# СЕКЦІЯ 1. НАУКОВЕ ЗАБЕЗПЕЧЕННЯ ЕКОЛОГІЧНО БЕЗПЕЧНИХ, ЕНЕРГО- І РЕСУРСОЗБЕРІГАЮЧИХ ТЕХНОЛОГІЙ В УМОВАХ ПІСЛЯВОЄННОГО ВІДНОВЛЕННЯ УКРАЇНИ

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## IMPACT OF *MZURI-PROTIL* TECHNOLOGY ON PRODUCTIVITY AND ECONOMIC EFFICIENCY OF WINTER WHEAT CULTIVATION

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**Abstract.** It has been established that under the conditions of the Southern Steppe of Ukraine, the grain yield of winter wheat depends on the weather conditions of the research year and the cultivation technology used. The relevance of introducing energy - and resource-saving technologies has been proven. In 2023, the yield under conventional technology was 6.30 t/ha, while under Mzuri-ProTil technology, it was 7.10 t/ha, an increase of 0.80 t/ha. In 2024, the yield dropped to 4.17 t/ha under conventional technology and reached 4.78 t/ha (+0.61 t/ha) under Mzuri-ProTil. This advantage indicates more efficient resource use and the capability of Mzuri-ProTil to deliver better results even under adverse weather. Resource optimization and reduced field operations led to a profitability level of 77.7 - 81.5% with Mzuri-ProTil, exceeding that of conventional technology by 28.4 - 30.2%.

**Keywords:** winter wheat, yield, economic efficiency.

Agriculture is one of the key sectors of Ukraine’s economy, ensuring not only domestic needs but also the country’s export potential. Winter wheat cultivation holds a particularly important place due to its high productivity and steady demand on both domestic and international markets [1]. A major challenge in modern agriculture is managing crop adaptation to progressing climate changes - such as extreme temperatures and water scarcity - to increase crop productivity [2]. Therefore, farmers are increasingly adopting soil conservation practices, biological farming methods, and environmentally sustainable cultivation approaches to realize the crops' potential [3]. One such practice is the implementation of resource-saving technologies, including for winter wheat.

Experimental research was conducted from 2022 to 2024 at the research field of Mykolaiv National Agrarian University. The test plots featured southern low-humus

chernozem with slight salinization and heavy loam on loess. Soil pH ranged from neutral (6.8 - 7.2), and the humus content in the 0 - 30 cm layer was 3.1 - 3.3%. On average, soils contained 15 - 25 mg/kg of nitrate nitrogen (Grandval-Lajeune method), 41 - 46 mg/kg of mobile phosphorus (Machigin method), and 389 - 425 mg/kg of exchangeable potassium (flame photometer method).

Weather conditions during the 2022 - 2023 growing season were favorable for winter wheat development, resulting in slightly higher grain yields than in 2023 - 2024, which saw frequent droughts and high temperatures.

The study focused on growth and development processes of the 'Perlyna Odeska' winter wheat variety, grain yield formation, and economic indicators of cultivation. Two cultivation technologies were compared: 1) Conventional, and 2) *Mzuri-ProTil.*

Our research has established that the application of the resource-saving technology for winter wheat cultivation, *Mzuri-ProTil*, has had a positive impact on the formation of crop productivity. On average, over the years of the study, the use of the *Mzuri-ProTil* technology for winter wheat cultivation contributed to an increase in the number of grains per ear by 6.5 grains, or 14.4%, and the weight of 1000 grains by 6.9 g, or 16.0%, compared to the classical technology variant for winter wheat cultivation.

Wheat yield depended on cultivation technology in all years. Under favorable 2022 - 2023 conditions, *Mzuri-ProTil* yielded 7.10 t/ha, which was 0.8 t/ha (11.3%) more than the conventional approach. The application of resource- and soil-saving technology for growing winter wheat under the adverse drought conditions of 2023 - 2024 resulted in a yield of 4.78 t/ha, which exceeded the grain yield achieved using the conventional cultivation technology by 0.61 t/ha or 12.8%.

Higher yields usually entail higher costs. Therefore, economic efficiency is a key indicator for assessing the feasibility of implementing cultivation technologies in agricultural production. In 2022 - 2023, *Mzuri-ProTil's* cultivation costs were 22,373.70 UAH/ha, lower than the 23,637.22 UAH/ha under conventional technology. Thanks to the higher yield achieved with this technology, which amounted to 7.10 t/ha, the cost of one ton of wheat decreased to 3,151.23 UAH/t, which is 600.71 UAH/t lower than the cost under the conventional technology.

In 2023 - 2024, cultivation costs for the conventional method were 16,541.09 UAH/ha, and production cost was 3,966.69 UAH/t.

The production costs for growing winter wheat using the *Mzuri-ProTil* technology in 2023 - 2024 amounted to 15,811.18 UAH/ha, which is lower compared to the conventional technology. The cost reduction with *Mzuri-ProTil* is attributed to the optimization of technical resource usage, efficient input application, and a decreased number of field operations.

