. A significant share of areas under sunflower crops is due to the high level of profitability of its production and significant global demand for vegetable fats.

Yield per 1 hectare of harvested area increased by 11.3% in 2019 compared to 2018, but in 2020 decreased by 21.09% and amounted to 20.2 centners per hectare. The volume of gross harvest of sunflower in Ukraine in 2020 decreased by 12.19%, compared to the previous year and amounted to 11492.9 thousand tons. Analyzing the data, we can conclude that the volume of production increases by extensive method, ie by increasing the sown area. The profitability of sunflower production in 2020 was the highest for the study period – 39.4%, which is 67.66 percentage points more than in 2019. The high level of profitability of growing this crop and producing oil from it is due to the minimal production costs and relatively high selling price.

In the current 2020/21 season, there is a decrease observed in sunflower oil production, which is driven by a drop in the production of sunflowerseeds and a decrease in their oil content as a result of the long-term negative impact of the dry weather conditions[4].

According to USDA estimates, Ukraine produced 7.05 mln t of sunflower oil (refined and unrefined) in 2019/20 and thus maintains its top spot, outpacing its closest competitor by nearly a quarter[5].

In a crisis, the problem of increasing gross harvest and increasing the efficiency and competitiveness of sunflower production remains one of the central problems of agri-

[4] Yu. Kernasiuk: Oilseeds: market trends 2020, http://agro- business.com.ua/agro/ekonomichnyi-hektar/item/15275-oliini-kulturytendentsii-na-rynku.html, access: 12.09.2021.
[5] U.S. Department of Agriculture, https://www.usda.gov, access: 12.09.2021.

cultural production. Its solution is directly related to the implementation of a wide range of measures to ensure stable yield growth, improve the quality of oilseeds, rational use of material, financial and labor resources of the enterprise, highly qualified organization of the production process.

To assess the impact of factors on sunflower production, we used index analysis (tab. 2). Index numbers are statistical devices designed to measure the relative changes in the level of a certain phenomenon in two or more situations

Table 2. Dynamics of indicators of production of sunflowers in Ukraine, 2019-2020

Indicator	Sown area, thsd. ha		Yield, c per ha		Production, thsd. t		
	Base year	Reporting year	Base year	Reporting year	Base year	Reporting year	Conditonal year
	S_0	S_1	Y_0	Y_1	Y_0S_0	Y_1S_1	Y_0S_1
Sunflower	5928	6457	25.6	20.2	15175.68	13043.14	16529.92

Source: calculated on the basis of State Statistics Service of Ukraine, http://www.ukrstat.gov.ua, access: 12.09.2021.

Calculate the index of gross products:

$$I_{yS} = \frac{\sum y_1 S_1}{\sum y_0 S_0} = \frac{13043{,}14}{15175{,}68} = 0{,}859$$

The absolute increase in gross production is defined as the difference between production in the reporting and base years:

$$\ddot{A}_{yS} = \sum y_1 S_1 - \sum y_0 S_0 = 13043{,}14 - 15175.68 = -2132{,}54\ centners$$

Gross harvest of sunflower in the reporting period compared to the base decreased by 14,1%, which is 2132.54 centners.

The change in gross harvest depends on two main factors - the yield of sunflower and the size of the sown area[6]. Accordingly, the gross harvest index can be represented as the product of the area ratio and the yield index:

$$I_{yS} = I_y * I_S\ \ddot{A}_{yS} = \ddot{A}_y + \ddot{A}_S$$

Determine the index of the size of the sown area:

$$I_S = \frac{\sum S_1}{\sum S_0} = \frac{6457}{5928} = 1.089$$

[6] A.L. Andriienko, O.O. Andriienko: Sunflower: Ukraine and the world. Agronomy today, “Sunflower” 2020, no 16, p. 7-13.

