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RESEARCH ARTICLE

The share of sunflower in the structure of cultivated areas of Ukraine in pre-war and wartime

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Abstract

The Russian invasion of Ukraine has had a profound impact on global food production, affecting the supply of agricultural products on world markets, including the structure of cultivated areas for major crops such as sunflower. This article examines the share of sunflower cultivation compared to other crops during the pre-war period and throughout the war, focusing on the cultivated areas by region in Ukraine. An analysis of the dynamics of sunflower cultivation areas is conducted. It is observed that the share of sunflower has increased due to a less problematic market compared to corn, maintaining almost guaranteed profitability, lower cultivation technology costs due to in-country processing facilities. Agricultural crops in Ukraine are characterized by an increase in the cost of cultivation technology, logistical chain issues, and a sharp decline in profitability, especially for cereal crops.

Keywords: Sunflower, Oilseed crops, Agricultural land, War in Ukraine, Soybean, Rapeseed

Introduction

The structure of agricultural crop cultivation in Ukraine has exhibited distinct features and trends throughout the entire period of independence. Cultivation technologies became more intensive, more mineral fertilizers were applied, biologicals were applied (Zhatova & Trotsenko 2017; Tkachuk et al., 2024) and better-quality seeds were used (Akuaku et al. 2019, 2020; Kharchenko et al. 2019, 2021). The export of sunflower seeds and other crops was finely tuned to generate profits. However, since February 24, 2022, a full-scale invasion by the Russian Federation has been ongoing, significantly impacting both the country as a whole and the agricultural sector, which serves as a substantial component of the Ukrainian economy. Oil refineries are not completely filled due to logistical challenges and the occupation of territories where sunflower cultivation was previously conducted.

Currently, it is crucial not only to identify the factors leading to a reduction in production volumes and cultivated areas but also to analyze the ongoing processes in the agricultural sector of the country one of the world's largest exporters of agricultural products.

Active combat operations, the occupation of portions of territories, constant attacks on infrastructure, and the destruction of agricultural machinery and entire agricultural complexes have resulted in alterations in the chains of agricultural production (Bohlmann et al., 2024). According to preliminary estimates, the production of cereal crops has decreased by 37% compared to 2021 due to armed aggression against Ukraine. The aforementioned issues are significant not only for Ukraine, where the agro-industrial complex accounted for 20% of the country's GDP, but they are also crucial for shaping a new strategy for humanitarian security and export relations.

The issue of exporting Ukrainian agricultural products to European countries is further exacerbated in light of the commencement of the harvest season, considering the uncertainty surrounding the status of the "grain agreement" and political tension surrounding decisions regarding the regulation of imported grain volumes (Meijl et al 2024). Due to high logistic costs and narrow capacities, there is an observed increase in imports from Ukraine to neighboring EU member countries. This influx of imports saturates storage capacities and logistic chains, particularly in Bulgaria, Hungary, Romania, Slovakia, Africa and others countries (Beluhova-Uzunova et al. 2024; Ngepah et al., 2024). These circumstances impact the economic viability of local producers in these countries and regions.

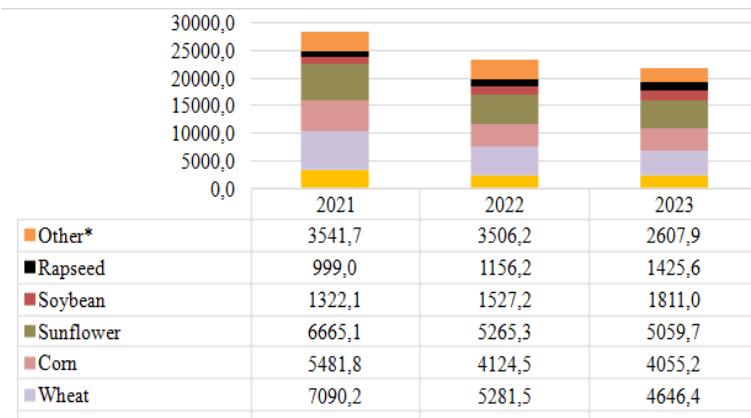
Materials and Methods

The objective of this article is to delineate the range of issues associated with the cultivation of cereal crops and sunflower in particular in Ukraine, taking into account active combat operations, to assess the cause-and-effect relationships influencing the redistribution of cultivated area structures, and to characterize the prospects of the oilseed segment as a vital component of food security.

To comprehend the dynamics of the situation, a timeframe spanning two years prior to the full-scale invasion by the Russian Federation was chosen as an example of stable sector development, along with two years during the war. Specifically, the time period from 2020 to 2023 was selected to provide a comprehensive examination of the processes of change in the structure of cultivating agricultural crops.

