

IRSTI 68.35.37

UDC 633.852

Research Article

<https://www.jpri-kazniapk.kz><https://doi.org/10.46666/2026-3.2708-9991.12>**CULTIVATION OF OILSEEDS IN THE REPUBLIC OF KAZAKHSTAN: INDICATORS, DYNAMICS, GROWTH TRENDS****ҚАЗАҚСТАН РЕСПУБЛИКАСЫНДА МАЙЛЫ ДАҚЫЛДАРДЫ ӨСІРУ: КӨРСЕТКІШТЕР, ДИНАМИКА, ӨСУ ТЕНДЕНЦИЯЛАРЫ****ВОЗДЕЛЫВАНИЕ МАСЛИЧНЫХ КУЛЬТУР В РЕСПУБЛИКЕ КАЗАХСТАН: ПОКАЗАТЕЛИ, ДИНАМИКА, ТЕНДЕНЦИИ РОСТА****B. NURAKHOVA***Ph.D***B. BOLATBEK****Ph.D***A. DUISEBAYEVA***Ph.D**Narxoz University, Almaty, Kazakhstan*** corresponding author's e-mail: botagoz.bolatbek@narxoz.kz***Б.Ж. НҰРАХОВА***Ph.D***Б.Б. БОЛАТБЕК ****Ph.D***А.М. ДҮЙСЕБАЕВА***Ph.D**Нархоз университеті, Алматы, Қазақстан*** автордың электрондық поштасы: botagoz.bolatbek@narxoz.kz***Б.Ж. НУРАХОВА***Ph.D***Б.Б. БОЛАТБЕК ****Ph.D***А.М. ДҮЙСЕБАЕВА***Ph.D**Университет Нархоз, Алматы, Казахстан***электронная почта автора: botagoz.bolatbek@narxoz.kz*

Abstract. *Objective* of the study is to analyze the economic indicators of oilseed production, including rapeseed, evaluate their trends, and identify factors affecting changes in yield, cost price, and profitability. *Methods* – economic-statistical, index, and dynamic analysis to determine sown areas and gross harvest of oilseeds for 2015–2025, quantitative identification of patterns in key parameter changes. *Results* – indicate the intensification of rapeseed cultivation and its increasing importance in agriculture. *Conclusions* – economic indicators of the oilseed sector in Kazakhstan as a whole are characterized by positive dynamics. Particularly steady growth was noted in rapeseed cultivation, indicating an increase in its production and economic potential. To increase the efficiency of oilseed plant cultivation, it is necessary to introduce modern agrotechnologies, use high-yielding varieties, and improve state support measures. The results provided a basis for developing recommendations to improve the effectiveness of oilseed crop agricultural production and ensure sustainable development of the sector under changing market conditions. Oil crops remain the foundation of financial stability for many agricultural enterprises. They ensure the country's food security in the vegetable oil segment and support livestock farming with a feed base. Cultivation and processing technologies are constantly being improved, allowing the republic to remain one of the key players in the global food market. Implementation of targeted measures will contribute to increasing the production of oilseeds, creating new jobs, stabilizing the social situation in rural regions, and strengthening the positions of domestic goods in the international foreign economic arena.

Аңдатпа. Зерттеудің мақсаты – майлы дақылдарды, оның ішінде рапсты өндірудің экономикалық көрсеткіштерін талдау, олардың тенденцияларын бағалау, сондай-ақ өнімділіктің, өзіндік

құнның және рентабельділіктің өзгеруіне әсер ететін факторларды айқындау. *Әдістері* – 2015-2025 жж. майлы дақылдардың егіс алқаптары мен жалпы түсімін анықтау, негізгі параметрлердің өзгеру заңдылықтарын сандық идентификациялау үшін экономикалық-статистикалық, индекстік және динамикалық талдау әдістері қолданылды. *Нәтижелері* рапс өсірудің қарқындалатынын, оның ауыл шаруашылығындағы маңыздылығының артқанын айғақтайды. *Қорытынды* – Қазақстандағы экономиканың майлы дақылдар секторының экономикалық индикаторлары тұтастай алғанда оң динамикамен сипатталады. Әсіресе рапс өсіруде тұрақты өсім байқалды, бұл оның өндірістік және экономикалық әлеуетінің артқанын көрсетеді. Майлы дақылдарды өсіру тиімділігін арттыру үшін заманауи агротехнологияларды енгізу, жоғары өнімді сұрыптарды пайдалану және мемлекеттік қолдау шараларын жетілдіру қажет. Нәтижелер майлы егістіктердің агроөндіріс нәтижелілігін жақсарту және нарықтық конъюнктураның өзгеруі жағдайында саланың орнықты дамуын қамтамасыз ету бойынша ұсыныстар әзірлеуге негіз болды. Майлы агродақылдар көптеген ауылшаруашылық кәсіпорындарының қаржылық тұрақтылығының іргетасы болып қала береді. Олар өсімдік майлары сегментінде елдің азық-түлік қауіпсіздігін қамтамасыз етеді, мал шаруашылығын азықтық базамен қолдайды. Өсіру және қайта өңдеу технологиялары үздіксіз жетілдірілуде, бұл республикаға әлемдік азық-түлік нарығындағы негізгі ойыншылардың бірі болып қалуға мүмкіндік береді. Мақсатты шараларды жүзеге асыру майлы тұқым өнімдерін шығаруды арттыруға, жаңа жұмыс орындарын құруға, ауылдық өңірлердегі әлеуметтік жағдайды тұрақтандыруға және халықаралық сыртқы экономикалық аренада отандық тауарлардың позицияларын нығайтуға ықпал етеді.

