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ECONOMIC EFFICIENCY OF GROWING NICHE CROPS IN UKRAINE

S u m m a r y

Background. The diversification of agricultural production through niche crops is an important strategy for increasing profitability, sustainability and resilience to climate change in Ukraine. Despite growing interest, the economic efficiency of cultivating niche crops remains insufficiently studied. This research aims to assess the economic performance of selected niche crops – sugar sorghum, grain sorghum, English lavender, lavender hybrid and medicinal hyssop – under the conditions of the Southern Steppe of Ukraine.

Results and conclusions. The study was based on production and financial data from the Educational, Scientific and Practical Center of Mykolaiv National Agrarian University for 2024. Sugar sorghum and grain sorghum demonstrated stable yields of 3.5 ÷ 3.7 t/ha and high profitability levels of 122 ÷ 125 %, reflecting low production costs and steady demand from the bioenergy and food sectors, although net profit per hectare remained relatively moderate. Essential oil crops generated substantially higher gross income. English lavender and lavender hybrid achieved yields of 5.7 ÷ 6.5 t/ha, with gross income exceeding 250,000 UAH/ha and profitability ranging from 53.5 to 59 %, despite higher initial investment costs. Medicinal hyssop showed the highest economic efficiency, with profitability reaching up to 150 % due to low production costs and high market value of essential oil. Overall, the findings confirm that niche crops are economically viable and represent a promising direction for diversifying agricultural production in Ukraine. The cultivation of essential oil crops, particularly lavender and hyssop, offers high added value and export potential, while sorghum ensures financial stability. Long-term profitability may be increased by using own planting material, expanding crop cultivation area and developing processing infrastructure.

Keywords: gross income, yield, sugar sorghum, essential oil, bioethanol, sustainable agriculture

Introduction

Niche agriculture plays an increasingly important role in modern agricultural production, contributing to higher profitability for enterprises, diversification of sown areas and strengthening the economic stability of the industry [27, 39]. At the same

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time, the effectiveness of niche crop cultivation in Ukraine remains insufficiently researched, complicating the assessment of their profitability and market prospects. This is particularly relevant for crops that have stable demand in the pharmaceutical, food and bioenergy sectors. The significant potential of crops such as sorghum (both sugar and grain), lavender and lavender hybrid necessitates a comprehensive economic analysis of their cultivation.

The issue of the economic efficiency of niche crops has already been addressed in the scientific literature, particularly in relation to their impact on the agricultural market and the sustainability of the agricultural sector. In the studies by Mirzoieva [25] and Mirzoieva and Tomashevskyi [24], the effectiveness of niche grain crops was analyzed in the context of food security. The authors highlight the importance of such crops for the diversification of agricultural production, the stability of the agricultural sector and reducing dependence on traditional grains. The conclusions stress the need for state support and integration of these crops into international value chains.

In the article by Ratushna [30], the market for niche grain crops in Ukraine, including demand, production and export, was studied. The author notes that the growing demand for organic and gluten-free products creates new opportunities for export, increasing profitability and integrating niche crops into international markets. The study by Dorosh [10] analyzed the potential of lavender fields as a tourist resource in Ukraine. The author points out that lavender cultivation can not only provide raw materials for the processing industry, but also contribute to the development of rural tourism, creating added value for the agricultural sector.

Bezhenar and Skyba [5] explored the development of niche crops in Ukraine, emphasizing the role of state support for small farms. The researchers observed that the growing demand for niche products promotes production diversification, but issues with inadequate infrastructure support and state funding remain. Their conclusions highlight the need for innovation to enhance the efficiency and competitiveness of niche crops. The study by Vysochanska and Zubchenko [46] addressed the ecological and economic aspects of niche crop cultivation. The authors emphasized the importance of sustainable farming methods for the efficient production of these crops, taking ecological requirements into account. They also noted that niche crops can be economically viable due to their high added value, but require detailed planning considering climatic and soil conditions. The key conclusion was the need to optimize production processes to improve economic efficiency and ecological sustainability.

Research on the effectiveness of organic fertilizers for improving soil quality and increasing crop yields was conducted by Shahini et al. [35]. The authors focused on the use of organic nitrogen fertilizers in the agricultural sector, which can be beneficial for improving the efficiency of niche crop cultivation. They confirmed that organic fertilizers not only improve soil health, but also provide stable productivity increases, which

is crucial for ensuring the economic efficiency of growing crops such as sorghum and lavender.

Manushkina et al. [21, 22] studied the impact of growth regulators on lavender productivity in the conditions of Southern Steppe Ukraine and the use of energy-efficient and environmentally safe technologies in agriculture. They found that the use of growth regulators significantly increases lavender yields, making it a promising niche crop for Ukraine. Furthermore, the authors emphasized the importance of implementing sustainable technologies to reduce the ecological impact of agricultural production. These approaches can be valuable for developing crops like lavender and sorghum, which in turn contributes to their economic efficiency and market appeal in the current agricultural climate. Drebot and Vysochanska [11] analyzed the economic efficiency of growing millet as a niche crop in Ukraine, focusing on its use in feed production and bioenergy resources. The authors paid special attention to the prospects of expanding this crop in the changing market environment and its role in diversifying agricultural production.

