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Statistical analysis of pulses harvests and their use in the Ukrainian market

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Abstract. The study aimed to assess the state of production of pulses and their use in the Ukrainian market. To achieve this goal, the production, yields, sown areas, export dynamics, and structure of the use of pulses such as beans, soybeans, and peas in 2015-2023 were analysed. The study determined that the production of exports and consumption of pulses in Ukraine from 2015 to 2023 shows significant changes in the industry. Production and area under pulses declined significantly from 2015 to 2022 but began to recover in 2023. The dynamics of pulse yields in the period from 2015 to 2023 are marked by fluctuations. Pea yields ranged from 22.4 cwt/ha in 2015 to 31.3 cwt/ha in 2016, with a further decline to 18.2 cwt/ha in 2018, before recovering to 25.7 cwt/ha in 2023. Bean yields increased from 13.5 cwt/ha in 2015 to 16.3 cwt/ha in 2023, while soybean yields increased from 18.4 cwt/ha in 2015 to 25.8 cwt/ha in 2023. In addition, the structure of pulses used in 2015-2023 also changed: the share of consumption in the food industry decreased from 35 to 27%, while the share of livestock increased from 40 to 48%. The share of the industry remained stable at 25%. The results obtained indicate the need to develop and support the production of legumes in Ukraine, as well as to optimise the structure of their use

Keywords: exports; planted areas; soybeans; peas; beans; agricultural production

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INTRODUCTION

Pulses are important for agricultural development due to their key role in ensuring food security, stimulating agricultural sector development and supporting sustainable rural development. They are an important component of the market with a wide range of applications in various industries. The research relevance is determined by the fact that despite the growing demand for these crops, their production and processing remain insufficient, causing market shortages and rising prices. In addition, the research focuses on preserving and improving soil fertility, as legumes are an important element of the agroecosystem.

According to B. Dessalegn *et al*. (2022), legumes are a highly valuable component of the diet for both humans and animals. These crops contain 20 to 30% of protein on a dry weight basis, which is significantly higher than in other crops. In addition, pulses are a rich source of energy that can be used not only for food but also for industrial purposes. The ecological value of pulses is also high, as they have a positive impact on the environment. According to M. Behnassi & M. El Haiba (2022), legumes improve soil structure and increase soil fertility and water permeability, which facilitates the growth of other crops. In addition, legumes are effective in combating soil erosion, as their roots can hold soil, which prevents it from being carried away. A. Freidenreich *et al*. (2022) also note that legumes increase biodiversity by providing food for various species of insects, birds and animals. Studies have also shown that legumes can be used to restore soils that have been damaged by intensive agriculture. They improve soil structure, increase its fertility and reduce degradation (Tibagonzeka *et al*., 2018). In addition, legumes can be used to create biological fertilisers that can replace synthetic fertilisers and reduce the environmental impact of agriculture (Zhao *et al*., 2024).

Notably, the energy industry also uses pulses to produce biofuels, which are an alternative source of energy for transport and various industries. According to S. Nath (2024), biofuels have several advantages. For example, it can be produced from local raw materials, which reduces dependence on energy imports from other countries. H. Yatsenko (2020) also noted that biofuels are a cleaner source of energy than traditional sources, as they do not contain sulphur and other harmful substances, rendering them a better option for countries seeking to reduce their environmental impact and increase energy independence. Thus, pulses are an important element of sustainable agricultural development and environmental protection (Fiott, 2022).

In Ukraine, growing pulses open new opportunities for exports and economic growth. Following O. Krupchan & V. Korol (2022), these crops are an important export commodity that brings foreign exchange earnings to the country and makes them an important component of international trade. This suggests that the development of the pulses industry could become one of the key areas for the development of the Ukrainian economy and increase its competitiveness in the global market. Increased exports of pulses will also contribute to the development of agriculture and the creation of new jobs in this sector. In this regard, A. Bohra *et al*. (2022) believe that the development of pulses production will contribute to increased investment in agriculture, improved infrastructure and the overall economic situation in Ukraine.

In the context of analysing the data from various authors, it should be noted that there is a gap in the collection and analysis of data on pulse production and consumption in Ukraine. Many studies focus on specific aspects of production, such as cultivation technologies, economic efficiency or environmental impact, but do not provide a complete picture of the pulses market in Ukraine. In addition, data on the production and consumption of pulses are often outdated or unrepresentative, making it difficult to conduct a reliable analysis. Therefore, to get a complete picture of the pulses market in Ukraine, it is necessary to conduct a comprehensive study that includes the collection and analysis of data on the production, yields, consumption and trade of pulses. The study aimed to assess the state of pulse production in Ukraine and its role in the market. To achieve this goal, the following objectives were set: to analyse the yields and consumption patterns of pulses in Ukraine and to develop recommendations for improving production efficiency and increasing exports of pulses.

MATERIALS AND METHODS

To conduct a comprehensive statistical analysis of pulse harvests in Ukraine, including their use and role in the agricultural sector, data from the Open Data Portal of Ukraine (n.d.) and State Statistics Service of Ukraine (n.d.) was used. The study was conducted using a comprehensive approach that included the use of several statistical analysis methods to study in detail the production and use of pulses in Ukraine. To logically combine the statistical data, the information was grouped and patterns alongside prospects of using these crops in Ukraine were analysed. The data obtained were analysed to identify trends and patterns in the production and export of pulses in Ukraine, including production dynamics, production and export structure. The information was also systematised, classified and analysed to identify patterns and trends in the use of pulses.