Results and Discussion

To gain a comprehensive understanding of the situation, we will begin by examining the general structure of cultivated areas in Ukraine over the specified period. For this purpose, we will analyze the graph (Fig. 1) presented below, focusing on two major cereal crops (wheat and corn) and three primary oilseed crops (sunflower, soy, and rapeseed).



Other* - sugar beet, potatoes, vegetable crops, fodder beet, fodder com, fruit and berry crops, grapes

Figure 1. Cultivated Area Structure for 2021-2023, thousand ha

Based on the data, it is notable that the overall trend is a reduction in cultivated areas from 27.529 to 21.800 million hectares. In other words, due to occupation and war, Ukraine lost a total of 5.729 million hectares, or 20.8% of cultivated

areas before the full-scale invasion. One in every five hectares of cultivation was lost. The geography of the currently occupied territories is primarily concentrated in the southeastern regions of Ukraine. A particular characteristic is that these regions were the main areas for cultivating crops such as sunflower and wheat.

Based on the data presented in Fig. 1, a significant increase in the share of oilseed crops in the structure of cultivated agricultural crops can be observed. This increase primarily applies to crops such as sunflower, rapeseed, and soy. This expansion occurred not only despite the overall reduction in cultivated areas due to the occupation of a considerable portion of Ukrainian territories but also through a decrease in the cultivated areas for cereal crops, particularly corn.

For instance, in 2021, the group of cereal and leguminous crops occupied 15,994.8 thousand hectares, while by 2023, this segment was cultivated on an area of 10895.8 thousand hectares. On the other hand, oilseed crops (sunflower, soy, and rapeseed) were sown on 8992.5 thousand hectares in 2021 and on 7910.9 thousand hectares in 2023. These figures indicate that due to the temporary occupation of a significant portion of Ukraine's territory, the cultivated areas for all agricultural crops experienced a reduction. However, a more detailed analysis of the percentage shares of crops from the total cultivated area allows for a more comprehensive examination of these processes.

From the data in Tab. 1, it can be concluded that despite the overall reduction in cultivated areas, the situation for each crop individually looks quite different. Cereal crops suffered the largest share loss from the total cultivated area, with a decrease of 8.2%. This means that despite the overall reduction in cereal cultivation areas by 31.9% compared to 2021, the actual reduction occurred only by 8.2%. In contrast, the oilseed crop group, despite a decrease in area by 12.1% compared to 2021, increased its share in the cultivation structure by 5.4%. While there was a slight reduction in the share of sunflower by 1%, crops like soy and rapeseed in 2023 set personal records for cultivation areas in the entire history of Ukraine's independence, doubling their share in the cultivation structure.

Table 1. Percentage values of crop areas and crop groups from the total cultivated area

Years	Cereals and legumes			Oil crops				Total sown area, thousand ha
	total	including wheat	including corn	total	including sunflower	including soyabeans	including rapeseeds	
2021	56	24.9	19.3	31.6	23.4	4.6	3.5	28476
2022	50.7	22.7	17.8	34.2	22.7	6.6	5	23228
2023	50	21.3	18.6	38.1	23.2	8.3	6.5	21800

According to the data from the State Statistics Service of Ukraine, due to the hostilities in partially occupied regions (Luhansk, Donetsk, Zaporizhzhia, and Kherson), there was a 4.2-fold decrease in the sunflower cultivation area (from 1,638.0 thousand hectares in 2021 to 307.8 thousand hectares in 2023). Thus, one of the primary factors contributing to the redistribution in the structure of cultivated areas for agricultural crops in Ukraine is the presence of the military factor, influencing logistics, resources, and the ability to conduct planting campaigns, considering territory clearance and the overall level of danger from shelling in the front-line areas. Despite the significant loss of sunflower cultivation areas in the main regions, an increase in cultivation areas can be observed in other regions (Dnipropetrovsk, Kirovograd, Poltava, Chernihiv, and others) (Tab. 2).

Among the main reasons for the increase in cultivation areas for oilseed crops, the rationality of their cultivation stands out, considering their prospects, the availability of large processing capacities, and high profitability. The significant rise in the cost of fertilizers, plant protection agents, fuel, and other components of cultivation technologies for all agricultural crops contributes to this shift. Export challenges due to the multiple cost increases in logistic routes from remote areas to ports make cereal crops economically unviable for agro-producers.

It is essential to note that the situation with the expansion of sunflower cultivation areas poses a threat to further soil degradation and yield reduction due to non-compliance with crop rotation practices. It is also crucial to understand that violating crop rotation practices for the sake of minimal profit will lead to an increase in technology costs, as plants will require more mineral fertilizers and more expensive plant protection systems to control pest and disease populations that accumulate in the soil.

