Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 21, Issue 1, 2021
PRINT ISSN 2284-7995, E-ISSN 2285-3952

THE ECONOMIC EFFICIENCY OF SUNFLOWER SEED PRODUCTION IN UKRAINE: STATE AND PERSPECTIVES

Tetyana KUTS, Oksana MAKARCHUK

National University of Life and Environmental Sciences of Ukraine – NULES of Ukraine, 11 Heroyiv Oborony, Kyiv 03041 Ukraine, Phone/Fax:+38(098)4781163; Phone/Fax:+38(096)2382548; E-mails: tetyana_kuts@nubip.edu.ua, makarchukoks@gmail.com

Corresponding author: tetyana_kuts@nubip.edu.ua

Abstract

This paper aims to provide analysis of current state and perspectives of the economic efficiency of sunflower seed production in Ukraine. There are investigated economic efficiency indicators of sunflower production in contemporary conditions; price analysis; main factors of further development of sunflower growing. According to the research results, the world market of sunflower seed and products of its processing (i.e. oil and meal) is developing rapidly. Ukraine occupies a significant place in this market segment. Our research has shown the close integration of the Ukrainian sunflower, oil and meal markets with world markets. The supply of sunflower seed depends primarily on production volumes and demand is determined by the consumption level of Ukrainian processing enterprises. Production cost influence significantly on the economic efficiency of sunflower seed. In this framework we analyzed one of production cost component - crude oil prices that in turn reflect on sunflower seed prices. Co-integration results showed that in the long-run Ukrainian sunflower seed could follow crude oil prices in common path.

Key words**:** *economic efficiency, profitability, sunflower seed, oil, production, cost*

INTRODUCTION

Sunflower production is an important and profitable area of the crop industry in Ukraine. Sunflower seed contains 48-50% fat, 16-19% protein and the yield of oil for industrial processing reaches about 50%. Sunflower oil is widely used in the food production (margarine, canned food, bread, confectionery) and in soap, paint and other industries. During the processing, the companies in addition to vegetable oil, get cake or meal that is valuable feed in animal husbandry.

Nowadays sunflower is remained a priority raw material for oil processing enterprises, which are actively increasing their capacities. Due to state regulation of the sunflower market in Ukraine, where in 1999 was introduced export duty for sunflower seed in the volume of 23% from the customs value according to the Law of Ukraine "On export rates (export) duties on seeds of certain types of oilseeds cultures" (from 10.09.1999, No. 1033-XI), sunflower seed is entirely aimed for processing domestically. After joining to the World Trade Organisation (WTO) in 2008, Ukraine is remained export duty for sunflower seed, however from the beginning of 1 January 2007 it was yearly decreased on 1% to reach 10% [11].

In such circumstances, we can observe a stable demand for sunflower seed from processing plants. Thereby, special attention in the article will be paid to the questions on how this market situation affects the sunflower seed profitability; and whether agricultural enterprises have taken advantages of the future economic opportunities to improve their economic efficiency indicators.

The economic efficiency of sunflower seed production and its processing depends on a complex set of natural, economic, technological, scientific, technical and other factors. Specialized literature indicates that the transition of production to the cultivation of high-yielding hybrids and sowing dates optimization allow significantly improve the production profitability, and at the same time reduce the cost of seeds and increase profit [9, 12].

The issue of economic efficiency of sunflower production is the subject of research by many Ukrainian and foreign authors. The research findings of Gerasymchuk and Mirzoeva (2017) revealed that in last years in Ukraine the increase the economic efficiency of sunflower seed production was attained due to the production intensification [5]. According to Chekhova (2018), evaluation of economic indexes (profitability, cost, competitive position) and production components (seed quality, efficient technologies, technological modernization, production diversification) will be allowed to implement existing ones and search for new reserves to increase economic efficiency of oilseeds production [2]. Among factor competitiveness of oilseeds at the industry level are offered: formation of state regional and sectoral medium-term seed production programs of oilseeds; the introduction of innovative energy saving technologies; modern high-yielding varieties and hybrids of plants; ensuring the availability of agricultural lending enterprises.

