

Economic Assessment and State Regulation of the Agri-industrial Sector in Ukraine: Solutions for Ensuring Food Security (Modeling and Analysis)

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ABSTRACT

The paper studies the dynamics of the relative production and consumption of the main agricultural crops in Ukrainian enterprises for 2017- 2021 years, in particular sunflower. The issues and provisions given in it may be used to analyze existing theoretical positions. Because of aggressive invasion of Russia, Ukraine suffers significant losses in agricultural production. This situation has a negative impact on the provision of agricultural food and food security around the world. In 2022, the war prevented Ukraine from sowing all areas of crops, which in fact, according to various estimates, range from 50% to 75%. Therefore, the issue of providing agricultural products not only to Ukraine, but also to those who import Ukrainian sunflower crops and other crops is of practical interest. In this work the relationship between the volume of sunflower gross harvest and its sown areas on many years research data – more than thirty years has been estimated on the basis of correlation-regression modeling. According to FAO estimates, 25-30% of fields in the 2022-2023 season may be unsown or unharvested in Ukraine. In addition, crop yields are expected to decline. According to some experts, in 2022 in Ukraine the sown area is less than 80% of last year's figures, and the total sown area has decreased to 3 million hectares. In this work on the basis of the analytical method the forecast of productivity in the conditions of military aggression of Russia against Ukraine at change of sown territories on an example of oilseeds is formed. It is established that price instability restrains the intensification, which increases the yield of oilseeds, but the degree of risk increases too. A set of measures for economic stimulation of agricultural cultivation of oilseeds has been developed, the foundations for the development of partnerships between the state and agrarian business and the population have been formed.

HIGHLIGHTS

- ① The paper studies the dynamics of the relative production and consumption of the main agricultural crops in Ukrainian enterprises for 2017- 2021 years, in particular sunflower.
- ① In this work the relationship between the volume of sunflower gross harvest and its sown areas on many years research data – more than thirty years has been estimated on the basis of correlation-regression modeling.
- ① A set of measures for economic stimulation of agricultural cultivation of oilseeds has been developed, the foundations for the development of partnerships between the state and agrarian business and the population have been formed.

Keywords: Sunflower, Oilseeds, Crops, Sown area, Economy, Correlation-Regression Modeling

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According to United States Department of Agriculture (USDA) estimates, Ukraine is the largest producer of sunflower seeds. In 2021/2022, the country produced 17.5 million tons, which is more than 30 % of world production. Ukraine also has a large domestic crushing industry, from which significant volumes of both sunflower meal and oil are exported. Of scientific and practical interest is the analysis of data on trade, world production, consumption and stocks of oilseeds. The main focus in the structure of oilseeds (copra, cottonseed, peanut, rapeseed, palm kernel, soybean and sunflower seed), meal (peanut, copra, cottonseed, palm kernel, rapeseed, soybean and sunflower seed) and oil (coconut, cottonseed, olive, palm kernel, peanut, palm, rapeseed, soybean and sunflower seed) is given to sunflowers (Oilseeds: World Markets and Trade, 2022).

Ukraine provides oilseeds to many countries around the world. Therefore, a reduction in crop yields will affect food security in the world's poorest countries. All this requires the development of a mechanism for maintaining sown areas at least at the level of 2021 in Ukraine and the joint progress of European countries against the aggression of the Russian Federation.

During the war, farmers seek to increase the area under crops and change their structure in relatively peaceful regions where there is no active hostilities. For example, this year the farmers of Lviv region want to increase the sown area by more than a thousand hectares. Additionally, the areas that have been deforested will be used. The total sown area will be over 707 thousand hectares. In particular, spring crops are planned to be sown on an area of 440 thousand hectares, which is 5 thousand hectares more than last year. The structure of sown areas will depend on the supply of imported resources and parts for agricultural machinery. In case of shortage of imported seeds, farmers sow those crops whose seeds are in stock.