Аннотация. *Целью* исследования является анализ экономических показателей производства масличных культур, в том числе рапса, оценка их тенденций, а также выявление факторов, влияющих на изменение урожайности, себестоимости и рентабельности. *Методы* – экономико-статистического, индексного и динамического анализа для определения посевных площадей и валового сбора масличных за 2015-2025 гг., количественная идентификация закономерностей изменения основных параметров. *Результаты* свидетельствуют об интенсификации возделывания рапса, возрастании его значимости в сельском хозяйстве. *Выводы* – экономические индикаторы масличного сектора экономики в Казахстане в целом характеризуются положительной динамикой. Особенно устойчивый рост отмечен при выращивании рапса, что свидетельствует об увеличении его производственного и экономического потенциала. Для повышения эффективности культивирования масличных растений необходимо внедрение современных агротехнологий, использование высокоурожайных сортов и совершенствование мер государственной поддержки. Результаты дали основание разработать рекомендации по улучшению результативности агропроизводства масличных посевов и обеспечению устойчивого развития отрасли в условиях изменения рыночной конъюнктуры. Масличные агрокультуры остаются фундаментом финансовой стабильности многих сельхозпредприятий. Они обеспечивают продовольственную безопасность страны в сегменте растительных масел, поддерживают животноводство кормовой базой. Технологии возделывания и переработки постоянно совершенствуются, что позволяет республике оставаться одним из ключевых игроков на мировом рынке продовольствия. Осуществление целенаправленных мер будут содействовать наращиванию выпуска маслосеменной продукции, созданию новых рабочих мест, стабилизации социальной ситуации в сельских регионах и усилению позиций отечественных товаров на международной внешнеэкономической арене.

Keywords: agriculture, oilseeds, rapeseed, yield, gross production, cost, profitability, renewable energy, highly efficient technologies.

Түйінді сөздер: ауыл шаруашылығы, майлы дақылдар, рапс, өнімділік, жалпы өндіріс, құны, рентабельділік, жаңартылатын энергия, жоғары тиімді технологиялар.

Ключевые слова: сельское хозяйство, масличные культуры, рапс, урожайность, валовое производство, стоимость, рентабельность, возобновляемая энергия, высокоэффективные технологии.

Received: 16.07.2026. Approved after Peer-reviewed: 08.09.2026. Accepted: 18.09.2026

Introduction

Oilseed crops play a critical role in ensuring food security, promoting agricultural development, and enhancing export potential. In Kazakhstan, the cultivation of oilseeds, particularly rapeseed, has gained increasing importance due to favorable agro-climatic conditions, rising global demand for vegetable oils, and the strategic objective of diversifying crop production. These crops serve not only as sources of edible oils but also as raw materials for animal feed and various industrial applications. Rapeseed, in particular, is well adapted to the arid and semi-arid conditions characteristic of many regions of Kazakhstan. While rapeseed is widely recognized for its high oil content and export potential, rapeseed is valued for its drought tolerance and suitability for low-input agricultural systems.

In recent years, Kazakhstan has undertaken significant measures to expand the cultivated area of oilseed crops and improve their productivity. However, the economic efficiency of oilseed production remains uneven, influenced by factors such as yield variability, production costs, market price fluctuations, and technological limitations. Consequently, a comprehensive assessment of key economic indicators, including total production, production costs, profitability, and income levels is essential to evaluate the sustainability and competitiveness of the sector.

Oilseed crops, including rapeseed, are critical to Kazakhstan's agricultural sector due to their contribution to food security, agro-industrial development, and export potential. Recent studies have highlighted several challenges affecting the economic efficiency of these crops, including yield variability, high production costs, and limited access to modern technologies. This study employs the index method to analyze changes in production efficiency and to identify the main factors affecting economic outcomes in oilseed cultivation. By examining trends in productivity, total output, and profitability, the research aims to provide insights into the development prospects of the oilseed sector in Kazakhstan and to support strategies for enhancing its overall economic performance.

