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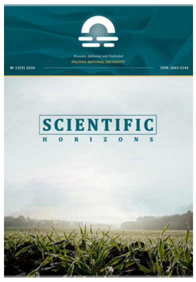

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Prospects and directions of diversification of oilseed group crops

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Abstract. The purpose of the study was to examine the influence of technology elements on the yield and quality of oil from various varieties of oilseeds, in particular, sunflower, rapeseed, safflower, camelina, and brown mustard. The effectiveness of various agricultural techniques (types of fertilisers, protection systems, and agrotechnical measures) to improve the quality and quantity of these crops was evaluated. The study was conducted for three years on the basis of the educational-scientific-practical centre of Mykolaiv National Agrarian University. The methodology included conducting field experiments with various agronomic technologies, laboratory analysis of the obtained plant samples, and determining the oil content. According to the results, the use of an optimised nutrition system and a combined protection system increases the yield of sunflower seeds by 15%, the quality of oil by 10%, and the use of innovative elements for growing flax increases the oil content of seeds by 8%. For rapeseed, it was determined that the use of adopted nutrition and

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protection systems increases the yield by 20%. The mustard examination showed a substantial improvement in the crop's resistance to diseases when using integrated plant protection. The findings confirmed the importance of choosing the optimal elements of the technology that contribute to improving the yield and quality of oilseeds. This issue is relevant since oilseeds occupy a substantial place in the agro-industrial complex. Increasing the efficiency of growing oilseeds not only provides stable profits for farmers but also has a positive impact on the food security of the country in general. Thus, the introduction of scientifically based agronomic measures is a critical factor for achieving sustainable development of the agricultural sector and diversification of oilseeds

Keywords: agro-industrial complex; oilseed plants; technology elements; varieties and hybrids; yield; seed quality

INTRODUCTION

Oilseeds play a vital role in the agro-industrial complex, providing important resources not only for the food industry but also for other applications, such as the production of biofuels, various types of oils, paints, and cosmetics. In the context of global climate change, economic fluctuations and growing requirements for food security, the issue of diversification of oilseeds is becoming particularly relevant. The main problem is to assess the possibilities of expanding the range of oilseeds in addition to sunflower, which will help reduce economic risks, increase productivity and reduce the negative impact on soil fertility due to the oversaturation of sunflower crop rotations. Crop diversification in the field of agronomy is associated with the selection of plant species of the oilseed group to improve disease resistance and increase their productivity (Kairbayeva *et al.*, 2022).

The subject of diversification of oilseeds is extremely relevant in the context of ensuring food security, economic stability and environmental sustainability of the agro-industrial complex (Shevchuk *et al.*, 2024). In particular, T. Zelt (2022) noted that diversification of oilseeds can substantially reduce the risks associated with monoculture cultivation, such as vulnerability to pests, diseases, and climate change. I. Nahvi *et al.* (2023) noted that the introduction of new varieties and hybrids of oilseeds, such as sunflower, rapeseed, soy, etc., can help increase yields and reduce production costs. A study conducted by L. Magno *et al.* (2022), focuses on the potential of oilseeds such as flax and hemp. These plants can provide additional sources of oil that not only meet consumer demand but also help reduce dependence on traditional oilseeds such as sunflower and rapeseed. Researchers C. Wen *et al.* (2023) determined that the diversification of oilseeds is an important factor that directly affects the development of the fat and oil industry engaged in processing these crops. D. Rudoy *et al.* (2023) established that the growing demand for oils with lower saturated fat content, such as flax or hemp seed oil, substantially encourages innovation in manufacturing processes. The paper of S. Jopony *et al.* (2023) analysed in detail how crop diversity can substantially change the structure of acreage and improve the efficiency of land use. The authors emphasise that optimisation of acreage and the introduction of adapted crops that can withstand climate change and diseases can not only increase the productivity of agricultural production but also ensure its sustainability in the long term.