The main *objective* of this work is the economic analysis and the integration of different knowledge and research from different sectoral, managerial, military, political, economic points of view and the development of an effective system for oilseeds yields in modern military conditions of Ukraine, including the introduction of international experience in food security in the context of sustainable development.

The *subject* of the research is the process of overcoming the food crisis based on the combined efforts of world countries and leaders, as well as the development of international trade between Ukraine and other states.

The main *purpose* of this article is an analysis and modeling of the relationship between sowing of oilseeds and yield, as well as forecasting yields in Ukraine in the near future for different scenarios of sowing areas – 75 %, 50 % and 25 %. Important for Ukraine is world positive experience in developing international trade and improving food security and developing recommendations for promoting food security and overcoming the food crisis.

Theoretical Premises

To provide food for the population, world food production must double by 2050 in line with population growth. It faces the impact of climate change on biodiversity, soil and water quality, and global market demands. EU agricultural policy has changed significantly in recent years in line with the need to help farmers overcome these challenges and respond to changing attitudes and expectations. Modern EU agricultural policy covers a wide range of areas, including food quality, traceability, trade and the promotion of EU agricultural products. The EU financially supports its farmers and encourages sustainable and environmentally friendly agricultural practices, as well as a significant increase in investment in rural development. The EU institutions cooperate in the formulation of food and agriculture policy, its implementation, monitoring and evaluation. National and local authorities enforce laws agreed at EU level. Through the EU budget, funds are provided to Member States in accordance with rules established at EU level. The EU also monitors how these laws are applied, how effective they are, and coordinates the necessary changes (Vibrant rural areas and quality agricultural products, 2022).

Russia's military aggression against Ukraine makes fundamentally new demands on the spring sowing campaign in Ukraine in 2022. According to FAO estimates, between 20 % and 30 % of fields used for growing crops such as sunflower, winter cereals, maize in Ukraine may not be sown or remain unharvested during the 2022–2023 season. In addition, crop yields are expected to decline. 10 %

due to delayed or missed fertilizer application times, inability to control possible diseases, pests, delayed harvesting, lack of manpower or infrastructure capacity for autumn harvesting (Problemni aspekty posivnoyi kampaniyi, 2022).

MATERIALS AND METHODOLOGY

The methodological basis of this article is the publications of domestic and foreign scientists in the field of agricultural production of oilseeds and the world oilseed projections of production and consumption. This paper analyzes the impact of the transformation of the agricultural production regime, the dynamics of sown areas on the efficiency of agricultural oilseed production of farmers based on the model of correlation-regression analysis, classical theory of division of labor and specialization, transaction costs and cooperation. The work is based on real statistical indicators of agricultural production and their analysis of data for 1991–2021. The methodology of the statistical survey is the official data of the State Statistics Committee of Ukraine. The model of agricultural production allowed to predict the yield of oilseeds under martial law in Ukraine. Such a long-term model should be used when assessing food security indicators for management decisions and regulating the area of land allocated for different crops. The methodology of this article is based on the correlation-regression model of the dependence of oilseeds yields on their sown areas in compliance with national security indicators. Farmers involved in the agricultural division of labor and cooperatives are transforming their agricultural production from a traditional self-sufficient way to a specialized and intensive one. The originality of the work is based on a unified basis for the modeling and analysis of the impact of the transformation of the regime of agricultural production of farmers on the efficiency of their production in modern military conditions in Ukraine. The agricultural division of labor, measured by farmers' participation in the agricultural division of labor at the stages of production or in agricultural production, and agricultural cooperatives, measured by farmers' participation in farmers' cooperatives, have a significant and positive effect on their agricultural production after endogenous adjustment.

An interdependence between the volume of

production (gross harvest) of oilseeds and Ukraine and their sown areas on the basis of correlation-regression modeling (1991–2021 years) have been detected. The relationship between the volume of production of oilseeds in Ukraine and their sown areas is close to linear, so in this case, as a relationship between variables, it is advisable to choose a linear function.