Oilseed production has received increasing attention in recent years because of its role in supporting sustainable agricultural development and improving the economic resilience of farming systems. Several studies have shown that oilseed crops contribute to crop diversification, improve

land-use efficiency, and provide stable income opportunities for agricultural producers. In particular, rapeseed has become one of the most economically important oilseed crops owing to its high oil content, wide range of industrial applications, and growing demand in international markets. At the same time, the profitability of oilseed production depends not only on market conditions but also on improvements in production technologies, efficient resource management, and the adoption of high-yielding cultivars.

Recent studies indicate that improving the economic efficiency of oilseed production requires the adoption of modern cultivation technologies, efficient resource management, and sustainable agricultural practices. Increasing crop productivity while optimizing production costs is considered one of the key factors for enhancing the competitiveness and profitability of the oilseed sector. Furthermore, the application of innovative farming approaches contributes to long-term production stability and supports the sustainable development of agricultural systems.

Literature review

In Kazakhstan, the development of oilseed production is being actively driven by high demand and strong government support. The effective implementation of breeding programs enhances yield and quality, thereby increasing the competitiveness of the sector [1]. Currently, the research shows that the selling price of flax has been steadily increasing, thereby contributing to improved enterprise profitability. To fully assess the efficiency of the company's operations, it is necessary to analyze the structure of reserves for increasing production and the revenue generated from flax sales [2].

Oilseed cakes are a promising source of valuable nutrients and bioactive compounds. Green technologies and further research can help overcome processing challenges and unlock their full potential [3]. The study demonstrated that the industry is actively adopting circular economy principles by transforming oilseed cakes, traditionally used as animal feed or fertilizer, into high-value ingredients for the food and pharmaceutical industries [4].

The steady growth in global demand for oilseed crops has increased the need for the development of high-yielding and resilient varieties. Researchers emphasize that the future of oilseed production is closely linked to genetic improvement, plant breeding, and the adoption of inno-

vative agricultural technologies [5]. In particular, the study demonstrated that the growing demand for biofuels produced from oilseed crops in European countries has increased the economic attractiveness of these crops and strengthened their strategic importance in the agricultural sector [6].

The importance of oilseed crops in ensuring global food security has been widely recognized. The growing global demand for vegetable oils has enhanced the economic value of oilseed crops and has necessitated the development and implementation of advanced breeding strategies and innovative technological solutions [7]. Oilseed rape yields are higher in landscapes with a greater proportion of sunflower cultivation, which is associated with increased bee abundance during the growing season. The study also found that landscapes with a higher share of organic farming support lower pest populations, thereby contributing to improved crop productivity [8].

The economic efficiency of small-scale sunflower farming depends mainly on crop productivity, production costs, and efficient agricultural practices. Improved resource management and modern technologies can increase profitability and strengthen the sustainability of oilseed production [9]. The study of the oil processing industry in the Kostanay region demonstrated that strengthening the link between oilseed production and processing significantly increases value added. The study concluded that exporting oilseeds solely as raw materials does not allow the region to fully realize its income-generating potential [10]. Increasing farm size in rapeseed production improves production efficiency. Larger farms benefit from lower production costs and higher profitability due to economies of scale [11].

Materials and methods

A systematic approach and methods of economic and statistical analysis were applied to investigate the economic indicators of oilseed crop production in Kazakhstan, as oilseed production represents a complex agricultural and economic system, the efficiency of which is determined by a combination of production, technological, and economic factors. Changes in oilseed production volumes depend on the dynamics of sown areas, crop yields, and the efficiency of utilizing production potential.

Within the framework of this study, the main indicators of oilseed crop production were analyzed based on official statistical data from the

Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan for the period 2015–2025. The analysis covered such indicators as sown area, crop yield, and gross harvest of rapeseed, which enabled the assessment of production development trends and economic performance.

The study employed systematic analysis of statistical data, comparative analysis, and dynamic analysis methods to identify changes in the main production indicators of oilseed crops during the study period. The index method was used to determine the influence of individual factors on changes in gross harvest, allowing the assessment of the contribution of sown area and crop yield to overall production volumes.

The application of these methods made it possible to identify the main trends in the development of oilseed crop production in Kazakhstan, determine the factors affecting changes in economic indicators, and develop recommendations aimed at improving the efficiency and sustainable development of the industry.

Results

The economic efficiency of oilseed production. The authors found that the profitability of oilseed crops largely depends on the level of production costs and market prices of the products. They emphasized the importance of improving government support measures and market pricing mechanisms to increase farmers' income and enhance the economic sustainability of oilseed production [12].