The study conducted a detailed analysis of several key indicators to get a definitive overview of the current state and prospects of pulses in Ukraine, including soybeans, beans and peas. The focus of this analysis was on the dynamics of production, yields, sown areas, exports and the overall structure of pulses used in the period from 2015 to 2023. The dynamics of pulse production were studied to determine the general trends in production volumes over the period. Thus, general trends in the agricultural sector were analysed, and annual fluctuations were determined. Yields, as an important indicator of the effectiveness of agronomic practices, were analysed to determine the level of productivity of each pulse crop, which included consideration of average yields, their changes over time, and comparison of yields of different crops with each other. The analysis of sown areas determined the scale of pulse cultivation in Ukraine and identified regions where pulses are most developed and promising. Exports were analysed to assess the competitiveness of Ukrainian pulses on the international market. The overall structure of pulses used was analysed to determine their role in the Ukrainian economy. This data was selected due to its completeness and reliability, as it was collected and validated by government agencies.

RESULTS

An analysis of the production and area of pulses in Ukraine shows important changes in this sector of agriculture. Thus, according to the Open Data Portal of Ukraine (n.d.) and State Statistics Service of Ukraine (n.d.), there is a downward trend in production and area under these crops from 2000-2020. In 2015, the production of pulses in Ukraine amounted to 502.1 thousand tonnes and the area under these crops was 246.7 thousand hectares, which increased to 600 thousand tonnes and 310.3 thousand hectares in 2020. In 2021 production continued to grow, reaching 680.6 thousand tonnes, with a stable area of 310.7 thousand hectares. However, the decline in pulse production to 334.2 thousand tonnes in 2022 is of particular concern. The area under these crops also decreased, reaching 174.1 thousand hectares in the same year. This stagnation can be attributed to various factors, including economic difficulties, changes in agricultural policy, climatic conditions, and war. However, there was some growth in 2023: production of pulses increased to 365 thousand tonnes and the area under them grew to 201 thousand hectares, indicating positive changes and the beginning of the industry's recovery after a period of prolonged decline (Fig. 1).

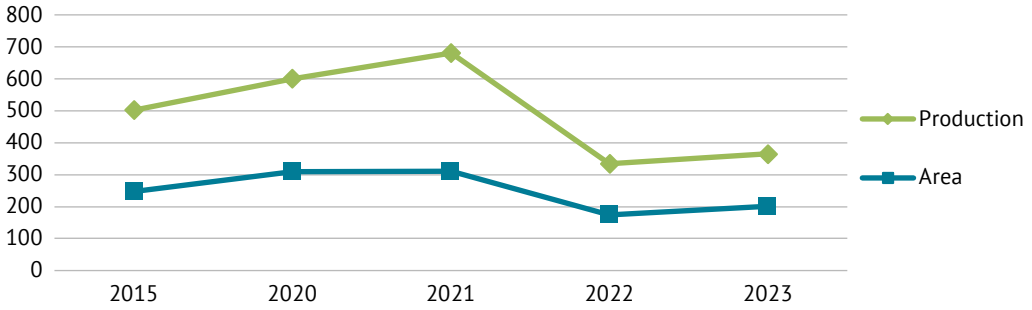

Figure 1. *Production (thousand tonnes) and area (thousand hectares) of pulses, 2015-2023*
Source: *compiled by the authors based on the Open Data Portal of Ukraine (n.d.) and State Statistics Service of Ukraine (n.d.)*

The analysis of the sown area of pulses for the 2024 harvest in Ukraine shows an overall increase in all regions of the country. The total area under pulses in Ukraine in 2024 is 292.9 thousand hectares, up 41.9% compared to 2023. This significant increase indicates a gradual recovery and expansion of production after a period of decline, which may be due to increased demand for these crops in the domestic and foreign markets.

In most of Ukrainian regions, an increase in sown areas is notable. In particular, the area increased by 11.6% in the Vinnytsia region, by 69.6% in the Volyn region and by 26.9% in the Dnipro region. Zhytomyr region showed an increase of 33.8%, and Zaporizhzhia region – 64.1%. The increase in planted areas is also observed in Kyiv region (21.1%), Kirovohrad region (40.6%) and Lviv region (25.3%). The largest growth was recorded in Mykolaiv region, where the area under crops increased by 90.2%, and in Odesa region, where the growth was 93.4%. Luhansk region was the only region to record a 9.6% decline in the area under pulses. Data for the Kherson region is not available due to the current situation in the region, which is caused by the fact that in 2023 the Kakhovka Dam, a critical infrastructure facility on the Dnipro River, was destroyed by Russian militants. Overall, the increase in planted areas in most regions indicates renewed interest in pulses and the possibility of their sustainable development

in the future. This positive trend indicates a potential increase in the production of these crops, which is an important factor in ensuring the country's food security and supporting its agricultural economy (Table 1).