Table 2. Sunflower cultivation areas by regions from 2021 to 2023, thousand hectares

Region	2021	2022	2023
Vinnitsia	311.6	327.7	287
Volyn	36.4	42	26.5
Dnipro	598.1	600.4	685.3
Donetsk	349.3	109.2	111
Zhytomyr	145.9	182	123.1
Transcarpathian	3.4	4.8	3.2
Zaporizhzhia	531.1	169.6	104.8
Ivano-Frankivsk	31.9	40.9	17.8
Kyiv	203.5	210.1	193.9
Kirovograd	599.8	604.8	631.6
Luhansk	427.4	72.9	61.9
Lviv	35.6	43.3	38.8
Mykolaiv	491.4	405.1	426.1
Odesa	398.3	421.8	362.7
Poltava	384.1	442.3	395.8
Rivne	36.6	55.1	49.9
Sumy	262.6	333.5	258.7
Ternopil	83	104.9	101.7
Kharkiv	565.6	303.7	480.8
Kherson	338.1	...	30.1
Khmelnytskyi	161.9	199.7	169.5
Cherkasy	255.1	246	238.8
Chernivtsi	22	18.9	20.3
Chernihiv	237	287.6	240.4
Total	6509.7	5238	5059.7

Conclusions

The full-scale invasion of Ukraine has significantly impacted the agricultural sector of the country. This is evident primarily in the loss of cultivated areas due to the occupation of a considerable amount of territory and the reorientation of agricultural producers towards more profitable crops, specifically oilseeds. Currently, it is challenging to fully grasp the scale of the problems resulting from the uncontrolled and ecologically unjustified increase in the share of oilseed crops in the cultivation structure. This issue will have a long-term effect in the future and will lead to the search for solutions to mitigate the consequences of this problem.

Despite this increase, logistical and political challenges in exporting agricultural products from Ukraine remain unresolved. The issue of access to the global market for agricultural products prompts an increase in prices, underscoring the importance of Ukrainian agricultural exports. The consequences of these challenges will necessitate ongoing efforts to address and alleviate the impacts on the agricultural sector in Ukraine.

References

- Akuaku J., Zherdetska S., Melnyk T., Surgan O., Makarchuk A. (2020). Yield and quality of confectionery sunflower seeds as affected by foliar fertilizers and plant growth regulators in the leftbank forest-steppe of Ukraine. *Sci Pap Ser A Agron.* 63: 155–166.
- Akuaku J., Makarchuk A. V., Melnyk T. I., Trostenko V. I. (2019). Productivity and quality of high-oleic sunflower seeds as influenced by foliar fertilizers and plant growth regulators in the Left-Bank Forest-Steppe of Ukraine. *Agro Life Sci J.* 8: 167–175.
- Beluhova-Uzunova R., Mann S., Prisacariu M., Sadłowski A. (2024). Compensating for the Indirect Effects of the Russian Invasion of Ukraine – Varied approaches from Bulgaria, Poland and Romania. *EuroChoices*.
- Bohlmann H., Bohlmann J., Cororaton C., Geda A., Henseler M., Lemma A., Michael P.M., Ngu D., Cherevko H. (2024). Challenges for the agriculture of Ukraine during the war and directions of its development. *Ann. PAAAE*. 26.
- Kharchenko O., Zakharchenko E., Kovalenko I., Prasol V., Pshychenko O., Mishchenko Y. (2019). On problem of establishing the intensity level of crop variety and its yield value subject to the environmental conditions and constraints. *AgroLife Sci.* 8: 113–120.
- Kharchenko O., Petrenko S., Sobko M., Medvid S., Zakharchenko E., Pschyichenko O. (2021). Models of quantitative estimation of sowing density effect on maize yield and its dependence on weather conditions. *Sci Pap Ser A Agron.* 64: 224–231.
- Ngepah N., Papadavid P., Raga S., Willem te Velde D., Zaki C. (2024). Impact of the Russia Ukraine war on Africa: policy implications for navigating shocks and building resilience' ODI Policy brief. London: ODI.
- Tkachuk O., Gucol G., Mazur O., Verhelis V., Titarenko O. (2024). Ecological safety of sunflower seeds in the conditions of agricultural intensification. *Sci Horizons.* 27: 71–79.
- Meijl H. V., Bartelings H., Berkum S., Cui D. H., Kristkova Z. S., Zeist W. J.v. (2024). The Russia-Ukraine war decreases food affordability but could reduce global greenhouse gas emissions. *Commun Earth Environ.* 5: 59.
- Zhatova G. A., Trotsenko V. I. (2017). Dynamics of sunflower rhizosphere microbiota. *Uk. J Ecol.* 7: 22–29.