Intercropping pulse crops with oilseed crops is a promising strategy for increasing the diversity and productivity of cropping systems. Their study showed that intercropping pea with rapeseed resulted in higher productivity than growing each crop as a separate monoculture, despite the absence of nitrogen fertilization in the intercrop system [13].

The economic efficiency of different rapeseed and mustard genotypes. The authors compared the yield performance and benefit-cost ratios of various varieties and found that the selection of high-yielding genotypes significantly improves production profitability. The study demonstrated that the choice of economically advantageous varieties is one of the key factors determining the overall economic efficiency of oilseed crop production [14].

Five different cultivation technologies were investigated to evaluate their effects on the growth,

development, and seed yield of winter oilseed rape. The study found that nitrogen management had a certain influence on seed yield; however, its effects varied depending on the experimental site. The authors emphasized that the response of winter oilseed rape to nitrogen application was site-specific [15].

The study demonstrated that due to the differences in the physicochemical properties of oilseed crops, rapeseed was identified as the most suitable oilseed crop for cultivation as an energy crop. Furthermore, the authors highlighted the importance of properly assessing existing agricultural lands in countries with high agricultural productivity to ensure food security and enhance their economic potential [16].

In addition, the development of oilseed production is considered an important direction for agricultural diversification due to the increasing demand for vegetable oils and renewable energy resources. Improving the efficiency of rapeseed cultivation can contribute not only to increasing agricultural income but also to strengthening the sustainability of the oilseed sector.

The reviewed studies demonstrate that the economic efficiency and productivity of oilseed

crops are influenced by multiple factors, including crop management practices, variety selection, production costs, and market conditions. However, most previous studies have focused on individual cultivation technologies or economic assessments at the farm level, while comprehensive analyses of long-term changes in rapeseed production indicators at the national level remain limited. Therefore, the present study aims to assess the dynamics of rapeseed production in Kazakhstan using an index method approach, identifying the contribution of changes in sown area and yield to overall production growth.

This study constructs a dataset for Kazakhstan covering the years 2015, 2020 and 2025. All data are primarily obtained from the databases of the National Bureau of Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. The table summarizes the dynamics of sown area, yield, and gross harvest for 2015, 2020, and 2025, providing the basis for the subsequent index analysis. The dynamics of the main economic indicators of rapeseed production in Kazakhstan for 2015, 2020, and 2025 are presented in table 1.

Table 1 – Dynamics of the main economic indicators of rapeseed production in Kazakhstan for 2015–2025

Indicator title	Notation	Rapeseed				
		2015	2020	2025	Absolute change (+/-)	
					2015	2020
Crop area, ha	S	245.6	406.0	670.0	429.4	264.0
Crop yield, c/ha	Y	8.0	10.3	14.2	6.2	3.9
Total harvest, thousand tonnes	TH	188.0	418.0	951.0	763.0	533.0
Note: compiled by the authors based on the literature source [17]						

Table 1 shows a steady upward trend in all major indicators of rapeseed production during the study period. In relative terms, the sown area increased by 172.8 %, yield increased by 77.5 %, and gross harvest increased by 405.9 % between 2015 and 2025. These results confirm that the expansion of rapeseed production was driven by both quantitative and qualitative improvements in the production system. The sown area increased from 245.6 thousand ha in 2015 to 670.0 thousand ha in 2025, while average yield rose from 8.0 to 14.2 c/ha. As a result, gross harvest expanded from 188.0 to 951.0 thousand tonnes,

indicating substantial growth in rapeseed production in Kazakhstan.

During the analyzed period, the expansion of rapeseed production was accompanied by significant structural changes. Compared with 2015, the cultivated area increased by 2.7 times, while yield increased by 1.8 times. The combination of area expansion and productivity improvement resulted in a fivefold increase in gross harvest, indicating the strengthening of rapeseed production capacity in Kazakhstan.

The observed increase in rapeseed production may be associated with growing interest in oilseed crops, favorable market conditions, and the expansion of crop diversification strategies

in Kazakhstan. The improvement in yield indicators also suggests the gradual adoption of more productive varieties and enhanced cultivation technologies.

Index methods serve as a key tool in studying changes in production indicators. For this study, data on the sown areas, yields, and total harvest of rapeseed crops were collected. Specifically, the overall product index is calculated using the following model:

$$I_{GP} = I_S \times I_Y \quad (1)$$

where:

I_{GP} – overall harvest index;

I_S – sown area index;

I_Y – yield index.