The selective linear regression function in this case will look like:

$$\hat{y} = b_0 + b_1x \quad \dots(1)$$

whereas \hat{y} – estimation of mathematical expectation of the dependent variable model (volume of production (gross harvest) of cereals and legumes in Ukraine);

x – independent model variable (sown areas of cereals and legumes in Ukraine);

b_0, b_1 – selective regression parameters.

The research methodology is based on the assessment of international trade between Ukraine and the other world countries in order to assess the current state and place of agricultural oilseeds production. According to EU concepts and definitions, non-EU trade statistics (trade between EU Member States and non-EU countries) do not record exchanges related to transit goods placed in customs warehouses or temporary admission (for fairs, temporary exhibitions, tests, etc.). This is known as “special trade”. The partner is the country of final destination of the goods for export and the country of origin for import.

Literature Review

A large number of scientists have studied and are currently studying ways to provide the population with food produced by agriculture. Agro-industrial production of the oilseed industry occupies a prominent place in the structure of consumption. Harry O. Doty in his academic work came to the conclusion that sunflower production has increased sharply since 1974 due to the development of high-yielding hybrid sunflower varieties and the high demand for these seeds in Europe. The cost of crop production continues to rise steadily, driven mainly by rising fuel costs as well as high interest rates. Recently, fertilizers and agricultural chemicals have

become much more expensive, which has affected economic costs. In the future, global demand for high-protein flour and vegetable oils will continue to grow in line with population growth and expanding use in less developed countries. According to the scientist, a significant part of these expanded needs in oilseeds, especially for soybeans and sunflowers, will be supplied to the world market by the United States (Harry O. Doty, 1983).

Moreover as Chris Callahan points out that conversion of oilseeds to biodiesel and other products is an extremely important task of modern economics (Callahan Chris, 2014). Famous scientist P. Rosson conceives of agricultural and food marketing systems as consisting of four main sub-systems: distribution, production, consumption and regulatory (P. Rosson, 1974). The authors Santosha Rathod, Kamalesh Narain Singh studied the state of Indian agriculture, scientists have seen a trend that oilseeds are low compared to food grains. Currently in India, the production of oilseeds and oils does not meet the growing demand for edible oils, and this growing gap between supply and demand has necessitated the import of edible oils. Today, India is the world's largest importer of oilseeds, importing more than 50 % of total production (Rathod, S., Singh, K. N., 2018).

A. Yakymchuk and others (Yakymchuk, A. Y. and oth., 2018) insist that Ukraine must develop its own production and processing of oilseeds, as the export of oilseeds is incredibly harmful to the economy. When exporting sunflower abroad, Ukraine loses jobs, economic added value, prospects for the development of the biofuel system, etc.

The researcher W. Patterson notes that if the war in Ukraine continues, there is a possibility that not all areas will be collected for the upcoming season. As for sunflower, there is a risk that a large share of this product will not hit the market. The risk of sunflower supply potentially affects the next season, sowing may be delayed and a much lower harvest of 2022–2023 (Patterson, W., 2022). M. Roberts emphasizes that economic sanctions could be applied to the trade of agricultural commodities and create more supply chain issues with implications for price volatility. The author thinks, that interference in domestic security are stoking “massive” sanctions against Russian's

agression. The war also further deplete very tight global supplies of fertilizers (Roberts, M., 2022).