The cost of one ton of grain using the *Mzuri-ProTil* technology decreased to 3,307.78 UAH/t, which is a lower figure compared to the conventional technology. This indicates that the increased yield helped reduce the cost per unit of production, thereby offsetting the expenses associated with implementing the technology.

The market price for winter wheat ranged from 5,600.00 to 6,000.00 UAH/t during the research years. This resulted in gross revenue of 25,020.00 - 35,280.00 UAH/ha using conventional technology. This level of income demonstrates the

potential of conventional technology to deliver stable financial results under favorable weather conditions; however, costs and production expenses remain critical factors when compared to alternative approaches such as the *Mzuri-ProTil* technology.

During the same period, the *Mzuri-ProTil* technology provided higher yields, which ranged from 4.78 to 7.10 t/ha. With a market price of 5,600.00 - 6,000.00 UAH/t, the gross product value for this technology ranged from 28,680.00 to 39,760.00 UAH/ha, which exceeds the classical technology indicator by 3,660.00 - 4,480.00 UAH/ha. These results confirm the economic feasibility of applying the *Mzuri-ProTil* technology due to its ability to use resources more efficiently, even under unfavorable weather conditions.

Net profit is a key financial indicator that reflects the difference between gross income and production costs. The value of gross product in 2022-2023, depending on the winter wheat cultivation technology, ranged from 35,280.00 to 39,760.00 UAH/ha, which allowed for a net income of 11,642.78 to 17,386.30 UAH per hectare.

In 2023 - 2024, under the conventional technology, the value of gross output amounted to 25,020 UAH/ha, with production costs of 16,541.09 UAH/ha. This resulted in a net profit of 8,478.91 UAH/ha. The decrease in yield due to unfavorable weather conditions led to a reduction in net profit compared to favorable years, highlighting the vulnerability of conventional technology to climate variability.

In 2023 - 2024, the *Mzuri-ProTil* technology generated a gross output value of 28,680 UAH/ha with production costs of 15,811.18 UAH/ha. This resulted in a net profit of 12,868.82 UAH/ha, which is 4,389.91 UAH/ha higher than that achieved with the conventional technology. The advantage of the *Mzuri-ProTil* system lies in its ability to enable more efficient moisture utilization by plants, leading to better outcomes even under adverse weather conditions.

An analysis of the research results demonstrates that the *Mzuri-ProTil* technology consistently delivers higher net profits compared to conventional technology, even under unfavorable conditions. This highlights its potential to enhance the profitability of winter wheat cultivation. On average, over the study years, the profitability level of winter wheat grown using the *Mzuri-ProTil* technology reached 79.6%, which exceeded the performance of conventional technology by 29.3%.

Thus, the application of the *Mzuri-ProTil* technology for winter wheat cultivation contributed to an increase in the number of grains per ear by 14.4%, the weight of 1000 grains by 16.0%, and the grain yield by 11.9% compared to the classical cultivation technology. On average, over the years of the study, the profitability level of the *Mzuri-ProTil* technology ranged from 77.7% to 81.5%, which exceeded the indicators of the classical winter wheat cultivation technology by 28.4% to 30.2%. The net profit from the *Mzuri-ProTil* technology ranged from 12,868.82 to 17,386.3 UAH/ha, which is 33.0% to 34.1% higher compared to the classical cultivation technology, which provided a net profit of 8,478.91 to 11,642.78 UAH/ha depending on the year of the study. The payback period for the *Mzuri-ProTil* technology during the study years was 1 year and 3 months, whereas for the classical technology it was 1 year 11 months to 2 years. This confirms the economic feasibility of implementing the latest technology even under unfavorable weather conditions.

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**Анотація.** Встановлено, що в умовах Південного Степу України, урожайність зерна пшениці озимої залежить від погодних умов року дослідження, а також технології вирощування культури. Доведена актуальність запровадження енерго- та ресурсозберігаючих технологій вирощування культури. Встановлено, що у 2023 р. урожайність за класичною технологією становила 6,30 т/га, тоді як за технологією *Mzuri-ProTil* – 7,10 т/га, що на 0,80 т/га більше. У 2024 році урожайність за класичною технологією знизилася до 4,17 т/га, а за технологією *Mzuri-ProTil* – склала 4,78 т/га (+0,61 т/га). Ця перевага свідчить про ефективніше використання ресурсів та здатність технології *Mzuri-ProTil* забезпечувати кращі результати навіть за несприятливих погодних умов. Обґрунтовано, що завдяки оптимізації використання ресурсів і зменшенню кількості операцій на полі рівень рентабельність вирощування культури за технологією *Mzuri-ProTil* склав 77,7-81,5% та на 28,4-30,2% перевищив показники за класичної технології вирощування пшениці озимої.

**Ключові слова**: пшениця озима, урожайність, економічна ефективність.