Galushko et al. (2017) focused on researching issues about break-even price of sunflower seed depending on yield, cost of crop growing and the projected market situation. Due to proposed methodological approaches the market of crop products could be monitored and developed strategies to support agricultural producers, taking into account tax policy, internal and external conditions in food markets [4].

Rotaru and Nastase (2014) suggested that technological processes are interrelated with natural biological processes [16]. In contemporary conditions the effectiveness of intensive technology involves taking into account technical, economic, energy and environmental criteria.

In the research of many scientists (Ilkiv, (2019), Makarchuk and Kuts (2020)) highlights the tendencies of growing the interconnection of the Ukrainian and world markets of sunflower oil [8, 10].

Mykhailov et al. (2020) analyzed sunflower seed production in Ukraine and details the technical equipment of post-harvest processing of sunflower seed; theoretical studies of the separation of airborne impurities; methodological aspects of research of experimental devices; results of laboratory and field studies of experimental devices and practical application of their efficiency and evaluation [12].

Popescu (2020) indicated that to enhance performance in oilseed sector, Romanian farmers have to adapt to the climate change taking into account some technological aspects: to use high earlier and production potential varieties and hybrids and resistant to drought, diseases and pests; to choose better sowing period depending on the soil moisture and temperature, to assure an optimum level of fertilization, crop maintenance and harvesting [15].

Therefore, improving the efficiency of Ukraine's economic activity in the field of oilseed production and oil products ensuring its competitiveness in the internal and external markets in the context of integration processes is also extremely important. The economic efficiency of sunflower seed was taken into consideration in the paper because it is actual subject in the point of view close relationship this market to the sunflower oil market where Ukraine positioning itself as leadership in sourcing to the world market.

The paper is organized as follows: Section 2 discusses the materials and methods of empirical investigation; Section 3 reports getting results and discussions; and Section 4 ends with conclusions of getting results.

MATERIALS AND METHODS

The purpose of the paper is to study the economic efficiency of sunflower seed production in Ukraine and determine main factors influencing the profitability of sunflower production; identification main trends in production, consumption and processing of sunflower seed.

Based on data of the State Statistics Service of Ukraine (2021), sunflower seed profitability decreased during last 5 years and in 2019 it was equaled to 23.5%, where in 2015 it was amounted to 80.5%. In these regards, we will consider which factors could negatively influence on economic efficiency of sunflower seed production.

The theoretical and methodological basis of the research were the basics of market economy, scientific works of Ukrainian and foreign scientists, methodology and system-wide principles of complex research.

One group of methods cover research that related to market analysis of sunflower seed: historical; abstract-logical; theoretical generalization; observation, graphical and tabular.

Assessment in the analyzed period covered the values of yield, cost of 1 quintal of product, selling price, level of income and profitability describing the efficiency of sunflower production in Ukraine.

Another group of methods related to the assessment the relationship between Ukrainian (UA) sunflower seed and crude oil prices. This dependence was taken into account in the frame of efficiency analysis of sunflower seed production in Ukraine to see how influence changes in crude oil prices on sunflower seed prices, taking into account that 12% in 2019 was equaled to fuel in the total production cost of sunflower seed. According to that the paper consists of an analysis of the price linkages between the UA sunflower seed and crude oil prices. The sources of data were the APK-inform (2021) and OPEC (2021) [1, 13].

Produced sunflower seed deliver mostly for processing domestically for sunflower oil, where as noted above, sunflower oil exports in the high level. To analyze UA sunflower seed prices with crude oil prices monthly price series data was used from January 2009 till January 2021 (Fig. 1).

As we can see in Fig. 1 the prices show how UA sunflower seed prices follow closely to crude oil prices. However, in some period of time could be observed the linkages between these prices, and another period of time we see not stable paths, and in some period of time UA sunflower seed prices were not followed crude oil prices.

From the figure we could also observe sharp decrease in crude oil prices, where contrary increase in UA sunflower oil prices, e.g. 2020. All variables were expressed in US dollar.