The economic sustainability of niche crops was also discussed by Starikov and Reva [40], focusing on the production of plant oils, particularly dill oil. The study also explored the impact of martial law on the agricultural sector and the need for enterprises to adapt to new economic realities. In this context, Dibrova and Stepasyuk [9] assessed the attractiveness of oat production as an alternative cereal crop. The authors' analysis included the dynamics of its cultivation, economic efficiency and potential to reduce dependence on traditional agricultural sectors. Another important aspect of niche crop development is their export potential. This issue was studied by Kucher et al. [19], who examined mechanisms for enhancing the competitiveness of agricultural enterprises by integrating such crops into international markets. In addition to economic and market factors, environmental considerations play a crucial role. Tretiak et al. [43] addressed the application of eco-innovations in the cultivation of niche crops, which helps improve production efficiency, while minimizing environmental impact.

Ukrainian studies emphasize the significance of niche crops for the agricultural sector, but the experience of foreign countries can provide new approaches and strategies for their implementation in Ukraine. As a result of the analysis of scientific sources on niche crop cultivation in the agricultural sector, gaps were identified in the research, including insufficient attention to the comprehensive analysis of the impact of these crops on food security and integration into international value chains. Most studies focus on specific aspects, such as profitability or ecological benefits, but there is limited research that covers state support and mechanisms for stimulating the production of niche crops in Ukraine. In this context, the aim of the study was a comprehensive analysis of the economic efficiency of niche crop cultivation, their contribution to food security and the possibilities for integration into international economic systems.

The tasks of the current research included identifying the key factors affecting the competitiveness of niche crops in Ukraine, as well as evaluating the impact of state support on the development of these crops. Special attention was given to the development of recommendations for improving mechanisms for stimulating niche crop production to enhance their attractiveness in Ukraine's agricultural sector.

Materials and methods

The study of the economic efficiency of growing niche crops in Ukraine was conducted using the example of the Educational, Scientific and Practical Center of Mykolaiv National Agrarian University, located in Mykolaiv Oblast, in the Southern Steppe zone of Ukraine. The enterprise has 1,339.3 hectares of agricultural land, with 150 hectares allocated for growing grain sorghum and sugar sorghum and 2 hectares for essential oil crops (English lavender, lavender hybrid, medicinal hyssop). The chosen enterprise specializes in growing niche crops, making it possible to assess the economic efficiency of their cultivation. Determining the profitability of such crops will be indicative for formulating recommendations regarding their further development and cultivation prospects.

The selection of hyssop, sorghum and lavender for this study was motivated by their potential for economic diversification, as well as their growing significance in Ukraine's agricultural sector. While sorghum is a diverse commodity with applications in the manufacturing of gluten-free foods and bioenergy, lavender and hyssop are important for their essential oils, which are in great demand in the pharmaceutical, cosmetic and aromatherapy industries. These crops were chosen to provide a thorough investigation of their sustainability under various agricultural conditions in Ukraine by representing a variety of high-value, niche agricultural products with differing environmental and economic requirements.

The study was conducted from April to December 2024, allowing for the consideration of the full vegetation cycle of niche crops and the evaluation of their economic efficiency during different cultivation periods. The selection of this period was determined by the need to account for the impact of current economic and climatic changes on Ukraine's agriculture. Data collection was based on the open sources of information, such as analytical reports from Opendatabot [28], APK-Inform [2] and the Ministry of Agrarian Policy and Food of Ukraine [23].

Data processing was carried out using Microsoft Excel (version 2021) and Statistica (version 13.3). All obtained indicators were entered into these programs for further analysis and calculation of economic indicators. To conduct the economic analysis, key indicators were identified, with a yield being the main element for calculations. The yield was calculated using the following formula (1):

$$Y = \frac{Gc}{Sa}, \quad (1)$$

where Y – yields; Gc – gross crop yield (tons); Sa – sown area (hectares).

To calculate the main economic indicators of production profitability, the analysis included the following indicators. Gross income was calculated using formula (2):

$$GD = Y * SP, \quad (2)$$

where GD – gross income (UAH); SP – selling price (UAH/ton).

Production cost was determined using formula (3):

$$CP = \frac{Tc}{Sa}, \quad (3)$$

where CP – production cost (UAH); Tc – total expenses (UAH).

Net profit is calculated as the difference between gross income and production cost (4):

$$NP = GD - CP, \quad (4)$$

where NP – net profit (UAH).

Profitability is defined as the ratio of net profit to production cost:

$$P = \left(\frac{NP}{CP}\right) * 100, \quad (5)$$

where P – profitability (%).