Table 1. *The sown area of pulses for the harvest of 2024 in farms of all categories by region, thou hectares*

	Sown area	
	2024	2024 in % before
Ukraine	292.9	141.9
Vinnytsia region	12.2	111.6
Volyn region	6	169.6
Dnipropetrovsk region	15.9	126.9
Donetsk	2.3	109.4
Zhytomyr region	10.4	133.8
Zakarpattia region	1.6	106
Zaporizhia region	6.2	164.1
Ivano-Frankivsk region	4.9	104.5
Kyiv region	7.2	121.1
Kirovohrad region	23.6	140.6
Luhansk	0.2	90.4
Lviv region	3.9	125.3
Mykolaiv region	37.2	190.2
Odessa region	72	193.4
Poltava region	12.4	108.9
Rivne region	2.5	159.4
Sumy region	8.9	136.3
Ternopil region	9	132.4
Kharkiv region	22.7	111.6
Kherson region	N/A	N/A
Khmelnytskyi region	9.7	110.3
Cherkasy region	9.4	106.8
Chernivtsi region	1.2	105.6
Chernihiv region	9.7	107.2

Source: *compiled by the authors based on the Open Data Portal of Ukraine (n.d.) and State Statistics Service of Ukraine (n.d.)*

The analysis of the dynamics of pulse yields, in particular soybeans, beans and peas, for the period from 2015 to 2023 shows instability in the indicators, which may be due to various factors, including weather conditions, growing technologies and agronomic practices. Overall, the yield of cereals and pulses increased from 41.1 cwt/ha in 2015 to 46.2 cwt/ha in 2023. The peak yield was reached in 2019 at 49.1 cwt/ha. This growth reflects an overall improvement in agricultural practices and growing conditions.

Pea yields showed significant fluctuations during the period under review. In 2015, the yield was 22.4 cwt/ha, rising to 31.3 cwt/ha in 2016, but then dropping to 18.2 cwt/ha in 2018. In 2023, yields rose again to 25.7 cwt/ha. The yield of beans increased from 13.5 cwt/ha in 2015 to 16.3 cwt/ha in 2023. The lowest figure was in 2015, and the highest was in 2018 – with 17.7 cwt/ha. Soybean yields are also on the rise, rising from 18.4 cwt/ha in 2015 to 25.8 cwt/ha in 2023. The highest level was reached in 2018 and 2023 – with 25.8 cwt/ha. This relatively stable growth reflects the gradual improvement of agricultural practices and technologies (Fig. 2). The results show that Ukrainian exports of soybeans, peas and beans have significant potential, but certain fluctuations could be caused by internal and external factors, such as changes in global market demand and the military and political situation. Thus, in 2015, soybean exports amounted to 2.4 million tonnes, peaked in 2016 (2.9 million tonnes), and then declined to 1.4 million tonnes in 2021. In 2022, soybean exports increased to 3.2 million tonnes, and in 2023 reached 3.6 million tonnes, the highest level for the entire period.

In 2015, pea exports totalled 340 thousand tonnes, with growth continuing until 2018, when exports reached 475 thousand tonnes. After that, there was a decline to 103 thousand tonnes in 2022, but in 2023, exports increased to 132 thousand tonnes. Bean exports grew gradually from 5 thousand tonnes in 2015 to 16 thousand tonnes in 2021. After that, there was a slight decline to 13.4 thousand tonnes in 2022, and in 2023, exports of the crop increased to 14 thousand tonnes (Fig. 3).

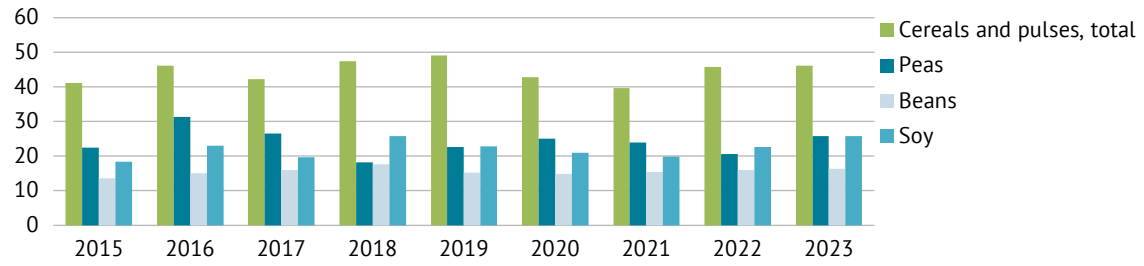

Figure 2. *Yield dynamics of pulses, t/ha (2015-2023)*
Source: *compiled by the authors based on the Open Data Portal of Ukraine (n.d.) and State Statistics Service of Ukraine (n.d.)*