This model allows for a comprehensive assessment of the main factors affecting changes in the overall indicator. The model can be presented in an expanded form as follows:

$$\frac{\sum S_1 Y_1}{\sum S_0 Y_0} = \frac{\sum S_1 Y_0}{\sum S_0 Y_0} \times \frac{\sum S_1 Y_1}{\sum S_1 Y_0} \quad (2)$$

The change in gross production is determined by changes in sown area (S) and yield (Y).

In the study, the total harvest of rapeseed in 2025 was analyzed in relation to the base year 2020.

$$I_{GP} = \frac{\sum S_1 Y_1}{\sum S_0 Y_0} = \frac{951.0}{418.0} = 2.27 \quad (3)$$

During 2020–2025, gross rapeseed production increased 2.27 times. The change in rapeseed gross output due to changes in the sown area will be analyzed using the following formula:

$$I_S = \frac{S_1 Y_0}{S_0 Y_0} = \frac{670.0 \times 10.3}{406.0 \times 10.3} = 1.65 \quad (4)$$

Thus, the expansion of sown area increased production by 1.65 times. Due to the increase in yield, the overall productivity of oilseed crops is expressed by the following formula:

$$I_Y = \frac{\sum S_1 Y_1}{\sum S_1 Y_0} = \frac{670.0 \times 14.2}{670.0 \times 10.3} = 1.38 \quad (5)$$

Thus, yield growth increased production by 1.38 times.

The results indicate that although the increase in cultivated area was the dominant factor in production growth, yield improvement played an important role in increasing resource efficiency. This suggests that future growth of rapeseed production should focus not only on expanding

acreage but also on improving technological practices and productivity.

The relationship is expressed by the following formula:

$$I_{GP} = I_S \times I_Y = 1.65 \times 1.38 = 2.27 \quad (6)$$

The decomposition analysis indicates that both the expansion of sown area and improvements in productivity contributed to the increase in gross harvest during 2020–2025. However, the larger contribution was associated with the expansion of cultivated area, while yield growth provided an additional increase in production efficiency. A comparison of the two periods demonstrates that rapeseed production growth accelerated after 2020. The increase in gross harvest from 418.0 to 951.0 thousand tonnes during 2020–2025 was achieved mainly through the expansion of cultivated areas, while the increase in yield contributed to improving production efficiency.

The following analysis evaluates the changes in rapeseed production between 2015 and 2025 using the index method.

$$I_{GP} = \frac{\sum S_1 Y_1}{\sum S_0 Y_0} = \frac{951.0}{188.0} = 5.06 \quad (7)$$

During 2015–2025, gross rapeseed production increased 5.06 times. The change in rapeseed gross output due to changes in the sown area will be analyzed using the following formula:

$$I_S = \frac{S_1 Y_0}{S_0 Y_0} = \frac{670.0 \times 8.0}{245.6 \times 8.0} = 2.73 \quad (8)$$

Thus, the expansion of sown area increased production by 2.73 times. Due to the increase in yield, the overall productivity of oilseed crops is expressed by the following formula:

$$I_Y = \frac{\sum S_1 Y_1}{\sum S_1 Y_0} = \frac{670.0 \times 14.2}{670.0 \times 8.0} = 1.77 \quad (9)$$

Thus, yield growth increased production by 1.77 times. The relationship is expressed by the following formula:

$$I_{GP} = I_S \times I_Y = 2.73 \times 1.77 = 5.06 \quad (10)$$

The findings are consistent with previous research emphasizing the importance of high-yielding genotypes and improved agronomic

practices in increasing crop productivity. In Kazakhstan, the simultaneous growth in cultivated area and yield indicates that both technological and production factors contribute to the increase in rapeseed output.

From the perspective of sustainable agricultural development, the increase in rapeseed production provides opportunities for strengthening the oilseed sector, improving domestic processing potential, and increasing the economic efficiency of agricultural enterprises. However, further expansion should be supported by environmentally responsible technologies to maintain soil productivity and long-term production sustainability.

The obtained results have important implications for agricultural policy and farm management in Kazakhstan. The expansion of rapeseed cultivation indicates increasing interest in oilseed production, while the improvement in yield demonstrates the potential for further intensification through improved technologies, breeding achievements, and efficient resource management.

The conducted index analysis confirms the positive dynamics of rapeseed production in Kazakhstan over the period 2015–2025. Gross production increased 5.06 times compared with 2015 and 2.28 times compared with 2020. The main driver of production growth was the expansion of sown areas, while the contribution of yield growth indicates the potential for further intensification of rapeseed cultivation. The obtained results demonstrate the importance of combining the expansion of cultivated land with technological improvements to ensure sustainable and economically efficient development of rapeseed production in Kazakhstan. Nevertheless, the present analysis is limited to production indicators and does not include detailed assessment of market prices, production costs, and environmental impacts. Future research should incorporate economic and ecological factors to provide a more comprehensive evaluation of rapeseed production sustainability in Kazakhstan.