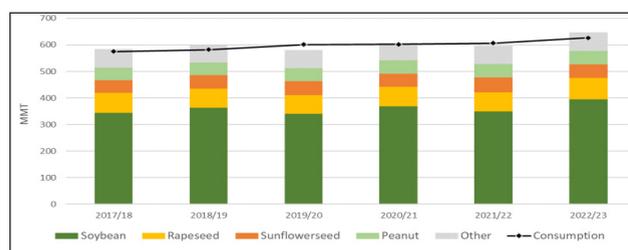
RESULTS AND DISCUSSION

In many world countries, including Ukraine, agriculture is the largest separate sector of the national economy. Agriculture typically employs more than 50 % of the workforce, and industry and trade depend on agricultural resources as a source of raw materials. It is obvious that the development of agriculture and marketing systems that affect it are the basis of the process of economic growth of each state. While population growth rates in developing countries average about three percent per year, their cities increase their population by about four percent annually. Of course, this means that the number of people in cities in need of agricultural products will double in a quarter of a century. This has clear implications for agricultural oilseed production and marketing systems that direct this production and distribute products to places of consumption. As a result, the number of farms will decrease with a simultaneous increase in their size; and agriculture is likely to become less labor-intensive and more capital-intensive (Agricultural and Food Marketing Management, 2022).

The study of the world market shows that there is forecast of increasing 8 % of global agricultural production of oil production for 2022–2023 (Fig. 1). Large sunflower losses due to active war in Ukraine are projected to be offset by the growth of soybean in USA and rapeseed production in European Union and Canada. The global production of oilseed will reach about 650 million tons in the world. Global oil consumption is projected to increase by 3 % in 2022–2023. Soybean crushing and consumption is estimated and most of the growth of global oil. Sunflower consumption is projected to increase by 3 %, while rapeseed consumption by 7 %. Global oil trade is predicted higher, mainly for higher demand for soybeans from China. Sunflowers, soybean, rapeseed and peanuts are expected to grow as a whole (Oilseeds: World Markets and Trade, 2022).

The authors of this article on the basis of the analysis of USDA official data on trade, production and consumption revealed factors that affect world oil trading. This data is represented in Table 1. The

largest exporters of oilseeds in the world are China, Mexico, Ukraine, Japan and the United States.



Source: From the data (Oilseeds: World Markets and Trade, 2022).

Fig. 1: Projected Global Oilseeds Growth and Consumption

According to OECD-FAO Agricultural Outlook (2021–2030), in this work has been analyzed a world oilseed projections of production and consumption (Table 2).

According to Table 2, the production and consumption of oilseeds by 2030 will only increase for all plant varieties. The largest share in the structure of production and consumption of oilseeds belongs to soybean and protein meals.

In 2022, in the conditions of the Russian war, Ukraine did not managed to sow a significant area of sunflower. Of course, compared to 2021, all indicators of crops in the territories are significantly lower. The area under sunflower is 4.27 million hectares (that is only 87 % of the planned area 4.93 million hectares), peas – 125.9 thous. ha (86 %), corn – 4.41 million ha (91 % of the planned area), spring barley – 928.4 thous. ha (91 %), spring wheat – 189.3 thous. ha (99.7 %), oats – 156.9 thous. ha (96

Table 1: Ranking of the largest markets for oilseeds in the world in 2021

Country (Market)	Total value, billion USD	Export, million tons in 2021	Yield forecast for 2023 and beyond, million tons
Ukraine	8.07	17.5	3.8 (7.04-10.56)*
USA	36.08	14.654	36.4
China	14.18	35.9	13.37
Mexico	3.91	26.56	25.5
European Union	2.68	12.7	2.1
Japan	1.52	15.61	16.4
Egypt	1.48	2.08	2.3
Canada	1.26	29.4	30.1
Indonesia	1.14	3.02	3.3
Philippines	1.03	3.59	3.6
Colombia	0.843	3.44	3.5
Taiwan	0.781	3.94	3.99
Total	72.974	168.33	=

* Calculated by the authors.

Source: From the data (Oilseeds: World Markets and Trade, 2022).