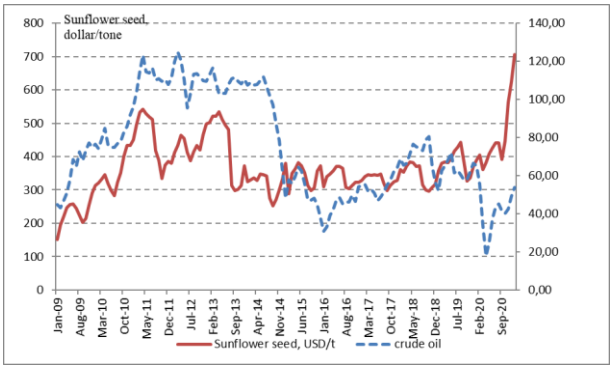

Fig. 1. Monthly UA sunflower seed price series and crude oil price series

Source: Built based on APK-inform and OPEC databases [1, 13].

The first stage of price series analysis was concerned to the statistical properties of price series. Augmented Dickey Fuller (ADF) test was applied (model with constant) to test series stationarity, where the null hypothesis states that time series is non-stationary (has unit root); the alternative is that stationary. This test statistic is based on tau-statistic of coefficient φ from OLS estimation of the following formula (Enders, 2001) [3]:

$$\Delta y_t = \alpha_t + \varphi y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + \varepsilon_t \quad (1)$$

where:

y_t – analyzed price series;

α_t – deterministic term (constant, trend);

p – the number of lags ensuring white noise properties of random component;

ε_t, δ_i – coefficients that describe the short-run persistence of Δy_t.

Further the ADF-GLS test was applied. In a first step, price series y_t is detrended and demeaned via a generalized method of least squares. In the second, the residuals of the equation ($\tilde{y}t$) are used for testing the unit root by using the ADF equation:

$$\Delta \tilde{y}_t = p\, \tilde{y}_{t-1} + \sum_{i=1}^{p} \delta_i \Delta \tilde{y}_{t-p} + \varepsilon_t \quad (2)$$

where:

ρ and δ are model coefficients,

p - maximum augmentation lag.

The value of the ρ coefficient in the formula (2) significantly different from the null one makes it possible to reject the null unit root

hypothesis (Hamulczuk M. et al., 2013; Hamulczuk M. et al., 2019) [6, 7].

The structural parameters of the model were estimated using the OLS. The purpose of the lagged components is to remove the autocorrelation of the random parameter. The number of lags was chosen with the use of Akaike's Information Criterion (AIC).

Next step we checked price series for cointegration. It takes possibility to identify the long-run relationship between researched price series. To test the existence of long-term relationship of series the Engle-Granger cointegration test was applied that is based on the following regression (Enders, 2001):

$$y_t = \beta_0 + \beta_1 x_t + \varepsilon_t \quad (3)$$

where:

x_t, y_t – variables tested for cointegration;

β_0, β_1 – structural parameters;

ε_t – residuals.

There is it could be stated about the cointegration between variables x_t and y_t if the residuals ε_t are stationary.

For a detailed systematization of the strengths and weaknesses of the UA sunflower seed market functioning and to generalize the opportunities and threats that affect it from the external environment, in the paper the SWOT analysis was used. The application of the SWOT analysis allowed substantiating the conclusions about perspectives of UA sunflower seed market, oil and cake at the national and international level.

RESULTS AND DISCUSSIONS

Market analysis of Ukrainian sunflower seed market. According to the results of our research and based on the balance of market demand and supply of sunflower seed, it should be noted that the Ukrainian market has been growing its capacity quite rapidly over the past 20 years (Fig. 2).

At the same time, the levels of supply and demand were mostly balanced. The supply of sunflower seed depends primarily on production volumes and demand is determined by the level of consumption by Ukrainian processing enterprises.

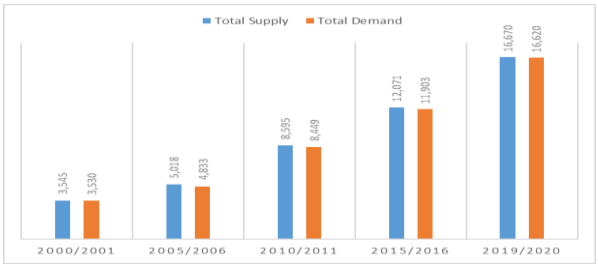

Fig. 2. Dynamics of supply and demand in the sunflower market in Ukraine, thousand MT

Source: Own calculation based on USDA-FAS (2021) [18].