Y. Jiang *et al.* (2024) examine in detail the environmental aspects of diversification, in particular, its positive impact on biodiversity, water management, and reducing the use of chemical fertilisers, which is critical for ecosystem conservation. I.V. Chekhova (2021) believes that the diversification of oilseeds improves the product range and also contributes to the development of more sustainable and innovative production practices in the industry. Despite the available research, there is a lack of work on niche oilseeds that can be commercially profitable, and there is also a lack of detailed data on the long-term economic benefits of diversification and the impact of these crops on the ecological aspects of agronomic systems. Therefore, it is necessary to assess the potential for diversification of oilseed group crops to improve agricultural production and economic benefits due to changes in climate and market conditions, including in the southern steppe zone of Ukraine. The main purpose of this study was to identify new approaches to the diversification of agricultural production and study the impact of various elements of technology on the yield and quality of oilseeds, such as sunflower, rapeseed, mustard, safflower, brown mustard, and camelina.

MATERIALS AND METHODS

An experiment was conducted on the basis of the educational-scientific-practical centre of Mykolaiv National Agrarian University during 2022-2024 to achieve the study goal. The selection of oilseed crops for the study was conducted at the educational and scientific-practical centre, where a decision was made to focus on six crop species (Table 1).

Sunflower is included with the greatest distribution, high yield and oil content, rapeseed – for its low content of saturated fats and the possibility of their use for the production of biodiesel, safflower – as a drought-resistant crop, with high nutritional value and fairly high oil content, mustard – due to its resistance to environmental conditions and additional value in medicine, oilseed flax – for its widespread use in medicine, industry, and camelina – for its prospects in the production of oil for cosmetics, food, jet fuel.

Table 1*. Varieties and hybrids of crops used in the study*

Culture	Variety/hybrid	Year of registration	Originator	Country
Sunflower	Forward	2018	V.Ya. Yuriev Plant Production Institute	Ukraine
Sunflower	P64LE25	2015	Pioneer	Netherlands
Winter rapeseed	Phoenix CL	2023	DSV	Austria
Winter rapeseed	Abacus	2010	NPZ (LEMBKE)	Germany
Safflower	Dobrynya	2016	Institute of Oilseed Crops of NAAS	Ukraine
Safflower	Lahidny	2011	Institute of Oilseed Crops of NAAS	Ukraine
Brown mustard	Dzhyonka	2008	Institute of Oilseed Crops of NAAS	Ukraine
Brown mustard	Zabahanka	2020	Institute of Oilseed Crops of NAAS	Ukraine
Oilseed flax	Orpheus	2002	Institute of Oilseed Crops of NAAS	Ukraine
Oilseed flax	Dobrodar	2022	Institute of Oilseed Crops of NAAS	Ukraine
Camelina	Prestige	2006	Institute of Oilseed Crops of NAAS	Ukraine
Camelina	Euro 12	2015	Institute of Oilseed Crops of NAAS	Ukraine

Source: *compared by the authors on the basis of data from the Ministry of Agrarian Policy and Food of Ukraine (2024)*

The experiment of the study was conducted on southern chernozem in the educational-scientific-practical centre of Mykolaiv National Agrarian University during 2022-2024. Weather conditions during the experiment were marked by the following trends: spring was characterised by gradual warming. The beginning of March was cool with periodic frosts, but in April and May the temperature increased substantially, precipitation decreased from March to May, but light precipitation fell. In summer, temperatures were high, with daily averages ranging from +20°C to +35°C, with temperature peaks above 40°C in July and August. The summer months were accompanied by short-term rains, alternating with prolonged droughts. In autumn, the temperature gradually decreased. September was warm, with temperatures ranging from +20°C to +30°C, in October the temperature gradually decreased, precipitation fluctuated, and it became more windy. Rain fell periodically and unevenly. In general, the weather during the entire period had changes characteristic of the steppe zone of the Mykolaiv region.

The study evaluated the impact of various technological elements on the yield and oil quality of sunflower, rapeseed, safflower, brown mustard, oilseed flax, and camelina crops, along with their resistance to major diseases and pests. The study aimed to determine the effects of crop variety or hybrid, fertilisers, and protection measures on the yield and quality of these oilseed crops. The experiment scheme included the following options:

1. Factor A – varieties and hybrids of oilseed crops: Sunflower (P64LE25, Forward), Rapeseed (Abacus, Phoenix CL), Safflower (Lahidny, Dobrynya), Brown Mustard (Dzhyonka, Zabahanka), Oilseed Flax (Orpheus, Dobrodar), Camelina (Prestige, Euro 12).
2. Factor B – Nutrition System:
   - without fertilisers (control);
   - recommended ($N_{60}P_{40}$);
   - optimised ($N_{30}P_{30}K_{30}$+ soil spray with the organic biopreparation Metawight at 10 L/ha + treatment of seeds and crops with biopreparations and microelements recommended for the studied crops).
3. Factor C – Protection System:
   - without protection (control);
   - recommended (application of recommended agents when the economic threshold of pest damage is exceeded);
   - optimised (agrotechnical measures and biologically derived agents).