These indicators allow for the assessment of the economic efficiency of growing each crop and comparison between them. After all calculations were performed for both enterprises, the data obtained were compared using the comparative analysis method. For measuring crop productivity and collecting agronomic data, instruments were used, including the agronomic yield sensor Yara N-Tester (Norway, 2021), which allowed for evaluating soil and plant conditions and determining the nutrient levels in the soil, as well as the digital hygrometer Testo 610 (Germany, 2020) for assessing air humidity and temperature during the crop vegetation period.

In the final part of the study, an analysis of the international market for niche and traditional agricultural crops was conducted using the examples of France, Bulgaria and Spain, allowing for the evaluation of the production and demand characteristics of these crops in different regions of the world. International organizations' data, such as Badische Anilin- und Sodafabrik (BASF) [3], Innovació Tecnològica Catalana (ITC) [14], and analytical reports and statistical databases, including the UN Comtrade Database [45], were used for this purpose.

To analyze the data obtained and statistical tests, the Student's t-test was applied, which allowed for comparing the mean economic indicators for different crops and enterprises. Additionally, Fisher's criterion was used to evaluate the variability of the

data, assessing the significance level of the results obtained. For the crop with the highest profitability, additional economic indicators were considered to help evaluate potential risks and drawbacks of production.

Results

The results obtained during the study represent an important step in determining the economic efficiency of growing niche crops, using a specific enterprise as an example. The assessment of the economic feasibility of growing niche crops was conducted based on an analysis of costs, income and other financial indicators, enabling a clear determination of the effectiveness of each enterprise within the context of their agro-climatic conditions and production approaches. Below are specific calculations that allow for the comparison of profitability indicators, investment payback periods and other important parameters for each of the enterprises, as well as an evaluation of the potential risks and benefits from growing the above-mentioned niche crops. Similarly, yield calculations were carried out for both enterprises. The yield of sugar sorghum was calculated using the formula (1):

$$y = \frac{525}{150} = 3.5 \frac{t}{ha}.$$

The yield of English lavender was calculated using the same formula:

$$Y = \frac{570}{100} = 5.7 \frac{t}{ha}.$$

Similar calculations were performed for other crops, including grain sorghum, lavender hybrid and medicinal hyssop. The results of the yield calculations for all the studied crops are shown in Figure 1.

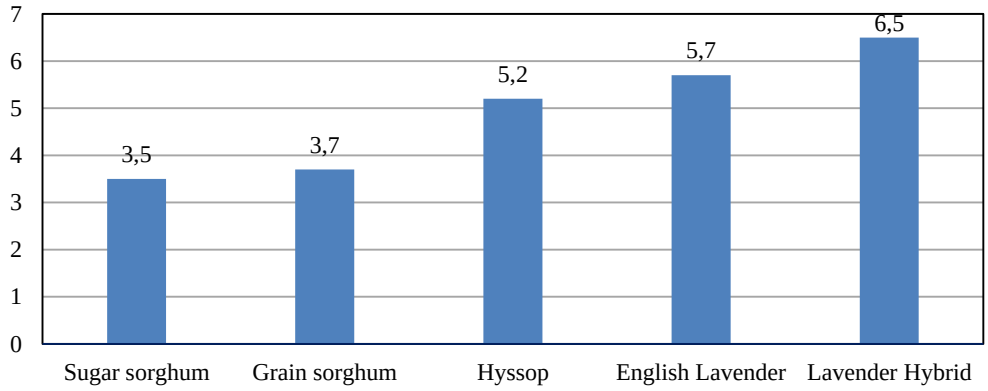

Figure 1. Crop yields in the studied enterprises for the year 2024

Explanatory notes: developed by the authors based on Opendatabot [28], APK-Inform [2], Ministry of Agrarian Policy and Food of Ukraine [23]

According to the findings, essential oil crops yield substantially more than sorghum varieties, especially English lavender and lavender hybrid. This implies that these crops offer higher yields and the possibility of larger financial returns, even though their initial investment costs are higher. The efficient application of cutting-edge agricultural technologies, like drip irrigation and specialized plant protection techniques, which improve crop development in the region's unique climate, may be the reason for the comparatively greater yields of lavender and lavender hybrid. Sorghum crops, on the other hand, exhibit lesser profitability in absolute terms despite yielding at a steady and consistent pace, underscoring the significance of product differentiation, market demand and added value in determining the economic success of these crops. Despite their higher initial costs, the essential oil crops are clearly more lucrative and present greater revenue potential, which highlights their allure for long-term agricultural investment in Ukraine.

Since niche crops have potential for expanding markets, particularly through export, it is important to assess not only the agro-technical aspects of their cultivation but also the competitiveness of the products, considering production, processing, and logistics costs. Further analysis will determine how growing these crops can ensure long-term profitability for enterprises and contribute to the diversification of agricultural production amid climate change and market trends.