In 2019, the harvest of sunflower was 16.5 MT, which was completely processed by oil and fat companies into oil. Thus, the share of production in total supply was about 99%, as well, as the share of domestic consumption in total demand. The dynamics of gross harvest growth occurs as a result of increasing sown areas and increasing yields. According to the results of the 2019/20 MY, the UA industry produced 7 million t of sunflower oil, where 6.4 million tons were exported (90%). Ukraine became the world leader in the production and export of sunflower oil during the analyzed period.

Export volume of sunflower oil from Ukraine to the EU has a growing tendency during the analyzed period. In 2019 it amounted near 1918 thousand t and the share of UA export of sunflower oil to the EU in total world export was equaled to 15.5% (Fig. 3).

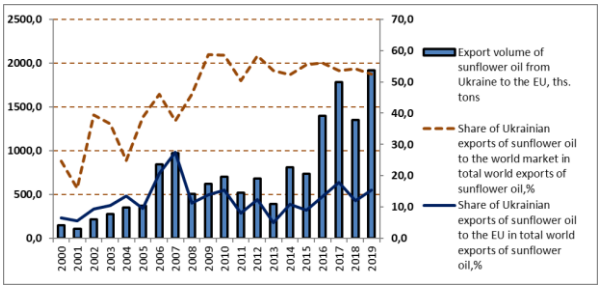

Fig. 3. Dynamics of the export volume of sunflower oil from UA to the EU and the share of it in the world export

Source: Own elaboration based on APK-Inform (2021) [1].

In 2019 EU countries became the largest importer of UA sunflower oil, where 31% of total exports were originated Ukraine. Big importers of sunflower oil from UA were also India (35%), China (14%), Iraq (7%) and other countries (13%) [17].

Thus, observing the tendency of sunflower oil production and export growing in the last decades, it is crucial important to analyze sunflower seed as the raw materials and the main part of sunflower oil cost structure (about 70%).

Our research shows that in Ukraine all categories of agricultural enterprises were engaged in sunflower production and they were increasing the level of sunflower yield each year: from 12.2 centners per ha in 2000 to 25.6 centners per ha in 2019 (Fig. 4).

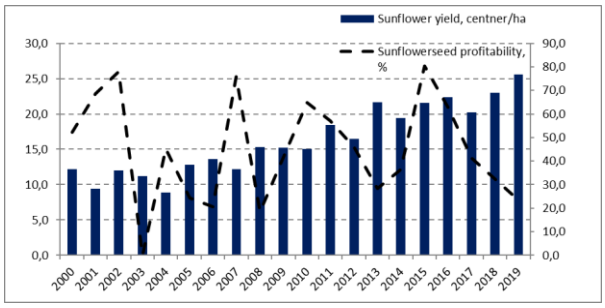

Fig. 4. Dynamics of sunflower yield and its profitability in Ukraine

Source: Own calculation based on the State Statistics Service of Ukraine (2020) [17].

According to the grouping of the enterprises by size of the sunflower harvested area in 2019, the largest share in the total production of sunflower were occupied by enterprises of third group (21.6%), fourth group (21.9%), fifth group (21.6%) (Table 1).

Table 1. Grouping Ukrainian enterprises by the size of sunflower area in 2019

Number of groups	Grouping enterprises by the area, ha	Number of enterprises		Volume of production		Yield, centner per ha
		units	in percentage to the total	thsd. tons	in % to total volume	
	Total	22,251	100.0	13,088.6	100.0	27.0
1	up to 100.00	13,602	61.1	1,051.2	8.0	21.8
2	100.01-200.00	2,821	12.7	1,090.2	8.3	26.4
3	200.01-500.00	3,313	14.9	2,830.2	21.6	26.8
4	500.01-1,000.00	1,510	6.8	2,865.6	21.9	27.1
5	1,000.01-2,000.00	736	3.3	2,819.5	21.6	27.9
6	2,000.01-3,000.00	175	0.8	1,178.5	9.0	27.9
7	more than 3,000.00	94	0.4	1,253.4	9.6	30.1

Source: Own calculation based on the State Statistics Service of Ukraine (2021) [17].