The yield was determined from each plot. Seed quality assessment, oil content for oilseeds taken, laboratory analysis for water content, and chemical residues were determined according to (DSTU 7011:2009, 2010; Methods of examination..., 2016). The experimental study with oilseeds followed the standards of the Convention on Biological Diversity (1992) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (1979).

RESULTS

Oilseeds continue to occupy leading positions among agricultural plants in the agro-industrial complex, as they are characterised by high profitability and substantial efficiency in production. These crops not only provide stable profits for farmers but also play an important role in shaping food security in countries. There are about 350 species of oilseeds in the world, which are grown in different climatic conditions, and have different agronomic properties. Among them, the most popular are sunflower, soy, and rapeseed, which are used for the production of oil, feed, and other food products.

Elements of the technology have substantially affected the yield of oilseeds, which is an extremely important factor for ensuring diversification (Shahini *et al.*, 2023). The inclusion of new varieties and hybrids of oilseeds in the study provided higher yields. This is due to unique genetic characteristics that allow them to adapt more effectively to different growing conditions, such as climate change, soil types, and the presence of moisture. The use of organic fertilisers also had a positive effect on yield, although not as substantial as the selection of varieties and hybrids. Organic fertilisers improve the quality of the soil, contribute to its enrichment with nutrients, and improve water retention capacity and structure, which provides better conditions for the growth and development of plants, allowing them to receive the necessary nutrients, which is important for their healthy development (Tonkha *et al.*, 2024). Irrigation and the use of pesticides also play an important role in ensuring a stable crop. Irrigation systems allow maintaining an optimal level of humidity in the soil, which is especially important during periods of drought (Yeraliyeva *et al.*, 2017). The use of pesticides helped to reduce losses from pests and diseases, and this substantially affected the entire crop volume of oilseeds of the Asteraceae and Linaceae families (Table 2), as well as the Brassicaceae family (Table 3). In general, the use of an integrated approach, including the latest varieties and agronomic technologies, usually gives better results compared to traditional methods. This will allow agricultural producers to maximise the use of resources, increase agricultural productivity, and ensure the sustainability of agricultural systems in the long term (Table 3).

***Table 2**. Seed yield of oilseed crops in the Asteraceae and Linaceae families (average for 2022-2024), t/ha*

Nutrition system (Factor B)	Protection system (Factor C)	Crop, Hybrid/Variety (Factor A)					
		Sunflower		Safflower		Oilseed flax	
		P64LE25	Forward	Lahidny	Dobrynya	Orpheus	Dobrodar
Without fertilisers	Without protection	1.74	2.02	1.57	1.6	1.22	1.27
	Recommended	1.81	2.15	1.62	1.6	1.25	1.33
	Optimised	1.82	2.17	1.63	1.67	1.25	1.33
Recommended	Without protection	2.29	2.69	1.77	1.85	1.41	1.47
	Recommended	2.37	2.75	1.83	1.93	1.47	1.53
	Optimised	2.38	2.78	1.83	1.93	1.47	1.53
Optimised	Without protection	2.37	2.89	1.82	1.99	1.47	1.62
	Recommended	2.47	3.12	1.89	2.09	1.47	1.69
	Optimised	2.51	3.19	1.9	2.1	1.51	1.71

***Source:** compiled by the authors*

***Table 3**. Seed yield of oilseed crops in the Brassicaceae family (Average for 2022-2024), t/ha*

Nutrition system (Factor B)	Protection system (Factor C)	Crop, Hybrid/Variety(Factor A)					
		Winter rapeseed		Brown mustard		Camelina	
		Abacus	Phoenix CL	Dzhyonka	Zabahanka	Prestige	Euro 12
Without fertilisers	Without protection	1.61	2.02	1.21	1.43	1.12	1.19
	Recommended	1.83	2.08	1.29	1.5	1.15	1.23
	Optimised	1.79	2.1	1.29	1.51	1.15	1.24
Recommended	Without protection	1.71	2.12	1.32	1.56	1.29	1.37
	Recommended	1.85	2.34	1.37	1.63	1.26	1.41
	Optimised	1.9	2.33	1.38	1.64	1.25	1.41
Optimised	Without protection	1.77	2.4	1.39	1.69	1.38	1.47
	Recommended	1.89	2.47	1.44	1.77	1.45	1.54
	Optimised	1.93	2.56	1.45	1.8	1.47	1.57