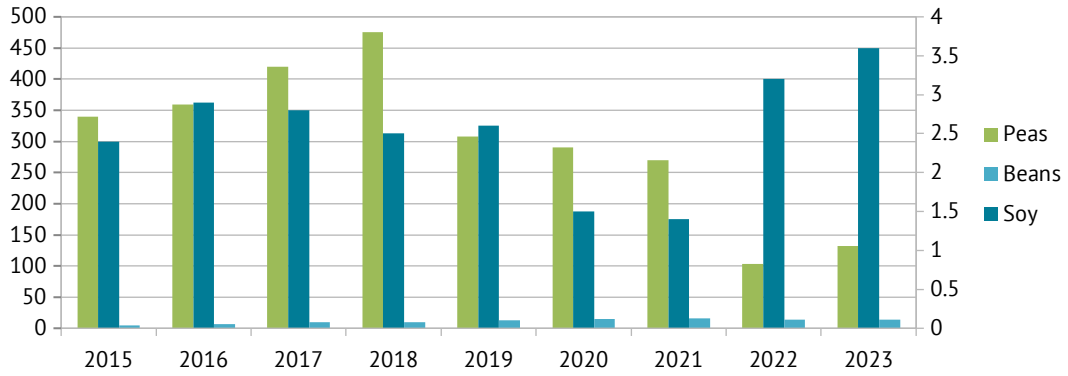

Figure 3. *Exports of soybeans (million tonnes), peas and beans (thousand tonnes) from Ukraine (2015-2023)*
Source: *compiled by the authors based on the Open Data Portal of Ukraine (n.d.) and State Statistics Service of Ukraine (n.d.)*

The study determined that the structure of legume crops used in Ukraine in 2015-2023 is characterised by a variety of purposes and areas of use. The main uses of pulses are in the food industry, livestock and industry. The food industry is the largest consumer of pulses in Ukraine, accounting for about 35% of total consumption in 2015, gradually decreasing to 27% in 2023. Livestock is the second largest industry, with its share increasing from 40% in 2015 to 48% in 2023. This growth was driven by increased demand for pork, poultry and cattle feed.

Industry, including the production of biofuels, chemicals, pharmaceuticals and other products, has maintained a stable share of 25% of total pulses consumption throughout the period. Exports and agriculture account for about 10 and 2% respectively, with no significant changes over the period. In the food industry, the largest sub-sectors are the production of canned beans, sauces, condiments, meat and bakery products, in livestock production – the production of feed for pigs, poultry and cattle, and in the industry – the production of biofuels, chemicals and pharmaceuticals (Fig. 4).

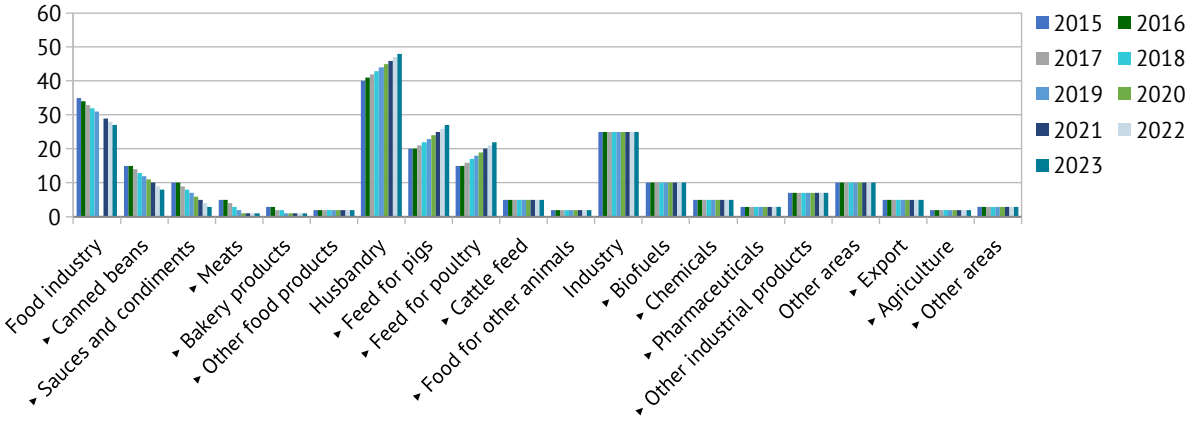

Figure 4. *The general structure of pulses used in Ukraine in 2015-2023, %*
Source: *compiled by the authors based on the Open Data Portal of Ukraine (n.d.) and State Statistics Service of Ukraine (n.d.)*

According to the Open Data Portal of Ukraine (n.d.) and State Statistics Service of Ukraine (n.d.), the market for pulses in 2015-2023 demonstrated several key trends. In particular, the demand for pulses in Ukraine, especially soybeans, beans and peas, was growing due to the increase in the production of feed for livestock and food industry. The development of the domestic pulses market has allowed farmers and producers to sell their products on the domestic market, not just export them. Large trading companies and chains are playing an increasingly important role in the pulses market, which has allowed them to control a significant market share and influence prices.

It is important to note that the development of e-commerce in pulses has allowed farmers and producers to sell their products online and get better prices. The popularity of organic and environmentally friendly pulses products grew and helped farmers to get better prices for their products. The cooperative movement among farmers is developing, allowing them to unite and jointly sell their products on the market. The role of the state in regulating the pulses market is also growing, as is its influence on prices, ensuring supply stability and supporting farmers.

The main actors in the pulses market in Ukraine are farmers and producers of pulses who produce and sell their products on the market, trading companies and networks that buy and sell pulses on the market, the food industry that uses pulses for food production, the livestock industry that uses pulses for animal feed production, and government agencies that regulate the pulses market and support farmers. In Ukraine, pulses are sold through several key distribution channels that ensure their availability on the market. Retail is an important link that allows farmers and producers to offer their products directly to the end consumer through supermarkets, shops and markets. This ensures wide access to pulses for ordinary consumers. Wholesale trade, in turn, is critical to ensuring the availability of pulses on the market. Retailers and chains purchase products in large volumes, which allows them to supply numerous retail outlets and other consumers.