Table 2: World Oilseed Projections of Production and Consumption to 2030

Type of Oilseed	Year										
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Soybean production	356.1	372.9	377.3	382.6	386.7	391.0	394.8	399.1	402.9	407.5	411.1
Soybean consumption	358.6	370.8	376.2	381.0	386.2	391.1	395.4	398.8	402.7	406.7	410.6
Other oilseeds production	156.0	159.4	162.7	165.6	167.0	169.2	171.1	173.3	175.2	177.4	179.5
Other oilseeds consumption	157.5	159.6	162.2	165.2	166.8	169.0	171.1	173.3	175.2	177.4	179.5
Protein meals production	353.7	363.4	368.8	374.3	379.4	384.6	389.3	393.2	397.4	401.9	406.3
Protein meals consumption	353.8	363.1	368.6	374.0	379.3	384.5	389.2	393.1	397.3	401.8	406.2
Vegetable oils production	212.9	219.7	222.9	226.6	229.3	232.4	235.4	238.2	241.1	244.0	246.9
Vegetable oils consumption	213.6	218.7	222.0	225.8	229.3	232.4	235.3	237.9	240.8	243.7	246.6

Source: From the data (OECD-FAO Agricultural Outlook 2021–2030, 2022).

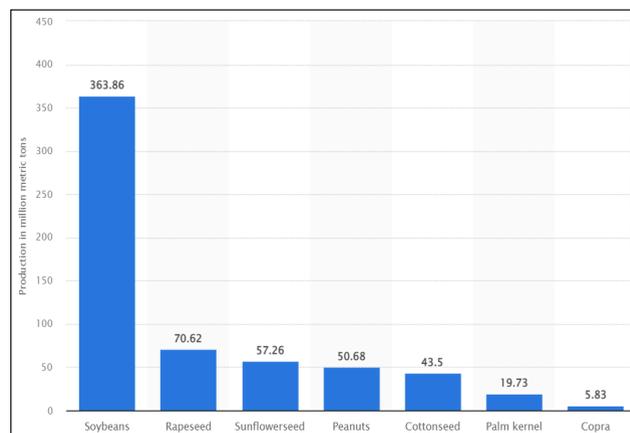
%). The sown area under potatoes in Ukraine in 2022 is 1.11 million ha (93 % of the planned area), soybeans – 1.15 thous. ha (92 %), sugar beet – 182,1 thous. ha (88 %), spring rape – 31.7 thous. ha (100 %), millet – 41.3 thous. ha (66 % of the planned area), buckwheat – 57.7 thous. ha (70 %). It is noted that the sown area has already amounted to 78 % of last year’s figures, in which 16.92 million ha were sown. During the war in Ukraine, about a third of the area could not be sown (Problemni aspekty posivnoyi kampaniyi, 2022).

European Union rapeseed production is projected to rise on larger plantings in 2022–2023. Imports are forecast to recover as larger supplies in Canada more than offset reduced availability from Australia. Projected larger supplies will permit both an increase in crush and replenishment of stocks depleted this year. Additional meal and oil production will go towards maintaining rapeseed meal consumption near historic norms and allowing food oil consumption to maintain trend growth. Rapeseed production in Ukraine is projected to grow, despite ongoing hostilities. As rapeseed fields are located in the west of Ukraine, away from hostilities, the planned harvest from sown areas will be 3.2 million tons. Although it is clear that profitability will fall below 2021. Historically, about 90 % of products are exported as seeds, of which 90 % are exported to Europe. Thus, Ukraine is less dependent on access to the Black Sea port and provides producers with an attractive option for landing. Oil exports will increase primarily to European countries. Ukraine sunflower seed exports are forecast higher at 750,000 tons. Sunflower seed meal exports are expected to fall to 2.9 million tons and oil exports are forecast to decline to 3.8 million tons (Oilseeds: World Markets and Trade, 2022).

Historically, China has been a major buyer of Ukrainian corn, grain and oilseeds. For example, in 2021, China imported 8.2 million tons of corn from Ukraine, which was about 30 % of total Chinese imports. As for wheat, China has already made adjustments, removing all restrictions on Russian wheat. Earlier, Russian imports were limited due to phytosanitary problems. China is likely to become home to a number of other Russian goods, given that China is unlikely to fall under Western sanctions. The vegetable oil market could potentially increase substitution if the war in Ukraine continues.