***Source:** compared by the authors*

The quality indicators of plant seeds are significantly influenced by cultivation technology. The introduction of new hybrids and varieties has led to an increase in oil content and improvements in other quality parameters, such as a reduction in chemical residues. The use of an optimised fertilisation system positively impacted overall quality but resulted in a slight increase in moisture content and chemical residues. Applying an optimised nutrition system alongside a combined protection system achieved optimal oil content and reduced chemical residues, though the impact on moisture content was variable (Table 4). Overall, implementing individual technological elements contributed to improved results, but their effectiveness depends on specific conditions and crop types.

***Table 4**. Oil content and seed moisture of studied crops under optimised nutrition and protection systems (average for 2022-2024)*

Culture	Variety/hybrid	Oil content (%)	Seed moisture (%)	Pesticide residues (mg/kg)
Sunflower	P64LE25	42	9	0.5
	Forward	47	8.5	0.3
Winter rapeseed	Abacus	44	8.8	0.4
	Phoenix CL	48.5	7.5	1
Safflower	Lahidny	40	9.5	0.2
	Dobrynya	42	9	1
Brown mustard	Dzhyonka	32	10.5	1.5
	Zabahanka	34	10	0.9
Oilseed flax	Orpheus	33	9.8	1.1
	Dobrodar	38	10	0.4
Camelina	Prestige	29	12.5	0.3
	Euro 12	31	11	0.8

***Source:** compared by the authors*

The technological elements used in sunflower cultivation had a significant impact on oil quality. The application of irrigation and pesticides ensured stable and high oil content, contributing to reduced acid and peroxide values, which indicate improved oil stability. The Omega-6 content, essential for human health, remained stable and may even increase with these agronomic practices. The optimised nutrition system positively affected sunflower oil quality, enhancing oil content and reducing the acid value, indicative of lower oxidative processes in the oil. Omega-6 content remained high, thus preserving valuable nutritional properties. In the control treatment, oil quality was at a basic level. Oil content, acid and peroxide values, and omega-6 content were indicators that provide baseline oil quality (Table 5). Overall, the use of fertilisers, irrigation, and pesticides significantly improved sunflower oil quality, promoting stability, reducing oxidation, and maintaining essential nutritional components.

***Table 5**. Quality indicators of sunflower oil from the hybrid forward*

Treatment	Oil content (%)	Quality indicators
Without fertilisers and protection	-	Acidity (°K): 0.3
		Peroxide value (meq/kg): 7
		Free fatty acid content (%): 0.1
		Iodine index (g iodine/100 g): 120
		Omega-6 content (%): 65
		Colour (Yellow scale): 2
Recommended nutrition and protection system	45.5	Acidity (°K): 0.2
		Peroxide value (meq/kg): 5
		Free fatty acid content (%): 0.1
		Iodine index (g iodine/100 g): 122
		Omega-6 content (%): 62
		Colour (Yellow scale): 1.8
Optimised nutrition and protection system	47	Acidity (°K): 0.4
		Peroxide value (meq/kg): 6.5
		Free fatty acid content (%): 0.2
		Iodine index (g iodine/100 g): 119
		Omega-6 content (%): 64
		Colour (Yellow scale): 2.5

Table 5. Continued

Treatment	Oil content (%)	Quality indicators
Combined protection+irrigation	48.5	Acidity (°K): 0.2
		Peroxide value (meq/kg): 4
		Free fatty acid content (%): 0.1
		Iodine index (g iodine/100 g): 123
		Omega-6 content (%): 65.5
		Colour (Yellow scale): 1.7