Exports are another important component of the pulses market in Ukraine. It assists Ukrainian producers in entering the international sales market and generating revenue from the sale of their products abroad. The food industry uses pulses to make a variety of products, such as canned beans, sauces, condiments and other food products. This could be used to turn raw materials into finished products, which are then sold to consumers. The livestock industry also uses pulses, to produce feed for pigs, poultry and cattle. This increased the productivity of animals and improved their quality.

Improving production efficiency and increasing exports of pulses in Ukraine requires a comprehensive approach that addresses various aspects of the industry. To achieve this, it is necessary to increase the production of pulses by expanding the area under cultivation, improving yields and improving product quality. The government can support farmers by providing subsidies, training and access to modern machinery and equipment. It is necessary to develop the infrastructure for the processing and storage of pulses, which will allow to produce high-quality products that will be exported to other countries.

Diversification of Ukrainian pulses exports will also be beneficial, with exports to other regions such as the Americas and the Middle East to be expanded. To support exporters, the government can fund export market research to help identify new opportunities and increase exports and organise trade missions to other countries to establish contacts with potential buyers and conclude trade deals. An important step will be to improve the quality of pulse products by implementing a set of control measures. These measures include product certification, labelling and promotion of sustainable agricultural and production practices. This will increase consumer confidence in Ukrainian products, improve their competitiveness in the global market and increase exports. In addition, the implementation of such measures will help reduce risks to consumer health, improve the environment and increase production efficiency.

However, the war in Ukraine significantly impedes the implementation of these recommendations. Hostilities can affect the availability of resources, security and infrastructure. In such circumstances, it is necessary to focus on small but effective steps that can be implemented even in a limited resource environment and unstable situation. Adherence to these recommendations will enable significant progress in the development of pulse production and exports in Ukraine. This will increase production efficiency, improve competitiveness in the global market and take a leading position among the leading players. In addition, it will improve the Ukrainian reputation as a reliable supplier of high-quality products, increase exports and revenues, and create new jobs, stimulating economic growth in the agricultural sector.

DISCUSSION

Ukraine is a significant link in providing food for the world's population, and growing crops is one of the main areas of the agricultural sector. The country has unique natural conditions, a large land area and a rich history of agricultural development, which creates

favourable opportunities for the successful cultivation of various crops, including pulses. The analysis of the production and area of pulses in Ukraine shows significant changes in this sector of agriculture. During 2015-2020, there was a downward trend in production and area under these crops. Except for 2023, when there was a slight increase in production and area, which indicates positive changes and the beginning of the industry's recovery after a period of decline.

V. Kravchenko *et al*. (2019) noted a decrease in the area and production of pulses, citing economic difficulties and climatic instability as the main reasons for this phenomenon. Similar conclusions were drawn by M. Bacchi *et al*. (2021), which pointed to the negative impact of the political situation and conflicts on the agricultural sector, leading to a decrease in the area under crops and production of pulses. However, the analysis of the sown area of pulses for the 2024 harvest in Ukraine has already shown a general increase in all regions of the country, which indicates a gradual recovery and expansion of production. At the same time, the dynamics of yields of pulses, in particular soybeans, beans and peas, showed a stable performance over the period from 2015 to 2023, which could be caused by various factors, including weather conditions, growing technologies, agronomic practices and war.

The results obtained by S. Kvasha *et al*. (2023) confirm the data obtained. They attribute the gradual growth and recovery of the agricultural sector to positive developments associated with increased demand for pulses and improved agronomic practices. In addition, scholars, including S. Belete *et al*. (2019) and C.K. Walker *et al*. (2023), confirm the upward trend in soybean yields, although note problems with pea and bean yields due to differences in growing technologies and climatic conditions. The study established that Ukrainian exports of soybeans, beans and peas have significant potential, but certain fluctuations may be due to internal and external factors, such as changes in global market demand and the military and political situation.

In terms of export markets, Ukraine has the potential to increase exports of pulses to Asia and Africa, as well as to the European Union. During the 2000s and 2020s, pulses gained significant international demand, which led to an increase in their production and exports. As one of the leading producers of pulses, Ukraine has also increased its participation in global exports. According to the Open Data Portal of Ukraine (n.d.) and State Statistics Service of Ukraine (n.d.), the most exported pulses are soybeans, peas and beans. As a confirmation of the research findings, several scholars, including L.M. Pörtner *et al*. (2022) and Y. Li *et al*. (2024), note that Ukraine is one of the largest producers of pulses in the world, with a harvest of over 2 million tonnes per year. High harvests allow Ukraine to take a leading position among the largest exporters of these crops on the world market. This provides significant income for agricultural enterprises and farms specialising in pulses. Growing demand for the products encourages farmers to expand the area under these crops and introduce modern growing technologies. This trend is driven by an increase in global protein consumption, which creates new opportunities for Ukrainian farmers (Carton *et al*., 2022; Yigezu *et al*., 2024).