Although problems with Ukrainian supplies arise at a time when some other markets, including palm oil, are already crowded. As a result, we could see more substitutes for soybean oil, which again would be positive for soybean shredders and ultimately soybean prices. This is a trend that we have recently seen from the world’s largest importer of vegetable oil, India, due to the tightness of the palm oil market. This trend is likely to intensify and increase, given the potential disruptions in Ukraine’s supply of sunflower oil to the world market.

In the 2021–2022 crop year, the leading type of oilseed in the world were soybeans (Fig. 2). Almost 364 million metric tons of soybeans were produced worldwide that year.

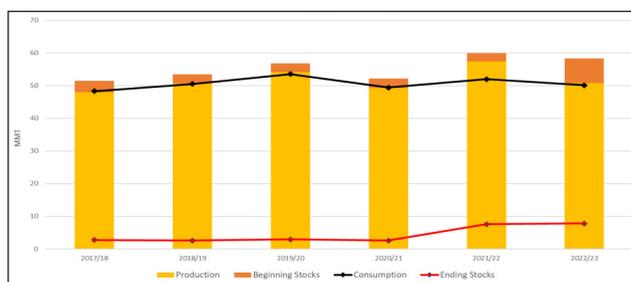


Source: From the data (Current World Markets and Trade, 2022).

Fig. 2: Dynamics of Worldwide Oilseed Production, 2021–2022, mln tons

Production of oilseeds and palm oil increased in the 2020/2021 marketing year due to a rebound in harvested area and higher yields in major producing countries. But demand increased faster than production, mainly driven by a strong increase in soybean imports by China and its improved trade relations with the United States (Oilseeds and oilseed products, 2022).

In 2022–2023, world sunflower production is possible at 50.7 million tons, which is 12 % less than the harvest of 2021 (Fig. 3). The largest reductions are expected in Ukraine, Moldova, and Russia due to smaller sowing areas. At the same time, for countries such as the European Union, Serbia, Argentina, the United States and Turkey, production will increase. Agricultural experts suggest that total profits do not compensate for total losses.



Source: From the data (Ukraine-EU - international trade in goods statistics, 2022).

Fig. 3: Expected Dynamics of World Sunflower Production and Consumption

World sunflower consumption is projected to fall by only 3 % in 2022–2023 to 50.1 million tons, as record stocks are likely to remain in high demand. Also, according to experts, world sunflower exports will increase by 44 %, thanks to Ukraine, Argentina, Kazakhstan and Russia. Countries such as China, Uzbekistan, Turkey and the European Union will increase sunflower imports. In the world market, trade in sunflower meal will decrease by 1 percent, while lower exports from Ukraine will be offset by larger supplies from the European Union and Argentina. Food imports are expected to decline in the European Union and China. World demand for sunflower oil is projected at 18.1 million tons, which is almost the same as last year. High demand for sunflower oil is expected to boost trade and imports by 2 % to 9.1 million tons. Higher demand for imports is largely due to the European Union and Iran, followed by continued high demand in China, India and Turkey. Due to declining pressure from major producers combined with growing global demand for oil, sunflower oil reserves are projected to fall 16 % to 2.0 million tons.

A sovereign state in Eastern Europe, Ukraine exported 68.9 billion doll. worth of goods around the globe in 2021. From 2020 to 2021, the value of Ukraine's exports accelerated by 33.4 %. The five most valuable exported products from Ukraine generated 41.9 % of the Eastern European country's total international sales in 2021. At the more detailed 4-digit Harmonized Tariff System (HTS) code level, Ukraine's top money-making shipments were for: sunflower-seed or safflower oil, iron ores or concentrates, corn, wheat and semi-finished products made from iron or non-alloy steel. That dollar amount reflects a 51.7 % increase since 2017.