To determine the profitability of growing niche crops, the following key indicators were calculated: gross income, production cost and net profit. The calculations of the economic indicators are presented below. The calculation of the main economic indicators is presented using the example of growing English lavender (Lavandula angustifolia). For other crops, calculations were conducted using a similar methodology, allowing for the comparison of economic efficiency across different types of agricultural crops in terms of costs, income and profit.

The calculation of gross income is as follows (2): $5.7 * 45{,}600 = 259{,}920 \ \frac{\text{hrn}}{\text{ha}}$.

The calculation of production cost according to (3): $\frac{560{,}000}{50} = 28{,}157 \ \frac{\text{hrn}}{\text{ha}}$.

The calculation of net profit according to (4): $44{,}737 - 28{,}157 \ = 16{,}580 \ \frac{\text{hrn}}{\text{ha}}$.

The calculation of profitability according to (5): $\left(\frac{16{,}580}{28{,}157}\right) * 100 = 59\ \%$.

The results of calculating the economic indicators for all crops and agricultural enterprises, including profitability, are presented in Table 1.

Table 1. Economic indicators of profitability for growing niche crops from April to December 2024

Crop	Yield [t/ha]	Gross income [UAH/ha]	Production cost [UAH/ha]	Net profit [UAH/ha]	Profitability [%]
Sugar Sorghum (*Sorghum saccharatum*)	3.5	33,300	15,000	18,300	122
Grain Sorghum (*Sorghum bicolor*)	3.7	31,500	14,000	17,500	125
Medicinal Hyssop (*Hyssopus officinalis*)	5.2	175,200	18,000	157,200	150
English Lavender (*Lavandula angustifolia*)	5.7	259,920	28,157	165,570	59
Lavender Hybrid (*Lavandula×intermedia*)	6.5	257,520	29,500	158,020	53.5

Explanatory notes: developed by the authors

An analysis of data for sugar sorghum (*Sorghum saccharatum*) and grain sorghum (Sorghum bicolor) indicates that these crops have high profitability figures – 122 % and 125 %, respectively. The high profitability is due to the relatively low cost of cultivation (from 14,000 to 15,000 UAH/ha) with a stable gross income (31,500 ÷ 33,300 UAH/ha). Net profit ranges from 17,500 to 18,300 UAH/ha, indicating the effectiveness of these crops in the short term. However, an important aspect of assessing economic efficiency is not only profitability, but also absolute income and profit figures. Despite relatively high profitability percentages, the net profit in UAH terms is much lower compared to lavender. This is due to the relatively low market price of sorghum (9,000 UAH/ton), making it less profitable compared to crops with high added value, such as essential oil plants. Therefore, although sorghum demonstrates good financial stability, to generate significant profits, it requires expanded sown areas or additional product processing.

When considering the economic efficiency indicators for growing English lavender (*Lavandula angustifolia*) and lavender hybrid (*Lavandula×intermedia*), the significantly higher gross income figures should be noted. For English lavender, this figure is 259,920 UAH/ha, and for lavender hybrid, it is 257,520 UAH/ha, which is 8 ÷ 9 times higher than the income from sorghum cultivation. This is explained by the high price of lavender and lavender hybrid essential oil, as well as the stable demand for these products on both domestic and international markets. However, unlike sorghum, lavender cultivation is associated with significant initial costs. The production cost in the third year of cultivation remains quite high: 28,157 UAH/ha for English lavender and 29,500 UAH/ha for lavender hybrid. This is because the agricultural enterprise is not yet fully provided with its own planting material, meaning considerable funds must be spent on purchasing new seedlings. Additional factors affecting production costs

include care for perennial crops and expenses for harvesting and primary processing technologies.

Regarding medicinal hyssop (*Hyssopus officinalis*), this crop also has high economic efficiency indicators. The gross income per hectare for hyssop is 175,200 UAH, with production costs of 18,000 UAH/ha. The net profit is 157,200 UAH/ha, resulting in the profitability of 150 %. This indicates the high profitability of hyssop, driven by high demand for essential oils used in the pharmaceutical, cosmetics and aromatherapy industries. However, unlike lavender, hyssop requires lower cultivation costs, allowing for high profitability with comparatively low expenses on planting material and plant care. Thus, hyssop is a promising crop for small and medium agricultural businesses, as it can generate significant profit even with limited sown areas.

In general, while all studied crops – sorghum, lavender and hyssop – demonstrate high profitability, each requires a distinct approach to managing production costs and product sales, which will determine their long-term efficiency. Despite relatively high costs, English lavender demonstrates profitability of 59 %, while lavender hybrid has the profitability of 53.5 %. This means that even at the stage when their own seedling fund is still being formed, the cultivation of these crops is already profitable. Meanwhile, the profitability prospects become even more attractive in the long term. The key factor in improving the economic efficiency of essential oil crops is switching to the use of own planting material [36]. This will significantly reduce production costs, as the largest expenses are related to purchasing seedlings in the first years of planting establishment. According to economic forecasts, starting from the fifth year of cultivation, the profitability of lavender production may exceed 200 % [1].