M. Behnassi & M. El Haiba (2022) also confirm that Ukraine is one of the leading exporters of pulses in the world. Key export markets include the European Union, India, China and the Middle East. In 2022, Ukraine exported about 1.5 million tonnes of pulses, which brought significant foreign exchange earnings to the national budget. In 2023, exports of pulses showed steady growth, confirming Ukrainian high export potential in this segment. The expansion of production capacities and the active introduction of innovative agricultural technologies have helped to strengthen the Ukrainian position in the global pulses markets.

A study by D. Rawtani *et al*. (2022) showed that pulses are one of the most profitable areas of Ukrainian agriculture. The authors also note that Ukraine has significant potential to increase production and exports of pulses, especially to the European and Asian markets. This is caused by the fact that pulses play a significant role in ensuring food security, replenishing the protein balance and maintaining soil fertility. According to M.T. Roberts (2021), pulse production in Ukraine is not only economically important but also socially important, as maintains employment in rural areas, which is significant for the development of local communities. In addition, the production of pulses stimulates the development of infrastructure, trade and services in rural areas, which helps to improve the quality of life of the population and increase their access to social services.

However, according to I. Salim *et al*. (2019), there is a risk of lower pulse yields caused by adverse weather conditions such as drought or excessive moisture, which could lead to lower pulse exports and income losses for agricultural enterprises and farmers. Low harvests could also lead to higher prices for pulses on the domestic market, which would negatively impact consumers. Following E. Shahini *et al*. (2023), current global changes, economic instability and geopolitical difficulties pose serious challenges to Ukraine's agricultural sector, such as water shortages, rising energy prices, declining soil fertility, biodiversity loss, trade barriers and political crises.

This opinion is also confirmed by H. Zhang *et al*. (2022) and B. Xavier (2023), who believe that climate change is a serious threat to agriculture in general. Adapting to these changes requires strategies that include changing agricultural practices, soil conservation, irrigation and diversification of production. The development and implementation of new technologies, raising awareness among farmers, establishing a system for monitoring and forecasting climate phenomena, and supporting research and development should be implemented to adapt agriculture to climate change.

Therefore, the study confirms the conclusions of C. Shikovets *et al*. (2020), which emphasise that to ensure the sustainable development of plant-based food production in Ukraine, it is necessary to address these challenges through the introduction of innovative technologies, environmental protection, efficient resource management, support for research and education, increased financial sustainability, infrastructure development and government support, and political stability. In addition, the development of the pulses market in Ukraine requires solving the problems associated with the damaged infrastructure of ports and granaries, as well as developing new routes for exporting pulses from Ukraine. This will help to increase the efficiency of pulse exports and reduce transportation costs.

At the same time, C. van der Giesen *et al*. (2022) emphasise that the environmental impact of increasing the production and export of pulses should not be forgotten. Increased pressure on the ecosystem and increased environmental pollution can be serious consequences of such development. Therefore, to address the environmental challenges associated with increasing production and exports of pulses, it is necessary to introduce environmentally friendly technologies and practices. These technologies include organic farming, conservation agriculture, efficient water use, biodiversity conservation, renewable energy, and pollution monitoring and control (Anders *et al.*, 2020). Thus, the results of this study confirm the findings of other researchers regarding the potential of Ukraine to increase production and exports of pulses, and the need for infrastructure development and investment in the agricultural sector to achieve this potential.

CONCLUSIONS

An analysis of pulse production in Ukraine shows significant changes in the sector. In particular, in 2015, Ukraine produced 502.1 thousand tonnes of pulses in an area of 246.7 thousand hectares. By 2020, production increased to 600 thousand tonnes, and the area under these crops increased to 310.3 thousand hectares. In 2021, the production of pulses continued to grow and reached 680.6 thousand tonnes, while the area remained at 310.7 thousand hectares. However, in 2022, the production of pulses decreased to 334.2 thousand tonnes and the area – to 174.1 thousand hectares. However, in 2023, there was a positive trend: production increased to 365 thousand tonnes and the area grew to 201 thousand hectares, which may indicate a recovery in the industry. The dynamics of pulse yields from 2015 to 2023 showed fluctuations in performance. Pea yields ranged from 22.4 cwt/ha in 2015 to 31.3 cwt/ha in 2016, with a further decline to 18.2 cwt/ha in 2018 and a recovery to 25.7 cwt/ha in 2023. Bean yields increased from 13.5 cwt/ha in 2015 to 16.3 cwt/ha in 2023. Soybean yields have also increased from 18.4 cwt/ha in 2015 to 25.8 cwt/ha in 2023.

Exports of pulses showed significant potential. Ukrainian soybean exports increased from 2.4 million tonnes in 2015 to 3.6 million tonnes in 2023, reaching a record level. Exports of peas decreased from 340 thousand tonnes in 2015 to 103 thousand tonnes in 2022 but increased again to 132 thousand tonnes in 2023. Bean exports grew gradually from 5 thousand tonnes in 2015 to 14 thousand tonnes in 2023. The structure of pulses used showed a variety of directions. The food industry decreased its share of consumption from 35 to 27%, while livestock increased its share from 40 to 48%. The industry has maintained a stable share of 25%. The main players in the domestic market of Ukraine are farmers, trading companies, the food industry and livestock, which influence the sale of products through retail, wholesale and export.