Based on the average exchange rate for 2021, the Ukrainian hryvnia depreciated by -2.6 % against the US dollar since 2017 and fell by -1.2 % from 2020 to 2021. Ukraine's weaker local currency makes its exports paid for in stronger US dollars relatively less expensive for international buyers (Ukraine's Top 10 Exports, 2021).

In this work an interdependence between the volume of production (gross harvest) of sunflower in Ukraine and its planted area on the basis of correlation-regression modeling (1991–2021 years) have been detected (Table 3).

Accordingly to the results of Table 3, the correlation model obtained in this study of the dependence of volume of production of sunflower in Ukraine and planted area on the basis of correlation-regression modeling (1991–2021 years) has such the form:

$$Y = -4145,4 + 2,753x \quad \dots(2)$$

To find estimates of the parameters of the model b_0 , b_1 used the value of the sowing area of agricultural crops (sunflower) and volume of production (gross harvest) of agricultural crops in Ukraine, for 1991–2021. As a result of calculations, the values of the model parameters were obtained $b_0 = -4145,436$; $b_1 = 2,753$. Since Fisher's criterion is $F = 257,376$, which is more than its critical value of $F_{cr} = 4,183$, the model is adequate and statistically significant. Since the values of $b_0 = -4145,436$ and $b_1 = 2,753$ by module there are greater than critical value, $t_{cr} = 2,045$, which also confirms the adequacy and significance of this regression model.

The degree of closeness of the linear relationship between the model variables was estimated using the correlation coefficient ($R = 0,948$), it was concluded that there is a close linear relationship between the indicators of the model.

The scientific result of this study is that the authors were able to predict the yield of sunflower in Ukraine in 2022, which will be 14,083 million tons. This is much less than in 2021. However, given the loss of sown areas of sunflower under martial law in Ukraine, the actual harvest will be even smaller and will range between 50–75 %, according to the experts, it will be only a 7,04–10,56 million tons. This is an extremely unfavorable situation that will hinder the export of these crops to the markets of the European Union and other countries.

Table 3: Regression statistics and model values of interdependence between the volume of production (gross harvest) of sunflower in Ukraine and this planted area (1991–2021 years)

Results (indicators) of modeling	Planted area of agricultural crops (sunflower), thous. hectares (x)		Volume of production (gross harvest) of agricultural crops (sunflower), thous. tons (y)		Years
Yield forecast for 2022, thous. tons (y)	14083,93		1991	1601 (x)	2311 (y)
Year	1992	1993	1994	1995	1996
x	1641	1637	1784	2020	2107
y	2127	2075	1569	2860	2123
Year	1997	1998	1999	2000	2001
x	2065	2531	2889	2943	2502
y	2308	2266	2794	3457	2251
Year	2002	2003	2004	2005	2006
x	2834	4001	3521	3743	3964
y	3271	4254	3050	4706	5324
Year	2007	2008	2009	2010	2011
x	3604	4306	4232	4572	4739
y	4174	6526	6364	6772	8671
Year	2012	2013	2014	2015	2016
x	5194	5051	5257	5105	6073
y	8387	11051	10134	11181	13627
Year	2017	2018	2019	2020	2021
x	6034	6117	5928	6457	6622
y	12236	14165	15254	13110	16392
Multiple Correlation coefficient R	Coefficient of Determination R-square		Normalized R-square	Standard Error	Observations of Analysis
0,948016090	0,898734507		0,89524259386	1508,1638	31
Standard Error	t-Statistics		P-Meaning	Coefficients	Upper 95%
722,8459819	-5,734881238		3,30404E-06	$b_0 = -4145,436$	-2667,05
0,171592585	16,04294031		5,85879E-16	$b_1 = 2,752849$	3,103796
Indicators	df	SS	MS	Fisher's Cr. (F)	Significance F
Regression	1	585416484,1	585416484,1	257,3759338	0,00021328
The rest	29	65962181,43	2274557,98	F_{cr}	4,182964
Total	30	651378665,5		t_{cr}	2,045229642

Source: Calculated by the authors.