Source: *compared by the authors*

Agronomic practices, such as the introduction of new varieties and hybrids, optimised nutrition and protection systems, and irrigation, significantly impact plant disease resistance, helping either to improve or maintain disease resistance at control levels across different crops. Selecting new crop varieties or hybrids often leads to increased resistance to disease. Specifically, new sunflower and rapeseed hybrids have shown improved resistance to respective diseases compared to control variants. The application of an optimised nutrition system can positively influence plant disease resistance, though results may vary depending on the crop and specific conditions. For instance, in some cases, fertilisation enhances resistance to certain diseases, while in others, the effect may be less pronounced. Irrigation and pesticide application also positively impact plant resistance, potentially improving resilience against diseases such as Fusarium or fungal infections, though effectiveness varies based on the crop and methods applied (Table 6). Overall, implementing new agronomic practices is an effective method for enhancing plant disease resistance, though their efficacy may fluctuate depending on specific growing conditions and crop type.

Table 6*. Resistance of studied oilseed crops to diseases and pests depending on production intensification*

Culture	Variety/hybrid	Disease resistance
Sunflower	P64LE25	Fusarium resistance – 80%, powdery mildew resistance – 75%
	Forward	Fusarium resistance – 90%, powdery mildew resistance – 85%
	Forward	Fusarium resistance – 80%, powdery mildew resistance – 75%
Winter rapeseed	Abacus	Fusarium resistance – 80%, powdery mildew resistance – 75%
	Phoenix CL	Soybean moth resistance – 75%, Fusarium resistance – 70%
	Phoenix CL	Soybean moth resistance – 85%, Fusarium resistance – 80%
Safflower	Dobrynya	Blackleg resistance – 75%, fungal infection resistance – 70%
	Dobrynya	Fungal infection resistance – 70%
	Lahidny	Fungal infection resistance – 70%
Brown mustard	Dzhyonka	Blackleg resistance – 75%, fungal infection resistance – 70%
	Zabaganka	Fungal infection resistance – 70%
	Zabaganka	Fungal infection resistance – 70%
Oilseed flax	Orpheus	Whitefly resistance – 70%, fungal infection resistance – 65%
	Dobrodar	Fungal infection resistance – 70%
	Dobrodar	Fungal infection resistance – 70%
Camelina	Prestige	Fungal infection resistance – 70%
	Euro 12	Fungal infection resistance – 80%
	Euro 12	Fungal infection resistance – 70%

Source: *compared by the authors*

New varieties and hybrids have demonstrated superior results compared to standard cultivars. They have shown increased yields and enhanced seed adaptability, making them recommended for further use. The application of organic fertilisers is an effective measure for improving the yield and quality of crop seeds. It is advisable to use organic fertilisers for all oilseed crops. This not only boosts yields but also positively influences the overall condition of the plants. The integrated use of pesticides and irrigation has proven effective in increasing plant productivity and reducing crop losses. The use of Confidor and Fury is recommended for pest control, along with ensuring adequate irrigation levels for optimal growth conditions. To achieve the best results, it is crucial to conduct regular monitoring of plant growth processes. Laboratory analysis for oil content and other physicochemical properties will ensure high product quality. The results of the study indicate a positive impact of selected elements on plant resistance and economic benefits. Therefore, this study demonstrates that innovative agronomic practices and the selection of high-yielding varieties can significantly enhance the effectiveness of oilseed cultivation.

DISCUSSION

The results obtained suggest that the introduction of new varieties (hybrids) of oilseed crops and the application of innovative technological elements positively influence yield and product quality. The findings establish that new varieties (hybrids) and agronomic measures (such as organic fertilisers and irrigation) enhance yield, oil content, and resistance to diseases and pests. For instance, the new sunflower hybrid, Forward, exhibited a yield increase to 3.2 t/ha compared to the standard variety, P64LE25, which yielded 2.5 t/ha. This is important, as such improvements can substantially enhance the economic benefits for agricultural producers, stabilise profits, and contribute to food security.

Research has substantiated that innovative technological elements, such as new varieties (hybrids) and cultivation conditions, significantly affect the yield and seed quality of camelina. The findings align with the conclusions of F. Al Juhaimi *et al*. (2024), who noted that new camelina varieties can substantially enhance yields. However, their study focuses more on the genetic characteristics of the varieties. In contrast, another study places greater emphasis on the agronomic elements of these technologies. According to F. Chen *et al*. (2024), agronomic practices, particularly the use of organic fertilisers, positively influence yield and seed quality. This is consistent with data showing that the application of organic fertiliser increased flax yield to 1.8 t/ha compared to the control, along with a reduction in oil acidity with the addition of organic fertilisers.