Indeed agricultural enterprises with a larger area of sunflower cultivation have higher yield, e.g. enterprises of group No. 1 (with a growing area up to 100 ha) received 21.8 centner per ha, group No. 4 (500 - 1,000 ha) - 27.1 centner per ha, group No. 7 (more than 3,000 ha) - 30.1 centner per ha.

The distribution of agricultural enterprises by size of sown areas is proved by technological and economic advantages of enterprises with a higher degree of concentration of the industry.

Sunflower is competitive oil crop. Its cultivation provides the agricultural enterprises with annual financial income and a fairly high level of profitability over the past 20 years in Ukraine.

This indicator was higher compared to grain, but its dynamic was not stable, the sharp decreases could be observed in 2005-2006, 2008, 2013 and 2019 [17].

Profitability indices depends on the level of market prices and the level of cost. We analyze the indices of economic efficiency during 2015-2019, when came conclusions about negative trend of profitability (Table 2).

Table 2. The economic efficiency of sunflower seed production in Ukraine

Indices	2015	2016	2017	2018	2019	2019 to 2015, %
Yield, centner per ha	21.6	22.4	20.2	23.0	25.6	118.50
Total cost of sunflower, UAH/t	3,621	4,483	6,266	6,795	6,542	180.67
Sales costs, UAH/t	402	515	720	816	816	202.9
Average selling price, UAH/t	6,535.9	7,307.3	8,854	9,003	8,079	123.61
Income, UAH/t	2,914.9	2,824.3	2,588	2,208	1,537	52.73
Profitability, %	80.5	63.0	41.3	32.5	23.5	X

Source: Own calculation based on the State Statistics Service of Ukraine (2021) [17].

The decline in the profitability of sunflower production was mainly due to some cost components increase.

During 2015-2019, average selling price for sunflower seed enlarged by only 20%, while the total cost of production was grew by 80%. Sales costs have doubled and its share in the cost was 12.5 %.

This situation led to significant losses of agricultural enterprises income.

In 2019 the cost structure contained the following components: direct costs – 54.6%, labor cost – 5.6% and other direct costs – 39.8%. In the structure of direct costs, a significant share was occupied by: inorganic fertilizers – 16.7%; seeds – 11.9% and oil products – 11.6% (Table 3).

Table 3. Cost structure of sunflower production in Ukrainian enterprises

Types of costs	2015	2017	2019
Total costs	100	100	100
Direct costs including:	70.8	56.7	54.6
- seeds	15.1	14.1	11.9
- mineral fertilizers	15.9	16.0	16.7
- oil products	12.9	10.5	11.6
- other direct costs	26.9	16.1	14.4
Labor costs	4.3	4.9	5.6
Other direct costs including:	24.9	38.4	39.8
- deductions on the social purposes	1.5	1.1	1.2
- depreciation of fixed assets	4.74	6.2	7.5
- payment of services and job of other organizations	-	8.1	8.1
- other direct and indirect costs	18.6	23.0	23.0

Source: Own calculation based on the State Statistics Service of Ukraine (2021) [17].

The main factors that restrained the increase in sunflower yield and the outpacing costs growth to sales prices are the low level of logistics and non-compliance with cultivation technology.

Price analysis. To analyze price series of Ukrainian sunflower seed and world crude oil, they were transformed into logarithmic data. First of all, stationarity of price series was tested using two tests: ADF and ADF-GLS. Results of these tests are presented in the table 4.

Table 4. ADF and ADF-GLS test results

Variable	ADF			ADF-GLS		
	tau	p-value	lag	tau	p-value	lag
l_UA_sun-flowerseed	-2.892	0.046	1	0.205	0.746	0
dl_UA_sun-flowerseed	-9.885	7.01E-01	0	-3.549	0.0003	0
l_crude_oil	-1.690	0.436	3	-1.108	0.244	4
dl_crude_oil	-8.356	4.39E-01	2	-8.209	1.32E-01	0

Source: authors' calculation.