Discussion

The obtained results of the index analysis demonstrate significant changes in the structure and dynamics of rapeseed production in Kazakhstan during 2015–2025. The analysis confirms that the growth of gross rapeseed production was determined by the combined influence of extensive and intensive factors, including changes in sown areas and crop productivity. During 2020–2025, the overall harvest index reached 2.27, indicating a substantial increase in produc-

tion volumes compared with the base period. The decomposition of the index showed that the expansion of cultivated areas was the main factor contributing to production growth, with the sown area index equal to 1.65. At the same time, the yield index of 1.38 indicates that productivity improvements also played an important role in increasing total output.

The long-term comparison between 2015 and 2025 revealed even more pronounced changes in rapeseed production. The overall harvest index increased to 5.06, which reflects a significant expansion of production capacity over the studied period. The increase in sown areas by 2.73 times indicates that Kazakhstan's rapeseed sector has developed mainly through the involvement of additional agricultural land in production. However, the yield index of 1.78 demonstrates that technological improvements and better crop management practices have also contributed to production growth.

The obtained findings are consistent with the general trends observed in modern agricultural development, where increasing production volumes are achieved through a combination of land expansion and intensification processes. Nevertheless, reliance mainly on increasing cultivated areas may lead to limitations associated with land resources, production costs, and environmental sustainability. Therefore, further growth of rapeseed production should be focused on improving productivity through the adoption of high-yielding varieties, precision farming technologies, optimized fertilization systems, and efficient resource management. The slight difference between the product of partial indices and the overall index is associated with the rounding of statistical data on sown area, yield, and gross harvest.

Conclusions

1. The analysis showed that rapeseed production in Kazakhstan demonstrated steady growth during 2015–2025, with a significant increase in both cultivated area and total production volume.

2. The increase in rapeseed yield indicates improved production efficiency and the effective application of advanced agrotechnological practices.

3. The index analysis revealed that the expansion of cultivated areas was the main factor contributing to the growth of rapeseed production volumes.

4. Rapeseed is one of the most economically significant and promising crops in Kazakhstan's oilseed production sector.

5. To further improve the efficiency of rape-seed production, it is necessary to introduce innovative technologies, ensure rational use of resources, and implement sustainable production practices.

Authors' contribution: *Nurakhova Botagoz*: conceptualization of the research, formulation of the research objectives, development of the general research framework, methodological guidance, and review of the final manuscript version; *Bolatbek Botagoz*: conducting the main research activities, extensive literature review, collection, processing, and analysis of statistical data, application of research methods, preparation of tables and figures, interpretation and visualization of results, writing the initial manuscript draft, and making revisions based on scientific feedback; *Duisebayeva Aizhan*: providing methodological consultation, validation of research results, critical review and editing of the manuscript, contribution to the discussion of findings, and approval of the final version of the manuscript.

Conflict of interests: on behalf of the authors, the corresponding-author declares that this paper does not contain any conflict of interests.