The limitation of the study is that its period covers only 2015 to 2023, which may not address long-term trends and cycles in the production and consumption of pulses. In addition, the war in Ukraine complicates the accuracy and completeness of statistical data and can significantly affect the production, storage and transportation of pulses. The prospect of further research is to develop strategies to reduce the risks for farmers associated with growing pulses.

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CONFLICT OF INTEREST

None.

REFERENCES

[1] Anders, E.J., Zulu, L.C., & Jambo, E.R. (2020). Limits to grain-legume technology integration by smallholder farmers: The case of time-sensitive labor demands and food security primacy in Malawi. *Agricultural Systems*, 184, article number 102879. doi: 10.1016/j.agsy.2020.102879.

[2] Bacchi, M., Monti, M., Calvi, A., Lo Presti, E., Pellicanò, A., & Preiti, G. (2021). Forage potential of cereal/legume intercrops: Agronomic performances, yield, quality forage and LER in two harvesting times in a mediterranean environment. *Agronomy*, 11(1), article number 121. doi: 10.3390/agronomy11010121.

[3] Behnassi, M., & El Haiba, M. (2022). Implications of the Russia-Ukraine war for global food security. *Nature Human Behaviour*, 6(6), 754-755. doi: 10.1038/s41562-022-01391-x.

[4] Belete, S., Bezabih, M., Abdulkadir, B., Tolera, A., Mekonnen, K., & Wolde-Meskel, E. (2019). Inoculation and phosphorus fertilizer improve food-feed traits of grain legumes in mixed crop-livestock systems of Ethiopia. *Agriculture, Ecosystems & Environment*, 279, 58-64. doi: 10.1016/j.agee.2019.04.014.

[5] Bohra, A., *et al*. (2022). The key to the future lies in the past: Insights from grain legume domestication and improvement should inform future breeding strategies. *Plant and Cell Physiology*, 63(11), 1554-1572. doi: 10.1093/pcp/pcac086.

[6] Carton, N., Swiergiel, W., Tidåker, P., Röös, E., & Carlsson, G. (2022). On-farm experiments on cultivation of grain legumes for food – outcomes from a farmer-researcher collaboration. *Renewable Agriculture and Food Systems*, 37(5), 457-467. doi: 10.1017/S1742170522000102.

[7] Dessalegn, B., Asnake, W., Tigabie, A., & Le, Q.B. (2022). Challenges to adoption of improved legume varieties: A gendered perspective. *Sustainability*, 14(4), article number 2150. doi: 10.3390/su14042150.

[8] Fiott, D. (2022). The fog of war: Russia's war on Ukraine, European defence spending and military capabilities. *Intereconomics*, 57(3), 152-156. doi: 10.1007/s10272-022-1051-8.

[9] Freidenreich, A., Dattamudi, S., Li, Y., & Jayachandran, K. (2022). Influence of leguminous cover crops on soil chemical and biological properties in a no-till tropical fruit orchard. *Land*, 11(6), article number 932. doi: 10.3390/land11060932.

[10] Kravchenko, V., Kononenko, L., Vyshnevska, L., Chinchik, A., & Oliforovych, V. (2019). Biologization of cultivation of leguminous crops in Ukraine. *Agrarian Bulletin of the Black Sea Littoral*, 92, 83-91.

[11] Krupchan, O., & Korol, V. (2022). Food security modern international law and rule-making priorities of Ukraine. *Entrepreneurship, Economy and Law*, 6, 112-121. doi: 10.32849/2663-5313/2022.6.17.

[12] Kvasha, S., Pavlenko, O., & Vakulenko, V. (2023). Current state of food production and consumption in Ukraine. *Economy and Society*, 58. doi: 10.32782/2524-0072/2023-58-15.

[13] Li, Y., Li, R., Ji, R., Wu, Y., Chen, J., Wu, M., &Yang, J. (2024). Research on factors affecting global grain legume yield based on explainable artificial intelligence. *Agriculture*, 14(3), article number 438. doi: 10.3390/agriculture14030438.

[14] Nath, S. (2024). Biotechnology and biofuels: Paving the way towards a sustainable and equitable energy for the future. *Discover Energy*, 4(1), article number 8. doi: 10.1007/s43937-024-00032-w.

[15] Open Data Portal of Ukraine. (n.d.). *Crop yields by region*. Retrieved from https://data.gov.ua/en/dataset/188450fa-3a63-43b5-a783-503b52b3f847/resource/a4cc75cb-3a9d-4c97-9cfb-00f3241416be.

[16] Pörtner, L.M., Lambrecht, N., Springmann, M., Bodirsky, B.L., Gaupp, F., Freund, F., Lotze-Campen, H., & Gabrysch, S. (2022). We need a food system transformation – in the face of the Russia-Ukraine war, now more than ever. *One Earth*, 5(5), 470-472. doi: 10.1016/j.oneear.2022.04.004.

[17] Rawtani, D., Gupta, G., Khatri, N., Rao, P.K., & Hussain, C.M. (2022). Environmental damages due to war in Ukraine: A perspective. *Science of the Total Environment*, 850, article number 157932. doi: 10.1016/j.scitotenv.2022.157932.