Getting results from ADF and ADF-GLS tests showed that log levels are not stationary, because value tau for all variables are lower than critical value tau=3.398. Thus, we accept the null hypothesis about non-stationary of price series. In turn, first differences are stationary because the test statistics (tau) of the model for first differences of price series with a constant had following values: dl_UA_sunfloweseed – -3.549; dl_crude_oil – -8.209. Obtained values are bigger than the critical value tau=3.398 and it means that the null hypothesis was rejected for the first differences of price series. Thus, investigated price series are integrated in order one I(1).

At the next step we evaluated the nature of the linkage between Ukrainian sunflower seed prices and world crude oil prices due to the Engle-Granger co-integration test (Table 5).

Table 5. Engle-Granger co-integration test results

Specification	Cointegration equation UA-EU: $l\_UA\ Sunflower\ seed_t=5.88+0.1*l\_crude\ oil_t+\varepsilon_t$
Estimated φ	-0.0989
Tau-value	-1.7007
P-value	0.6779

Source: authors' calculation.

Obtained results for the model with constant ($l\_UA\_Sunflower\ seed_t = 5.88+ 0.1*l\_crude\_oil_t +\varepsilon_t$) confirms about existence of co-integration. In the obtained model P-value is higher than critical ones (0.05 or 0.01), thus it allows us to accept alternative hypothesis about co-integration of prices.

In the long-run it means that there is could be significant force for prices in common path.

Perspectives for Ukrainian sunflower seed production. Analyzing the economic efficiency of sunflower seed production in Ukraine, it is crucial important to find further trends taking into account internal and external factors.

Thus, we evaluated sunflower seed market based on SWOT analysis that in turn could facilitate to find significant advantages and opportunities for this sector.

Ukraine has enough land and economic resources to increase the supply of sunflower seed and meet the needs of the processing

industry. The competitive advantages of agricultural enterprises should also include a favorable geographical position for sunflower seed production (Table 6).

At the same time as was mentioned above, sunflower seed market in UA is regulated by the state. UA sunflower seed market is interdependent with UA sunflower oil and sunflower cake markets.

Table 6. SWOT analysis of Ukrainian sunflower seed market

Strength	**Weaknesses**
- availability of land and labor resources; - high technology processes that is used for production; - yield increase; - significant demand for seeds from processing companies in the domestic market; - favorable geographical position for production of seed; - protection of the domestic market through customs tariffs on sunflower seed.	- not sufficiency of working assets in producers; - low sunflower prices as a result of high supply; - high degree of competition between producers.
Opportunities	**Threats**
- production growth; - costs decrease due to implication of new technologies; - high competitiveness of the products; - demand for sunflower seed, oil and cake on external markets; - favorable geographical position for export deliveries of sunflower oil and cake; - prices increase.	- price and demand volatilities on the global market; - change in economic indicators of the macroenvironment; - weather conditions; - observance of crop rotations.

Source: Own conception.

Therefore, the active demand as in UA and worldwide for sunflower oil and cake will further determine its stability.

CONCLUSIONS

In next years, sunflower oil production industry will continue to influence sunflower seed prices, since about 95% of sunflower processed internally. Oil processing capacity is almost 5 million tons that is higher than real production, and farmers have no problems for selling sunflower seed.

The expected variation in sunflower sales prices will be influenced by the average sunflower oil export price and the average annual US dollar exchange rate on the market. Important to note that on sales prices could affect changes of cost structure component. In the paper the correlation between UA sunflower seed prices and crude oil prices was presented. As approximately 12% belongs to crude oil in total cost structure by sunflower producing, it was important to analyze whether changes in crude oil prices influence on UA sunflower seed prices. Results indicated high linkages between UA sunflower seed and world crude oil prices. The Engle-Granger co-integration test confirmed the long-run equilibrium relationship between these prices, where the model is $l\_UA\_{Sunflower\ seed_t}=5.88+0.1*l\_crude\ oil_t+\varepsilon_t$.

Further research should include the development of possible scenarios for the development of the sunflower market and the impact of COVID-19 on pricing in the market for both seeds and sunflower oil. The market conditions and price dynamics will further determine the trends in the efficiency of sunflower production.

REFERENCES

[1]APK inform, 2021, https://www.apk-inform.com/en/prices, Accessed on January 12, 2021.