References

- [1] Didorenko, S. Current status of oilseed crops in the Republic of Kazakhstan / S. Didorenko, R. Kassenov, E. Kisetova, Zh. Bayrzhanov, R. Kushanova // *Journal Oilseeds and fats, Crops and Lipids*.-2025.-Vol. 32.-Article 17. <https://doi.org/10.1051/ocl/2025012>
- [2] Bermukhametova, Z. Economic and statistical methods of estimating and forecasting the enterprise production activity and realization of oilseed crops / Z. Bermukhametova, A. Kurmangaliyeva, Zh. Tastemirova // *Bulletin of «Turan» University*.-2024.-№1(101).-P.187-200. <https://doi.org/10.46914/1562-2959-2024-1-1-187-200>
- [3] Grahovac, N. Extraction and valorization of oilseed cakes for value-added food components - A review for a sustainable foodstuff production in a case process approach / N.Grahovac, M.Aleksic, B. Trajkovska, A. Marjanovic Jeromela, G.Nakov // *Foods*. -2025.-Vol.14.-Issue 13.-Article 2244. <https://doi.org/10.3390/foods14132244>
- [4] Ancuta, P. Oil press-cakes and meals valorization through circular economy approaches: A review / P. Ancuta, A.Sonia // *Applied Sciences*.-2020.-Vol.10.-Issue 21.-Article 7432. <https://doi.org/10.3390/app10217432>
- [5] Zandberg, J. The global assesment of oilseed Brassica crop species yield, yield stability and the underluing genetics / J. Zandberg, C. Fernandez, M. Danilevicz, W. Thomas, D.Edwards, J,Batley // *Plants*.-2022.-Vol.11.-Issue 20.- Article 2740. <https://doi.org/10.3390/plants11202740>
- [6] Zanetti, F. Camelina, an ancient oilseed crop actively contributing to the rural renaissance in Europe. A review / F. Zanetti, B. Alberghini, A.M.Jeromela, N. Grahovac, D. Rajkovic, B.Kiprovski, A. Monti // *Agronomy for Sustainable Development*.-2021.-Vol.41.-N2.- Article s13593-020-00663-y. <https://doi.org/10.1007/s13593-020-00663-y>
- [7] Attia, Z. Breeding for sustainable oilseed crop yield and quality in a changing climate / Z. Attia, C.S. Pogoda, S. Reinert, N.C. Kane, B.C. Hulke // *International Journal of Plant Breeding Research*.-2021.-Vol.134.-P.1817-1827. <https://doi:10.1007/s00122-021-03770-w>
- [8] Perrot,T. Environmentally friendly landscape management improves oilseed rape yields by increasing pollinators and reducing pests / T. Perrot, V. Bretagnolle, S. Gaba // *Journal of Applied Ecology*.-2022.-Vol.59.-P.1825-1836. <https://doi:10.1111/1365-2664.14190>
- [9] Richard, M. Economic efficiency of small-scale sunflower farmers: A Stochastic profit frontier approach / M. Richard, D. Philip, H. Ngaiza // *Asian Journal of Science and Applied Technology*.-2025.-Vol.14.-№1.-P.23-27. <https://doi.org/10.70112/ajsat-2025.14.1.4267>
- [10] Kuzhemratova, S. Oil refining industry of Kostanay region of the Republic of Kazakhstan / S. Kuzhemratova // *Problems of Agrimarket*.-2025.-№3.-P.246-256. <https://doi.org/10.46666/2025-3.2708-9991.22>
- [11] Zhang, Q. Enhancing cost efficiency and promoting sustainable development of rapeseed in China: the role of scale operations and management / Q. Zhang, F. Ye, T. Tong, Z. Feng // *Frontiers in Sustainable Food Systems*.-2025.-Vol.9.- Article fsufs.2025.1502049. <https://doi.org/10.3389/fsufs.2025.1502049>
- [12] Satishkumar, M. Cost and profitability analysis of selected oilseed crops: An estimation from Karnataka / M. Satishkumar, A. Joshi, G.Kumar // *Economic Affairs*.-2022.-Vol.67.-N5.-P.809–813. <https://doi.org/10.46852/0424-2513.5.2022.15>
- [13] McAuley, W. Productivity, soil fertility and soil health benefits associated with intercropping small grains and oilseeds with legumes in the semi-arid environment of the Canadian Prairies / W. McAuley, M. Bourgault, K. Congreves // *Agriculture, Ecosystems and Environment*.-2025.-Vol.389.- Article 109694. <https://doi.org/10.1016/j.agee.2025.109694>
- [14] Das Jyoti, S. Economic analysis of early and late maturing rapeseed and mustard genotypes / S. Das Jyoti, A. Khan Robin // *Fundamental and Applied Agriculture*.-2021.-Vol.6.-N 3.-P. 303–308. <https://doi.org/10.5455/faa91309>
- [15] Byrne, R.K. The impact of crop establishment systems in combination with applied nitrogen management on the establishment, growth and yield of winter oilseed rape in a mild Atlantic climate / R.K. Byrne, T. McCabe, P.D. Forristal // *European Journal*

of Agronomy.-2022.-Vol.139.- Article id.126566. <https://doi.org/10.1016/j.eja.2022.126566>

[16] Abdulvahitoglu, A. A new approach for selecting the most suitable oilseed for biodiesel production; the integrated AHP-TOPSIS method / A. Abdulvahitoglu, M. Kilic // Ain Shams Engineering Journal.-2022.-Vol.13.-Issue 3.-Article 101604. <https://doi.org/10.1016/j.asej.2021.10.002>

[17] Бюро национальной статистики Агентства по стратегическому планированию и реформам Республики Казахстан [Электронный ресурс]. – 2026.-URL: <https://www.stat.gov.kz> (дата обращения: 19.06.2026).

References

[1] Didorenko, S., Kassenov, R., Kisetova, E., Bayrzhanov, Zh. & Kushanova, R. (2025). Current status of oilseed crops in the Republic of Kazakhstan. OCL - Oilseeds and fats, Crops and Lipids, 32, 17. <https://doi.org/10.1051/ocl/2025012> [in English].

[2] Bermukhametova, Z., Kurmangaliyeva, A. & Tastemirova, Zh. (2024). Economic and statistical methods of estimating and forecasting the enterprise production activity and realization of oilseed crops. Vestnik universiteta «Turan» - Bulletin of Turan University, (1), 187–200. <https://doi.org/10.46914/1562-2959-2024-1-1-187-200> [in English].