The findings of the economic analysis suggest that different niche crops have differing levels of profitability; essential oil crops like medical hyssop and lavender have higher economic efficiency than sorghum. However, significant differences are shown when these crops are compared more closely in similar environmental settings. Lavender is more suited for the areas with reliable irrigation systems because of its high yield and profitability, but it also demands a lot of water resources, as it is sensitive to moisture stress. On the other hand, sorghum, especially sugar and grain types, is a more resilient option in arid areas since it is more drought-resistant and uses less water. Lavender is also more vulnerable to illnesses and pests, which raises the demand for pest management methods and, consequently, production expenses. In contrast, sorghum requires fewer treatments and is less susceptible to pests, which helps explain why its production costs are comparatively cheaper. Lavender necessitates nutrient-rich soils and specific attention to attain maximum yields, but sorghum is more tolerant of a greater variety of soil types, underscoring its economic viability in less fertile environments. Sorghum provides agricultural enterprises with a more economical, stable and low-maintenance option, especially in drier regions, while lavender, despite its

higher profitability, requires higher initial investment and care due to these comparative factors: water usage, pest susceptibility and nutrient needs.

The global niche crop market is showing dynamic growth, driven in part by increasing demand for organic and functional products. Crops in this category are not only distinguished by unique properties, but also by their ability to meet specific consumer needs in various sectors [31, 44, 50]. Among the most popular crops, we can highlight not only lavender, but also other promising species such as quinoa, sorghum, essential oil herbs, nuts and medicinal plants. Specifically, quinoa plays an important role in the production of superfoods, while medicinal plants are used to make natural medicines and cosmetic products [42].

Ukraine has significant potential for the production and export of niche agricultural products, due to favorable natural and climatic conditions and high levels of agricultural training. However, at this stage, the country is not sufficiently integrated into global value chains, which is a limiting factor for the broader involvement of Ukrainian producers in international niche crop markets. Specifically, the lack of efficient infrastructure for processing and certifying organic products limits opportunities for Ukrainian producers to fully enter the European and North American markets [17, 20].

Niche crops occupy an important position in the current agricultural market, providing producers with opportunities for diversification, which is especially relevant in the context of climate change and fluctuations in traditional markets. Crops such as lavender, lavender hybrid, sugar sorghum and grain sorghum are not only becoming promising for export supplies, but also gaining importance in the domestic market due to steadily increasing demand driven by their unique properties and wide range of applications.

English lavender and lavender hybrid occupy key positions in the market due to the use of their essential oils in the cosmetic, pharmaceutical and food industries. The demand for these oils, particularly organic production, continues to grow on the global market due to the increasing demand for natural skincare and aromatherapy products. Sugar sorghum, in turn, has high potential in bioethanol production, which aligns with the trends in renewable energy development [7]. Grain sorghum, with its gluten-free properties, is gaining popularity in the food industry for making specialized products for people with gluten intolerance, as well as in animal husbandry as a high-calorie forage crop [18].

Medicinal hyssop, another promising crop, is gaining popularity due to its medicinal properties. Due to its high essential oil content, hyssop is used in aromatherapy, the pharmaceutical industry and cosmetics. The demand for it is steadily increasing, as its oil has anti-inflammatory, antiseptic and antioxidant properties. Hyssop crops are also capable of adapting to various climatic conditions, making them advantageous for cultivation in the areas with dry summers and fluctuating weather conditions [12].

Thus, niche crops such as lavender, sorghum, lavender hybrid and hyssop demonstrate significant economic potential for development in the Ukrainian market and may become an important element of the global agricultural economy. Given this, Ukraine should actively implement strategies to integrate into international supply chains, ensuring high product quality to meet global market demand. The cultivation of these crops is concentrated in specific climate-favorable regions, which defines their competitiveness at the international level.

The main producers of lavender and lavender hybrid are France, Bulgaria, Spain, Italy and China, which annually account for a significant share of the global essential oil market [37, 38]. Sugar sorghum is mainly grown in the USA, Brazil, India and China, where there are powerful processing capacities for biofuel production. Grain sorghum is a strategic crop for African countries such as Nigeria and Sudan, as well as for the USA and Australia, where it is used as a highly liquid alternative to corn in the feed industry. Medicinal hyssop, in turn, has the highest concentration of production in countries such as France and Italy, where demand for its products is steadily growing. The main exporting countries and their production volumes of niche crops as of 2025 are presented in Table 2.