SUMMARY, RECOMMENDATIONS

Authors summarize the state of the agricultural production of Ukraine in conditions of war in order to implement the best world experience. The results of the analysis are represented show, that the developed countries need to import quality Ukrainian oilseeds and grain crops. Therefore, today it is extremely important to preserve and increase the Ukrainian oilseeds and grain crops harvest in the face of Russian aggression to avoid famine in poor countries. The scientific result of this study is that the authors were able to predict the sunflower yield of crops in Ukraine in 2022, which will be only 14,083 million tons. This is much less than in 2021. However, given the loss of sown areas

under martial law in Ukraine, the actual harvest of sunflower will be even smaller and will range between 50–75 %, according to the authors, it will be a 7,04–10,56 million tons. This is an extremely unfavorable situation that will hinder the export of these crops to the markets of the European Union and other countries.

This scientific work is based on the analysis of data on multi-year studies of sunflower cultivation – from 1991 to 2021 in Ukraine. Accordingly to the results of this study, the correlation model obtained of the dependence of volume of production of sunflower in Ukraine and planted area. To find estimates of the parameters of the model₁ used the value of the sowing area of sunflower and

volume of production in Ukraine. As a result of calculations, the values of the model parameters were obtained, Fisher's criterion is more than its critical value, that is why the model is adequate and statistically significant. The degree of closeness of the linear relationship between the model variables was estimated using the correlation coefficient ($R = 0,948$), it was concluded that there is a close linear relationship between the indicators of the model.

Most production and processing of oilseeds and products is highly mechanised and labour mobility is of less importance. During seasonal field work, it is proposed to use agricultural machinery on a cooperative basis, in particular at the level of inter-municipal cooperation, to increase the intensity of equipment use by attracting IDPs who have relevant practical knowledge as operators of machinery. Today, in conditions of uncertainty, storage and primary processing of agricultural products are of special importance in Ukraine. Therefore, in this aspect, it is advisable to use the results of decentralization and increase the capacity of communities, as happened in the Republic of Poland at the time. In particular, it is necessary to conduct an inventory of the property complex transferred to the ownership of communities in order to possibly re-profile individual facilities for storage, refrigeration and other facilities for storage and primary processing of agricultural raw materials in them.

The production of oilseeds has decreased recently in Ukraine. Therefore, urgent attention should be paid to increasing sunflower yields through improved and high-yielding varieties, smart technologies, irrigation, policy and price support and effective expansion, effective marketing. Direct marketing without intermediaries will help improve the marketing of oilseeds and increase producers' profits, as well as create economic incentives for farmers to retail their products. Prices for oilseeds do not match, they vary from year to year, which does not encourage farmers to grow oilseeds. The government must develop tools and take the necessary measures for pricing and introduction of a minimum price of support for major oilseeds.

China has been a major buyer of Ukrainian corn, grain and oilseeds. For example, in 2021, China imported 8.2 million tons of corn from Ukraine, which was about 30 % of total Chinese imports.

According to the Ministry of Agrarian Policy of Ukraine, sowing in 2022 was the most difficult in the history of independent Ukraine. It began later, due to the long winter, the destruction of oil depots by Russian missiles and troops. It is worth noting that this is enough to get a yield above average. 75 % of seeds are already in Ukraine. Remedies are available by 55 %. In such circumstances, public-private partnership programs will be effective in addressing food security in Ukraine and around the world.

State regulation of agricultural activities is also essential. Ukraine must develop its own production and processing of oilseeds, as the export of oilseeds is incredibly harmful to the economy. After all, the government will supply fuel and lubricants to enterprises that agree to sow crops defined by the state, as well as forward state and local purchases of new crops. All this will allow adjusting the structure of sown areas of oilseeds in accordance with the priorities of meeting the domestic and foreign markets with important social foods.

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