In studies conducted by A. Wenda-Piesik and K. Ambroziak (2022), it was determined that the application of irrigation could significantly improve the oil quality of safflower. The results affirm the importance of optimising cultivation conditions to achieve high-quality raw material outputs. Specifically, in one of the trials where an irrigation system was implemented, a notable improvement in oil quality was observed. This suggests that proper water resource management can considerably influence the agronomic characteristics of safflower, which, in turn, may positively impact the expansion of its cultivated area (Bulgakov *et al.*, 2020).

K. Kuzmin *et al*. (2024) focused on a detailed examination of the impact of various fertiliser types on camelina productivity. Their study revealed that the application of a combination of organic and mineral fertilisers could significantly enhance both yield and seed quality. These findings are consistent with data from the current study, which demonstrated that the use of organic fertiliser increased mustard yield to 1.8 t/ha. This underscores the importance of using organic fertilisers as a technological element to achieve optimal results in the cultivation of various agricultural crops (Malik *et al.*, 2024).

S. Deekshitha *et al*. (2024) established that new varieties (hybrids) can improve oil content. Their research confirms that the camelina variety Euro 12 provided a higher oil content in seeds compared to the standard. F. Xiang *et al*. (2024) investigated the effect of irrigation on seed quality, noting significant improvements in oil quality. The results corroborate these findings, as irrigation in one of the trials raised the iodine value to 123 gI_2/100 g. A. Kaolaor *et al*. (2024) indicated that fertilisers and growing conditions can enhance resistance to pests and diseases. The data from this study support these findings, as all variants exhibited high resistance to diseases and pests. L. Nguyen *et al*. (2024) discovered that new varieties with enhanced agronomic traits significantly improve yield and product quality. This aligns with the results obtained in this study, where new varieties (hybrids) demonstrated higher yields and seed quality compared to control variants.

V.A. Vytoptova (2023) reported the advantages of modern hybrids, although specific comparative values were not provided. She also explored the state and challenges of Ukrainian agriculture during wartime, noting that performance may vary by region. A. Snetkova (2019) and A.A. Mazaraki and V.D. Lagutin (2016) focused their studies on new oilseed varieties, although their findings indicate lower oil content in seeds, dependent on growing conditions. These findings suggest that the Forward sunflower hybrid used in this study indeed holds competitive advantages under favourable conditions. In addition, K. Tkachenko (2022) and K. Vasylkivska (2021) examined oilseed production and export trends, closely linked to the new hybrids and varieties featured in this study.

F. Zanetti *et al*. (2019) engaged in mathematical modelling of crop processes. The results of this study confirm the researchers' conclusions on the effectiveness of irrigation technologies, offering valuable insights into optimising production processes, which could substantially enhance productivity in the sector. The researchers also explored new crops for biofuel, providing relevant context to the study's focus on new varieties and hybrids. Their findings open up new possibilities for alternative energy sources, reducing reliance on conventional fuels. L. Pari *et al*. (2019) examined the environmental impact and economic viability of oilseed crops. The findings of their studies directly correlate with the conclusions of this study, particularly in the context of using organic fertilisers and irrigation. This highlights the importance of integrating environmental aspects into oilseed crop production, which can not only improve yields but also conserve ecosystems. Such a holistic approach to agronomy helps to mitigate environmental impact and supports sustainable development within the agricultural sector.

J. Ji *et al*. (2024) provided a detailed analysis of the positive effects of organic fertilisers and modern irrigation methods on agricultural crop yields. The findings of this study not only corroborate prior conclusions but also demonstrate consistency in the data obtained, underscoring the importance of adopting organic farming methods that can enhance productivity and increase the resilience of agro-systems to climate change. S. Yaheliuk and M. Fomych (2024) highlighted significant achievements in the development of resilient crop varieties that demonstrate similar adaptation results under stress conditions. This enabled a comparison of the resilience levels of the sunflower, flax, rapeseed, mustard, camelina, and safflower varieties under study, aligning them with top-performing varieties in the field and confirming their competitiveness. L. Pokopceva *et al.* (2024) identified a positive impact on sunflower productivity through the application of various biopreparation modifications and growth regulators. The importance of such studies lies in the potential to create new varieties and hybrids capable of withstanding extreme conditions, thereby ensuring high yields and reducing risks for agricultural producers. The findings of this study not only corroborate numerous conclusions drawn in other studies but also expand the understanding of how agronomic practices and conditions affect the cultivation of key oilseed crops such as sunflower, flax, rapeseed, mustard, safflower, and camelina.