Table 2. Main exporting countries and production volumes as of 2025

Crop	Leading countries	Production volume (thousand tons/year)	Main markets
English Lavender	France, Bulgaria, Spain	40,000 ÷ 50,000	USA, Germany, China, Japan
Lavender Hybrid	France, China, Italy	60,000 ÷ 80,000	EU, North America
Sugar Sorghum	USA, Brazil, India	30,000 ÷ 35,000	EU, China, Japan, South Korea
Grain Sorghum	USA, Nigeria, Sudan	55,000 ÷ 60,000	China, Mexico, EU, Japan
Medicinal Hyssop	France, Italy	10,000 ÷ 12,000	EU, USA, Japan, China

Explanatory notes: developed by the authors based on data from BASF [3], ITC [14], UN Comtrade Database [45], Yermolenko [51]

The dynamics of international demand for niche crops indicate their economic appeal and high potential for development. The price of lavender essential oil ranges from USD 90 to 120 per liter, while lavender hybrid oil has a slightly lower price of USD 50 to 70 per liter. The main consumers are countries in the EU, North America and Asia, where there is a steady interest in natural cosmetics and pharmaceutical products. Sugar sorghum, as a raw material for bioethanol, remains an important element of renewable energy, supporting its price at USD 200 ÷ 250 per ton. It is expected that by 2030, demand for bioethanol will increase by 15 ÷ 20 %, ensuring market sta-

bility for this crop. Grain sorghum, the demand for which is driven by the growth of gluten-free product production in the USA and the EU, sells in the range of USD 230 ÷ 270 per ton, showing a positive price growth trend.

Medicinal hyssop, a new crop on the agricultural market, also demonstrates significant prospects. Given the growing interest in natural medicinal and cosmetic products, the price of hyssop essential oil ranges from USD 500 to 600 per liter. This is due to the high content of biologically active substances in the plant, such as antioxidants, anti-inflammatory and antiseptic components, making it popular in the pharmaceutical and cosmetic industries [16]. It is expected that the demand for hyssop will continue to grow, as consumers increasingly turn to natural products, contributing to the expansion of markets for this type of product.

The prospects for the development of the niche crop market are confirmed by global trends, including increasing environmental requirements for agriculture, rising demand for natural products and the expansion of the biofuel sector [6, 52]. It is expected that over the next five years, lavender and lavender hybrid production will continue to expand, particularly in the countries with favorable climatic conditions. Sugar sorghum may receive additional development opportunities through government support for renewable energy sources, especially in the USA and Europe [34]. At the same time, grain sorghum remains a promising crop for expanding exports to China, Mexico and EU countries, which will contribute to the growth of its production.

Hyssop, in turn, has great prospects for expanding production due to the high price of its essential oil and its wide range of applications. Considering the growing demand for natural medicinal products, hyssop could become an important element of the agricultural economy, and its cultivation in countries with dry climates could help increase added value in the agricultural sector.

Conclusions from the analysis of the international niche crop market indicate the high potential of these crops for further development and expansion of their share in global trade. Given the positive market trends, further research should focus on optimizing cultivation technologies, improving processing methods, and expanding the application areas for these crops. Additionally, it is necessary to assess the economic feasibility of introducing new approaches to the cultivation of lavender, lavender hybrid, sorghum and hyssop in the regions that have not traditionally been involved in the production of these crops but have potential for their cultivation. The development of this sector requires further scientific study of the impact of agro-climatic conditions on the qualitative indicators of production, as well as the analysis of economic models that will enhance the efficiency of production and niche crop sales on the international market.

Discussion

The results of the study show the high potential of growing niche crops in Ukraine, particularly sorghum and lavender, for enhancing the economic efficiency of the agricultural sector. It has been determined that growing sorghum, especially sugar and grain sorghum, is economically feasible in the context of the modern Ukrainian agricultural market, due to the increasing demand for gluten-free products and bioethanol. At the same time, despite the prospects of sorghum as a source of bioethanol, its cultivation efficiency in Ukraine requires further research on optimizing technologies and adaptation to local agro-climatic conditions. The high profitability of lavender, used in the production of essential oils for the cosmetic and pharmaceutical industries, also confirms its significance for diversifying the agricultural sector. However, the development of this sector faces certain challenges, particularly regarding ensuring stable production of high-quality products and introducing innovative cultivation methods. These results align with the studies of other authors who emphasize the importance of developing niche crops for sustainable agricultural development and the economy as a whole.

The next step will be to analyze the findings of foreign authors concerning the efficiency of growing niche crops and their economic attractiveness. This will allow for comparing the approaches applied abroad with the Ukrainian realities and assessing their potential for adaptation to the Ukrainian agricultural market.

Research by Zbancă et al. [53] and Şahin Demirel et al. [32] focuses on the economic aspects of growing lavender for essential oil production, considering investment management and technological innovations in this sector. However, while the first study emphasizes investment management and economic benefit for producers in Moldova, the second one examines new technological directions in lavender use, particularly in agro-industrial productions. The work by Crișan et al. [8] focuses on contemporary trends in lavender (*Lavandula angustifolia* Mill.) cultivation, emphasizing the quality of essential oil and its importance for crop productivity. All three works have a connection with the current study, which focuses on the economic aspects of growing niche crops, particularly lavender in Ukraine. However, despite different focuses, these works highlight the importance of innovation and rational management for increasing production efficiency and strengthening economic stability in the agricultural sector.