The absolute increase in yield is determined by the formula:

$$\ddot{A}_S = \left(\sum S_1 - \sum S_0\right) Y_0 = (6457 - 5928) * 25{,}6 = 1354{,}24\ centners$$

Due to the increase in the size of the sown area in the reporting period compared to the baseline by 8.9%, the gross harvest increased by 1352.4 centners.

The size index of the sown area can be determined by another formula:

$$I_S = \frac{y_0 \sum S_1}{y_0 \sum S_0} = \frac{16529{,}92}{15175{,}68} = 1{,}089$$

The absolute increase in yield is equal to:

$$\ddot{A}_S = 16529{,}92 - 15175{,}68 = 1354{,}24\ centners$$

The change in the gross harvest in the reporting period compared to the baseline also depends on the change in the actual yield of individual crops with the same structure of sown areas.

$$I_y = \frac{\sum y_1 S_1}{\sum y_0 S_1} = \frac{13043{,}14}{16529{,}92} = 0{,}789$$

In this case the absolute increase is equal to:

$$\ddot{A}_y = \sum y_1 S_1 - \sum y_0 S_1 = 13043{,}14 - 16529{,}92 = -3486{,}78\ centners$$

Thus, the gross harvest in the reporting period compared to the base due to changes in sunflower yield decreased by 21.1%, which in absolute terms is 3486.78 centners.

Nowadays, the most productive and high-oil varieties and hybrids of sunflower are grown only in the most heat-supplied areas of state. This mostly applies to Mykolayiv, Zaporizhia, Dnipropetrovsk, Kherson, Odesa, and Kirovohrad regions. At the same time, about 90% of the total commodity production of sunflower oil seeds is concentrated in three regions: Dnipropetrovsk, Kirovohrad and Kharkiv. The role of Dnipropetrovsk region in sunflower production in Ukraine is traditionally significant. This region occupies about a third of Ukraine's agricultural land and ranks 3rd in the production of sunflower seeds by agricultural enterprises of the country (fig. 3).

In the structure of agricultural enterprises according to the sowing of sunflower, the largest number falls on enterprises with an area of up to 100 hectares – 58.1 percent (tab. 3). There is a direct relationship between the amount of sown area and yield. Sunflower yield varies from 16.4 c/ha (enterprises with an area of up to 100 ha) to 24.7 c/ha (enterprises with an area of 2000.01 to 3000 ha).

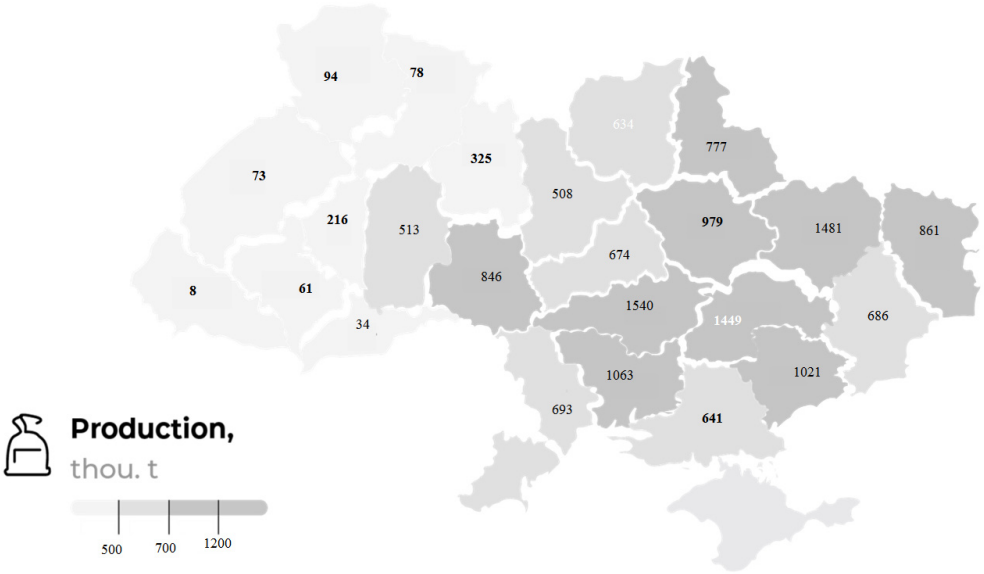

Figure 3. Sunflower production in the regions 2020, thsd. t.