[2]Chekhova, I., 2018, Propozytsiyi shchodo pidvyshchennya ekonomichnoyi efektyvnosti vyrobnytstva oliynykh kul′tur [Proposals to increase the economic efficiency of oilseeds production]. Institute of Oilseeds of the National Academy of Agrarian Sciences of Ukraine, 48 (in Ukrainian).

[3]Enders, W., Siklos, P. L., 2001, Cointegration and threshold adjustment. J. Bus. Econ. Stat. 19, 166–176.

[4]Galushko, V., Kovtun, O., Taranets, L., 2017, Otsinka efektyvnosti vyrobnytstva nasinnya sonyashnyku v umovakh rynkovykh vidnosyn [Estimation of efficiency of production of sunflower seeds in the conditions of market relations]. Actual problems of innovative economy, № 4 (in Ukrainian).

[5]Gerasymchuk, N., Mirzoeva, T., 2017, Ekonomichna efektyvnist′ vyrobnytstva sonyashnyku ta osnovni faktory yiyi zabezpechennya v sil′s′kohospodars′kykh pidpryyemstvakh [Economic effectiveness of sunflower production and main factors of its provisition at agricultural enterprises]. Visnyk Kyivskoho natsionalnoho universytetu tekhnolohii ta dyzainu – Bulletin of the Kyiv National University of Technologies and Design, 3(111): 31–40 (in Ukrainian).

[6]Hamulczuk M., Grudkowska S., Klimkowski C., Stanko S., 2013, Essential econometric methods of forecasting agricultural commodity prices. Institute of

Agricultural and food economics, National Research institute, № 90.1, 182.
[7]Hamulczuk, M., Makarchuk, O., Sica, E., 2019 Price Behaviour and Market Integration: Preliminary Evidence from the Ukrainian and European Union Rapeseed Markets. Problems of World Agriculture/ Problemy Rolnictwa Światowego, 19: 47-58.
[8]Il'kiv, L., 2019, Economichni aspecty vyrobnytstva sonyashnyku [Economic aspects of sunflower production]. «Young Scientist», № 10 (74): 661-665 (in Ukrainian).
[9]Kuts, T., 2016, Vytraty ta efektyvnist′ vyrobnytstva produktsiyi v sil′s′kohospodars′kykh pidpryyemstvakh (monitorynh) [Costs and efficiency of production in agricultural enterprises (monitoring). Collective monograph/ ed. O. Shpychak, 350 (in Ukrainian).
[10]Kuts, T., Makarchuk, O., 2020, Ukrainian Sunflower Market on the Background of EU and US Markets. Zeszyty Naukowe SGGW w Warszawie - Problemy Rolnictwa Światowego, 20 (35) (3): 4-15.
[11]Law of Ukraine «On rates of export (export) duty on seeds of the types of oilseeds») (Закон України «Про ставки вивізного (експортного) мита на насіння деяких видів олійних культур»), 2012, https://zakon.rada.gov.ua/laws/show/1033-14, Accessed on December 15, 2020.
[12]Mykhailov, Ye., Golebiewski, J., Kiurchev, S., Hutsol, T., Kolodii, O., Nurek, T., Glowacki, Sz., Zadosna, N., Verkholantseva, V., Palianychka, N., Kucher, O., 2020, Economic and technical efficiency of sunflower seed processing. Monograph. Warszawa. 158.
[13]OPEC, 2021, https://www.opec.org/opec_web/en/, Accessed on January 10, 2021.
[14]Prime cost of Ukrainian agricultural production in details, https://www.apk-inform.com/en/exclusive/topic/1502861, Accessed on October 5, 2020
[15]Popescu A., 2020, Oilseeds crops: sunflower, rape and soybean cultivated surface and production in Romania in the period 2010-2019 and forecast for 2020-2024 horizon. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol. 20(3), 467-477.
[16]Rotaru, G., Nastase, M., 2014, Analysis of sunflower production, at macro and microeconomic level. Case study. https://mpra.ub.uni-muenchen.de/61736/1/MPRA_paper_61736.pdf, Accessed on October 12, 2020.
[17]State Statistics Service of Ukraine (Ukrstat). http://www.ukrstat.gov.ua/, Accessed on January 2, 2021
[18]USDA-FAS, https://www.fas.usda.gov/, Accessed on January 5, 2021