The studies by Schmutz and Schöb [33] and Wang et al. [48] address different aspects of growing niche crops. The first study focuses on water distribution in plant mixtures, highlighting how companion planting can optimize water resource use. The other study analyses the impact of Ralstonia solanacearum infection on the microbiome and nitrogen metabolism in soil, which is also significant for the development of niche crops. These studies highlight important nuances in growing niche crops, particularly regarding resource use efficiency and ensuring plant resilience to external stresses.

This aligns with the new study, which also analyses the efficiency and resilience of niche crops in agro-industrial production, but in a different context, without focusing on the biological and ecological aspects of crop interaction.

Research by Phiri et al. [29] and Jha et al. [15] explores the aspects of growing and the potential of chickpeas as a niche crop, particularly focusing on its production capabilities, challenges for small farmers and biofortification opportunities to improve nutritional properties. The first article analyses the challenges faced by farmers in Malawi, while the second one offers strategies for improving the nutritional quality of chickpeas through biotechnology. These studies reveal not only the economic, but also the nutritional potential of niche crops like chickpeas in agricultural systems. They emphasize the importance of developing these crops for food security in small farms and suggest methods for improving their nutritional properties. This article also focuses on the importance of niche crops but in a different context – focusing on their resilience and effectiveness in different agro-industrial systems.

The study by Wang et al. [47] assesses the production potential of the mung bean variety "Zhonglv 5". The authors examine various aspects of its cultivation, including growth conditions, productivity and resilience to external factors. This research is significant for understanding the potential of mung beans as a niche crop, which could be useful for diversifying agricultural production in the context of changing climates and economic instability. The results of the authors' work can be compared with the conclusions of the current study, which also analyses the efficiency and resilience of niche crops in Ukraine's agro-industrial systems.

In the study by Tesema [41], the technical efficiency of growing sorghum in Ethiopia is analyzed. The author points to inefficiency factors, including limited access to resources and technologies. This research correlates with the current study, which examines the efficiency of growing sorghum in Ukraine. However, unlike Ethiopia, the main issues in Ukraine are related not to a lack of resources, but to insufficient state support for new crops and the agricultural sector.

The study by Widodo et al. [49] examines the economic value of sorghum in Indonesia, showing that the crop has potential, but requires financial and educational support. This is similar to the situation in Ukraine, where funding and educational programs are also important for the development of sorghum and other niche crops. However, in Ukraine, significant factors also include the demand for products and the development of the processing industry.

The study by Gao et al. [13] focuses on optimizing sorghum cultivation in high-salinity areas. It emphasizes the importance of efficient resource use to increase profitability. This correlates with the current study, which also considers the efficiency of sorghum cultivation in Ukraine, with special attention to agro-climatic conditions and water resource availability.

Mykhailenko et al. [26] conducted a chemical analysis of English lavender essential oil grown in Ukraine, comparing its quality composition with samples from other countries. The study confirmed the high content of biologically active substances and significant antioxidant activity, indicating the competitiveness of Ukrainian raw materials in the global essential oil market. This data can serve as an additional economic argument for the profitability of growing lavender as a niche crop in Ukraine's agro-industrial complex.

Bazaluk et al. [4] conducted an energy evaluation of sorghum cultivation in the southern regions of Ukraine amid climate change. Field experiment results showed that with rainfall of around 350 mm, it is possible to obtain a green mass yield of 40.6 t/ha of sorghum, indicating the high adaptability of the crop to dry conditions. It was determined that the main sources of energy costs are mineral fertilizers (56.99 %), while the energy efficiency ratio for sugar sorghum reached 11.18, and for grain sorghum ranged from 2.8 to 16.7. These data confirm the agronomic, as well as the economic feasibility of growing sorghum as a niche crop with bioenergy potential, which aligns with the study conducted in the current article.

All these studies emphasize the importance of support and optimal resource use for developing niche crops, which is relevant for Ukraine in the context of the current research. In conclusion, it can be noted that research on the economic aspects of niche crop cultivation focuses on investment management, technological innovations and resource management to increase production efficiency. The work of scientists worldwide highlights the importance of applying new technologies and rational management to achieve economic stability and competitiveness for agricultural enterprises engaged in the cultivation of less common and specialized crops. All these factors, including innovative approaches to management, processing technologies and the use of new agro-technical methods, are critical for achieving the sustainable development of agro-food enterprises working in the context of global economic and ecological changes.