Source: calculated on the basis of Latifundist Media, https://latifundist.com, access: 12.09.2021.

Table 3. Groupings of enterprises by harvested area size under sunflowers, 2020

Number of enterprises by harvested area size, ha	Number of enterprises		Gross harvest		Yield, centners per ha
	units	percentage to total number	thsd. t	percentage to total gross harvest	
no more than 100.00	12692	58.1	771.2	6.7	16.4
100.01–200.00	2894	13.2	829.3	7.2	19.6
200.01–500.00	3424	15.7	2267.4	19.8	20.7
500.01–1000.00	1704	7.8	2496.8	21.7	20.8
1000.01–2000.00	824	3.8	2458.9	21.4	22.1
2000.01–3000.00	181	0.8	1070.9	9.3	24.7
more than 3000.00	137	0.6	1598.4	13.9	24.6

Source: calculated on the basis of State Statistics Service of Ukraine, http://www.ukrstat.gov.ua, access: 12.09.2021.

The largest share – 74% of sunflower production is produced by agricultural enterprises, 16% - farms and 10% – households (fig. 4).

The leader in terms of sunflower production in Ukraine is the Kharkiv region – 1611.8 thousand tons, and the lowest production was recorded in the Transcarpathian region – 7.6 kg / ha (tab. 4).

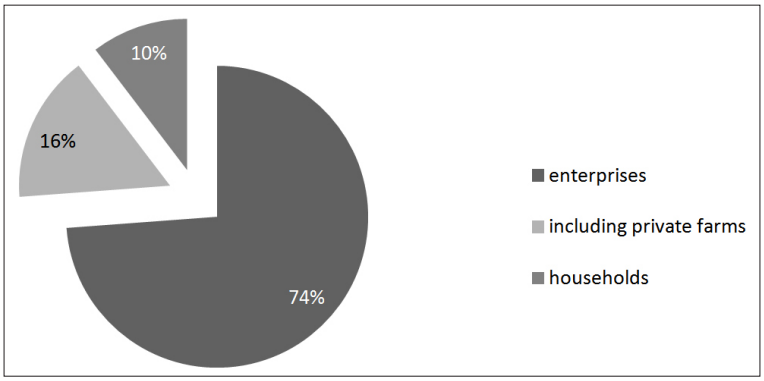

Figure 4. Structure of sunflower production by categories of enterprises, 2020

Source: calculated on the basis of State Statistics Service of Ukraine, http://www.ukrstat.gov.ua, access: 12.09.2021.

Table 4. Production of sunflower by types of agricultural holdings and regions, 2020

Regions	Production of sunflower by households		Production of sunflower by private farms		Production of sunflower by enterprises	
	thsd. t	%	thsd. t	%	thsd. t	%
Vinnytsya	24.4	2.57	175.7	18.51	749	78.92
Volyn	0	0.00	23.7	19.02	100.9	80.98
Dnipropetrovsk	117.7	9.19	267.6	20.89	895.8	69.92
Donetsk	112.9	16.57	109.5	16.07	458.9	67.36
Zhytomyr	37.5	9.99	29.5	7.86	308.5	82.16
Zakarpattya	1.1	14.47	1.2	15.79	5.3	69.74
Zaporizhya	206.5	20.77	167.1	16.80	620.8	62.43
Ivano-Frankivsk	0.3	0.41	9.2	12.52	64	87.07
Kyiv	4.5	0.86	67.5	12.92	450.3	86.21
Kirovohrad	246.5	18.89	271.7	20.82	786.6	60.29
Luhansk	110.2	12.74	186.4	21.56	568.1	65.70
Lviv	–	0.00	10.9	11.39	84.8	88.61
Mykolayiv	182.6	21.64	151.8	17.99	509.3	60.37
Odesa	86	15.50	101.8	18.35	366.9	66.14
Poltava	111.4	9.82	160.6	14.15	862.7	76.03
Rivne	–	0.00	4.8	4.51	101.7	95.49
Sumy	20.9	2.13	101.2	10.31	859.2	87.56
Ternopil	–	0.00	25.4	8.17	285.4	91.83
Kharkiv	115.6	7.17	256	15.88	1240.2	76.95
Kherson	195.8	31.53	89.4	14.40	335.8	54.07
Khmelnytskiy	1.1	0.17	65.9	10.38	567.7	89.44
Cherkasy	30.3	4.58	92.7	14.01	538.5	81.41
Chernivtsi	11.2	18.06	9.4	15.16	41.4	66.77
Chernihiv	1	0.13	86.4	11.10	691.1	88.77