[18] Roberts, M.T. (2021). Understanding modern history of international food law is key to building a more resilient and improved global food system. *Journal of Food Law & Policy*, 17(1), article number 6.

[19] Salim, I., González-García, S., Feijoo, G., & Moreira, M.T. (2019). Assessing the environmental sustainability of glucose from wheat as a fermentation feedstock. *Journal of Environmental Management*, 247, 323-332. doi: 10.1016/j.jenvman.2019.06.016.

[20] Shahini, E., Korzhenivska, N., Haibura, Yu., Niskhodovska, O., & Balla, I. (2023). Ukrainian agricultural production profitability issues. *Scientific Horizons*, 26(5), 123-136. doi: 10.48077/scihor5.2023.123.

[21] Shikovets, C., Kvita, H., & Shelest, V. (2020). Simulation of dynamics of economic development of small agricultural enterprises. *Market Infrastructure*, 49, 160-166. doi: 10.32843/infrastruct49-28.
[22] State Statistics Service of Ukraine. (n.d.). *Production volume, yield and harvested area of agricultural crops by type by region*. Retrieved from https://ukrstat.gov.ua/operativ/operativ2021/sg/ovuzpsg/Arh_ovuzpsg_2021_u.html.
[23] Tibagonzeka, J.E., Akumu, G., Kiyimba, F., Atukwase, A., Wambete, J., Bbemba, J., & Muyonga, J.H. (2018). Post-harvest handling practices and losses for legumes and starchy staples in Uganda. *Agricultural Sciences*, 9(1), 141-156. doi: 10.4236/as.2018.91011.
[24] Van der Giesen, C., Cucurachi, S., Guinée, J., Kramer, G.J., & Tukker, A. (2020). A critical view on the current application of LCA for new technologies and recommendations for improved practice. *Journal of Cleaner Production*, 259, article number 120904. doi: 10.1016/j.jclepro.2020.120904.
[25] Walker, C.K., Assadzadeh, S., Wallace, A.J., Delahunty, A.J., Clancy, A.B., McDonald, L.S., Fitzgerald, G.J., Nuttall, J.G., & Panozzo, J.F. (2023). Technologies and data analytics to manage grain quality on-farm – a review. *Agronomy*, 13(4), article number 1129. doi: 10.3390/agronomy13041129.
[26] Xavier, B. (2023). *Future use prospects of legumes through improvement and the challenges faced*. London: IntechOpen. doi: 10.5772/intechopen.109428.
[27] Yatsenko, H. (2020). The impact of weather conditions on economic activity in Ukraine. *Visnyk of the National Bank of Ukraine*, 249, 25-49. doi: 10.26531/vnbu2020.249.03.
[28] Yigezu, Y.A., *et al*. (2021). Institutional and farm-level challenges limiting the diffusion of new varieties from public and CGIAR centers: The case of wheat in Morocco. *Food Security*, 13(6), 1359-1377. doi: 10.1007/s12571-021-01191-7.
[29] Zhang, H., Mascher, M., Abbo, S., & Jayakodi, M. (2022). Advancing grain legumes domestication and evolution studies with genomics. *Plant and Cell Physiology*, 63(11), 1540-1553. doi: 10.1093/pcp/pcac062.
[30] Zhao, N., *et al*. (2024). Combined application of leguminous green manure and straw determined grain yield and nutrient use efficiency in wheat-maize-sunflower rotations system in Northwest China. *Plants*, 13(10), article number 1358. doi: 10.3390/plants13101358.

Статистичний аналіз врожаїв зернобобових культур і використання їх на ринку України

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Анотація. Метою виконаного дослідження було оцінити стан виробництва зернобобових культур та їх використання на ринку України. Для досягнення поставленої мети проаналізовано виробництво, урожайність, посівні площі, динаміку експорту та структуру використання таких зернобобових культур, як квасоля, соя та горох за 2015-2023 рр. Встановлено, що виробництво, експорт та споживання зернобобових культур в Україні з 2015 по 2023 роки показує суттєві зміни в галузі. Виробництво та площа посівів зернобобових культур значно скоротилися у 2015-2022 рр., але почали відновлюватися в 2023 році. Динаміка урожайності зернобобових культур за період 2015-2023 рр. відзначається коливаннями. Урожайність гороху варіювала від 22,4 ц/га у 2015 році до 31,3 ц/га у 2016 році, з подальшим зниженням до 18,2 ц/га у 2018 році, а потім відновилася до 25,7 ц/га у 2023 році. Урожайність квасолі зросла з 13,5 ц/га у 2015 році до 16,3 ц/га у 2023 році, урожайність сої збільшилася з 18,4 ц/га у 2015 році до 25,8 ц/га у 2023 році. Крім того, структура використання зернобобових культур у 2015-2023 роках також змінилася: частка споживання у харчовій промисловості зменшилася з 35 % до 27 %, тоді як частка тваринництва зросла із 40 % до 48 %. Частка промисловості залишилася стабільною на рівні 25 %. Отримані результати свідчать про необхідність розвитку та підтримки виробництва зернобобових культур в Україні, а також оптимізації структури їх використання

Ключові слова: експорт; посівні площі; соя; горох; квасоля; сільськогосподарське виробництво