Conclusions

1. The study identified the key parameters of yield and economic efficiency for growing niche crops such as sugar sorghum, grain sorghum, English lavender, lavender hybrid and hyssop, based on the activities of the Educational, Scientific and Practical Center of Mykolaiv National Agrarian University. The results show a stable level of productivity for the studied crops, ensured by modern agro-technical measures and optimal cultivation conditions.
2. The yield analysis revealed that sugar sorghum on 150 hectares provides 3.5 t/ha, while grain sorghum yields 3.7 t/ha. The main factors influencing yields are agro-technical methods, including effective crop rotation schemes, the use of adapted varieties and ensuring adequate soil moisture. At the same time, it was found that

growing sorghum demonstrates high profitability (122 % for sugar sorghum and 125 % for grain sorghum), which is explained by low production costs and stable income levels.

3. The yield of English lavender and lavender hybrid ranges from 5.7 to 6.5 t/ha, which is a high indicator for these crops. The introduction of drip irrigation and specialized plant protection methods contributes to increased productivity. The gross income from growing English lavender is 259,920 UAH/ha, and for lavender hybrid, it is 257,520 UAH/ha, significantly surpassing the financial indicators for sorghum. However, high initial costs and the need to purchase planting material temporarily reduce the economic efficiency of these crops, as confirmed by profitability levels: 59 % for English lavender and 53.5 % for lavender hybrid.
4. Regarding hyssop, the crop shows promising indicators: a yield is 5.2 t/ha, gross income is 175,200 UAH/ha, production cost is 18,000 UAH/ha, and a net profit reaches 157,200 UAH/ha. The profitability of growing hyssop is estimated at 150 %, which is a high indicator compared to other niche crops, though lower than sorghum. This is explained by lower cultivation costs and the high price of essential oil derived from this crop.
5. The results obtained indicate the promising nature of growing niche crops, as they ensure a stable level of profitability and have export potential. In particular, to increase the profitability of growing essential oil crops in the long term, it is advisable to switch to using own planting material, which will help reduce production costs. Additional opportunities for improving economic efficiency include expanding sown areas and introducing additional product processing, which will increase the added value of production.
6. A limitation of this study is its focus on a specific agricultural enterprise, which does not allow for generalized conclusions for the entire niche crop sector. Further research could focus on a detailed analysis of the factors influencing profitability in different regions, as well as assessing the impact of climate change on the economic efficiency of growing these crops.

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EKONOMICZNA EFEKTYWNOŚĆ UPRAWY ROŚLIN NISZOWYCH NA UKRAINIE

Streszczenie

Wprowadzenie. Dywersyfikacja produkcji rolniczej poprzez uprawę roślin niszowych stanowi istotną strategię zwiększania rentowności, zrównoważonego rozwoju oraz odporności rolnictwa Ukrainy na zmiany klimatu. Pomimo rosnącego zainteresowania, efektywność ekonomiczna uprawy roślin niszowych pozostaje niewystarczająco zbadana. Celem niniejszego badania jest ocena wyników ekonomicznych wybranych roślin niszowych – sorga cukrowego, sorga ziarnowego, lawendy wąskolistnej, lawendy mieszańcowej oraz hyzopu lekarskiego – w warunkach Południowego Stepu Ukrainy.

Wyniki i wnioski. Badanie oparto na danych produkcyjnych i finansowych Ośrodka Dydaktyczno-Naukowo-Doświadczalnego Mykołajowskiego Narodowego Uniwersytetu Agrarnego za 2024 rok. Sorgo cukrowe i sorgo ziarnowe charakteryzowały się stabilnymi plonami na poziomie 3,5 ÷ 3,7 t/ha oraz wysoką rentownością wynoszącą 122 ÷ 125 %, co wynikało z niskich kosztów produkcji i stabilnego popytu ze strony sektora bioenergetycznego i spożywczego, choć zysk netto na hektar pozostawał umiarkowany. Rośliny olejkodajne generowały znacznie wyższe przychody brutto. Lawenda wąskolistna oraz lawenda mieszańcowa osiągały plony 5,7 ÷ 6,5 t/ha, przy przychodach brutto przekraczających 250 000 UAH/ha oraz rentowności na poziomie 53,5 ÷ 59 %, mimo wyższych nakładów inwestycyjnych. Najwyższą efektywność ekonomiczną wykazywał hyzop lekarski, którego rentowność sięgała 150% dzięki niskim kosztom uprawy i wysokiej wartości rynkowej olejku eterycznego. Uzyskane wyniki potwierdzają, że rośliny niszowe są ekonomicznie opłacalne i stanowią perspektywiczny kierunek dywersyfikacji produkcji rolniczej na Ukrainie. Uprawa roślin olejkodajnych, zwłaszcza lawendy i hyzopu, zapewnia wysoką wartość dodaną i potencjał eksportowy, natomiast sorgo gwarantuje stabilność finansową. Długoterminową ren-

townność można zwiększyć poprzez wykorzystanie własnego materiału nasadzeniowego, rozszerzenie powierzchni upraw oraz rozwój infrastruktury przetwórczej.

Słowa kluczowe: dochód brutto, plon, sorgo cukrowe, olejki eteryczne, bioetanol, rolnictwo zrównoważone