Source: calculated on the basis of State Statistics Service of Ukraine, http://www.ukrstat.gov.ua, access: 12.09.2021.

Sunflower production is heterogeneous and depends on natural areas. The size of variation in the country is – 1604.2 t / ha, the coefficient of variation – 68.85% indicates the heterogeneity of the population. Household sunflower production is characterized by a variation of 116.4%. In particular, in 4 oblasts there is no production in enterprises of this form of ownership – Volyn, Lviv, Ternopil and Rivne. Most households produce in the Kirovohrad region - 246.5 thousand tons.

The leader in the production of sunflower in private farms is also Kirovograd region – 271.7 thousand tons. The lowest production in the Transcarpathian region – 1.2 thousand tons. The coefficient of variation – 83.2 percent.

Kharkiv region is the leader in sunflower production in agriculture enterprises – 1240.2 thousand tons. The outsider is the Transcarpathian region with a production volume of 7.6 thousand tons. For enterprises of this organizational form, the size of variation is smaller, but it is heterogeneous too. The coefficient of variation is 67.8 percent.

Summary

Sunflower cultivation is characterized by insignificant fluctuations in the area under crops and sunflower yields in Ukraine over the past three years. In 2020, despite the record sown area under cultivation of 6.6 million hectares, the production potential of sunflower was not fully realized. Arid weather conditions negatively affected not only the yield but also the oil content. On average during last 30 years, sunflower production increased annually by 442.99 thousand tons. The gross harvest in 2020 compared to 2019 due to changes in sunflower yield decreased by 21.1%, which in absolute terms is 3486.78 centners. Due to the increase in the size of the sown area in the 2020 compared to 2019 by 8.9%, the gross harvest increased by 1352.4 centners.

The main share of sunflower production is concentrated in agricultural enterprises. The factor that stimulates the realization of the available potential and increase economic efficiency is the intensive nature of the development of sunflower production in Ukraine. The main advantages of sunflower production in the market of agricultural crops are stable high demand for the crop, high prices in the domestic market. At the same time, there are a number of problems that farmers and domestic consumers face and need to be addressed. First of all, it is the expansion of sown areas and violations of agricultural techniques for growing oilseeds. For example, according to the rules of crop rotation, re-cultivation of sunflower on the same area is possible only after 7 years. Otherwise, soil fertility and yield are threatened. Instead, farmers use mineral fertilizers and a range of chemicals[7].

In order to obtain high sustainable gross yields of sunflower seeds and provide raw materials for the oil and fat subcomplex, both to meet the needs of the domestic market and to increase export potential, it is necessary to change the structure of oilseeds by strictly adhering to science-based crop rotation and gradually increasing yields. Sun-

[7] Sunflower fertilizer system, http://nasinnevabaza.com/ua/news/sistema-udobrenija-podsolnechnika, access: 12.09.2021.

flower due to the use of high-quality seed material, the introduction of resource-saving, innovative cultivation technologies and measures of economic incentives for workers to obtain high yields and oilseeds.

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