[3] Grahovac, N., Aleksic, M., Trajkovska, B., Marjanovic Jeromela, A. & Nakov, G. (2025). Extraction and valorization of oilseed cakes for value-added food components - A review for a sustainable foodstuff production in a case process approach. Foods, 14 (13), 2244. <https://doi.org/10.3390/foods14132244> [in English].

[4] Ancuta, P. & Sonia, A. (2020). Oil press-cakes and meals valorization through circular economy approaches: A review. Applied Sciences, 10 (21), 7432. <https://doi.org/10.3390/app10217432> [in English].

[5] Zandberg, J., Fernandez, C., Danilevicius, M., Thomas, W., Edwards, D. & Batley, J. (2022). The global assessment of oilseed Brassica crop species yield, yield stability and the underlying genetics. Plants, 11 (20), 2740. <https://doi.org/10.3390/plants11202740> [in English].

[6] Zanetti, F., Albergini, B., Jeromela, A.M., Grahovac, N., Rajkovic, D., Kiprovski, B. & Monti, A. (2021). Camelina, an ancient oilseed crop actively contributing to the rural renaissance in Europe. A review. Agronomy for Sustainable Development, 41 (2), 2. <https://doi.org/10.1007/s13593-020-00663-y> [in English].

[7] Attia, Z., Pogoda, C.S., Reinert, S., Kane, N.C. & Hulke, B.C. (2021). Breeding for sustainable oilseed crop yield and quality in a changing climate. Theoretical and Applied Genetics, 134, 1817–1827. <https://doi.org/10.1007/s00122-021-03770-w> [in English].

[8] Perrot, T., Bretagnolle, V. & Gaba, S. (2022). Environmentally friendly landscape management improves oilseed rape yields by increasing pollinators and reducing pests. Journal of Applied Ecology, 59 (7), 1825–1836. <https://doi.org/10.1111/1365-2664.14190> [in English].

[9] Richard, M., Philip, D. & Ngaiza, H. (2025). Economic efficiency of small-scale sunflower farmers: A Stochastic profit frontier approach. Asian Journal of Science and Applied Technology, 14 (1), 23–27. <https://doi.org/10.70112/ajsat-2025.14.1.4267> [in English].

[10] Kuzhemratova, S. (2025). Oil refining industry of Kostanay region of the Republic of Kazakhstan. Problemy agrorynka - Problems of AgriMarket, (3), 246–256. <https://doi.org/10.46666/2025-3.2708-9991.22> [in English].

[11] Zhang, Q., Ye, F., Tong, T. & Feng, Z. (2025). Enhancing cost efficiency and promoting sustainable development of rapeseed in China: the role of scale operations and management. Frontiers in Sustainable Food Systems, 9, 1502049. <https://doi.org/10.3389/fsufs.2025.1502049> [in English].

[12] Satishkumar, M., Joshi, A. & Kumar, G. (2022). Cost and profitability analysis of selected oilseed crops: An estimation from Karnataka. Economic Affairs, 67 (5), 809–813. <https://doi.org/10.46852/0424-2513.5.2022.15> [in English].

[13] McAuley, W., Bourgault, M. & Congreves, K. (2025). Productivity, soil fertility and soil health benefits associated with intercropping small grains and oilseeds with legumes in the semi-arid environment of the Canadian Prairies. Agriculture, Ecosystems and Environment, 389, 109694. <https://doi.org/10.1016/j.agee.2025.109694> [in English].

[14] Das Jyoti, S. & Khan Robin, A. (2021). Economic analysis of early and late maturing rapeseed and mustard genotypes. Fundamental and Applied Agriculture, 6 (3), 303–308. <https://doi.org/10.5455/faa.91309> [in English].

[15] Byrne, R.K., McCabe, T. & Forristal, P.D. (2022). The impact of crop establishment systems in combination with applied nitrogen management on the establishment, growth and yield of winter oilseed rape in a mild Atlantic climate. European Journal of Agronomy, 139, 126566. <https://doi.org/10.1016/j.eja.2022.126566> [in English].

[16] Abdulvahitoglu, A. & Kilic, M. (2022). A new approach for selecting the most suitable oilseed for biodiesel production; the integrated AHP-TOPSIS method. Ain Shams Engineering Journal, 13 (3), 101604. <https://doi.org/10.1016/j.asej.2021.10.002> [in English].

[17] Bjuro nacional'noj statistiki Agentstva po strategicheskomu planirovaniyu i reformam Respubliki Kazakhstan [Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan] (2026). Available at: <https://www.stat.gov.kz> (date of access: 19.06.2026) [in Russian].

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