CONCLUSIONS

This study assessed the impact of new oilseed crop varieties, particularly camelina, on seed yield, quality, and the economic appeal for agricultural production. Results indicate the positive effects of innovative technologies, such as organic fertilisers and irrigation systems, on key agronomic factors. The average yield of camelina reached 1.6 t/ha, substantially higher than that of standard varieties. The influence of irrigation and pesticides on plant growth was positive, providing optimal conditions for plant development. High oil quality was observed in the seeds of new varieties and hybrids, with improved oil content and reduced chemical residues. The use of organic fertilisers also enhanced product quality, though moisture content was slightly higher. New varieties and hybrids demonstrated increased resistance to major diseases. Organic fertilisers positively affected overall plant health, although their impact on disease resistance varied. The combined use of irrigation and pesticides increased plant disease resistance, but the effect was inconsistent depending on the specific crop.

It is recommended to continue the selection and introduction of new crop varieties (hybrids) to enhance yield and product quality, with a particular focus on their resistance to diseases and stress conditions. For maximising outcomes, the optimisation of fertiliser types and dosages is advised, with an emphasis on organic fertilisers, which have shown promising results. The continued use of irrigation and pesticides is also encouraged, with ongoing evaluation under varying conditions to optimise costs and improve efficiency. Regular monitoring of product quality is essential, including analysis of oil content and chemical residues. However, this study has limitations; it was conducted within a single geographic area (Mykolaiv region), which may restrict the generalisability of the findings to other regions. Furthermore, it did not extensively explore different types of organic fertilisers or irrigation methods in the context of climate change impacts. Future research should encompass multiple geographic zones, include a broader range of crop varieties (hybrids), organic fertiliser types, irrigation methods, and schedules, and evaluate the effects of climate change and new technological elements. Long-term monitoring of soil fertility and crop productivity changes is also essential to obtain more accurate and sustainable results.

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CONFLICT OF INTEREST

None.

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Перспективи та напрямки диверсифікації культур олійної групиї

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Анотація. Метою роботи було дослідити вплив елементів технології на врожайність і якість олії з різних сортів олійних культур, зокрема соняшника, ріпаку, сафлору красильного, льону, рижію, гірчиці сизої. Оцінено ефективність різних методів агротехніки (види добрив, системи захисту та агротехнічні заходи) для покращення якості і кількості врожаю цих культур.Дослідження проводили впродовж трьох років на базі навчально-науково-практичного центру Миколаївського національного аграрного університету. Методологія включала проведення польових експериментів дослідів із різними агрономічними технологіями, лабораторний аналіз отриманих рослинних зразків, визначення вмісту олії. За результатами встановлено, що застосування оптимізованої системи живлення та комбінованої системи захисту підвищує врожайність насіння соняшника на 15 % та якість олії на 10 %, застосування інноваційних елементів за вирощування льону збільшує олійність насіння на 8 %. Для ріпака було встановлено, що використання прийнятих систем живлення та захисту підвищує врожайність на 20 %. Дослідження гірчиці продемонструвало значне поліпшення стійкості культури до хвороб при застосуванні інтегрованого захисту рослин. Висновки підтверджують важливість вибору оптимальних елементів технології, які сприяють підвищенню врожайності та якості олійних культур. Це питання є надзвичайно актуальним, оскільки олійні культури займають значне місце в агропромисловому комплексі. Підвищення ефективності вирощування олійних культур не лише забезпечує стабільний прибуток для аграріїв, але й позитивно впливає на продовольчу безпеку країни в цілому. Таким чином, впровадження науково обґрунтованих агрономічних заходів є ключовим фактором для досягнення сталого розвитку аграрного сектору та диверсифікації культур олійної групи

Ключові слова: агропромисловий комплекс; рослини олійної групи; елементи технології; сорти і гібриди; урожайність; якість насіння