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DEPENDENCE OF THE ECONOMIC EFFICIENCY OF CROP PRODUCTION ON THE CONDITION OF SOIL COVER IN THE POLISSIA ZONE

Under current conditions of transformation of Ukraine's agricultural sector and intensification of land degradation processes, the issue of ensuring the economic efficiency of crop production through the rational use of soil resources has become particularly relevant. In the Polissia zone, this problem is systemic in nature due to the widespread occurrence of low-fertility soils characterized by increased acidity, low humus content, and unstable water-physical properties [1; 2]. Under such conditions, soil cover should be considered an economic resource that directly determines the level of productivity, production costs, and profitability of agricultural production [3].

In this regard, there is a need for a comprehensive assessment of the impact of soil cover conditions on the economic performance of agricultural enterprises, as well as for determining the efficiency of measures aimed at restoring and improving soil fertility. Therefore, the purpose of this study is to determine the dependence of the economic efficiency of crop production on the condition of soil cover in the Polissia zone and to assess the economic feasibility of measures intended to improve soil fertility.

The results of the study indicate that soil quality is a key factor in shaping economic performance. A comparative analysis of production indicators under different soil and climatic conditions demonstrates that improving natural soil fertility ensures a 20–30% increase in crop yields, an 8–12% reduction in production costs, and an increase in profit per hectare of more than 60% [4]. It has been established that one of the determining indicators of soil cover quality is humus content, which generates both productive and cost-related effects. An increase in humus levels leads simultaneously to higher crop yields and optimization of production costs, which collectively results in more than a twofold increase in production profitability [3]. The generalized results of assessing the impact of humus levels on economic indicators are presented in Table 1.

Table 1

**Impact of soil humus content on the economic indicators
of crop production in the Polissia zone (2015–2025)**

Indicator	Low Fertility Level (Humus Content ≤1.5%)	Medium Fertility Level (Humus Content 1.6–1.8%)	Increased Fertility Level (Humus Content ≥1.9%)
Grain crop yield, t/ha	3,7	4,3	4,9
Production cost per 1 t, UAH	6 150	5 480	4 920
Net profit, UAH/ha	2 400	3 650	5 100
Profitability, %	12–15	20–24	28–33

Source: compiled by the author based on sources [3; 4]

The analysis of the data presented in Table 1 indicates the existence of a direct relationship between soil fertility and the economic efficiency of production. In particular, an increase in humus content ensures a rise in crop yields by more than 30%, a reduction in production costs by 15–20%, and more than a twofold increase in profitability. This confirms that the soil factor has a systemic impact on the formation of the financial performance of agricultural enterprises. To provide a more comprehensive justification of the identified trends, a correlation and regression analysis of the relationship between soil fertility indicators and the economic performance of production was conducted.

The results of the correlation and regression analysis confirm the existence of a strong positive relationship between soil fertility indicators and the level of production profitability ($r = 0.76\text{--}0.81$), which indicates the decisive role of agrochemical characteristics in shaping economic efficiency [5]. At the same time, it was established that deterioration in soil conditions leads to an increase in maintenance costs: the share of expenditures on fertilizers and land reclamation measures in farms with degraded soils is 10–12 percentage points higher compared to farms with a stable level of soil fertility [3]. This provides grounds to assert that the qualitative condition of soil cover directly affects not only production outcomes but also the overall level of economic sustainability of agricultural enterprises. Further analysis of the dynamics of crop production development in the Polissia zone demonstrated that the growth of economic efficiency occurs mainly through production intensification. Increased crop yields ensure growth in gross output and profitability even under relatively stable sown areas, indicating the limited role of extensive development factors and the dominance of qualitative factors [6]. Thus, it

is precisely the improvement of soil productivity and the efficiency of resource use that forms the basis for the economic development of the crop production sector in the region.

In the context of the identified trends, assessing the economic efficiency of measures aimed at improving soil fertility becomes particularly important. The calculations conducted demonstrated their high investment feasibility. In particular, the liming of acidic soils provides additional profit at the level of UAH 3,200–4,100 per hectare with a payback period of 2–3 years; the use of organic fertilizers generates UAH 2,500–3,400 per hectare; and the implementation of precision farming technologies yields up to UAH 4,500 per hectare [4; 5]. The results obtained indicate the formation of a significant economic effect combining increased production productivity with the optimization of production costs.

Thus, the results of the study confirm that soil cover acts as a strategic economic resource that largely determines the efficiency of the crop production sector. Improving soil fertility provides a multiplicative effect manifested in increased crop yields, reduced production costs, and higher profitability levels. In contrast, soil degradation causes the opposite consequences by reducing economic returns and increasing the cost burden on agricultural enterprises. Under such conditions, investments in the restoration and preservation of soil fertility should be regarded as a strategically justified direction for enhancing the competitiveness of the agricultural sector and ensuring the sustainable development of crop production in the Polissia zone.

References:

1. The State of the World's Land and Water Resources for Food and Agriculture – Systems at Breaking Point. Rome: FAO, 308 p.
2. Agricultural Policy Monitoring and Evaluation 2023. Paris: OECD Publishing, 356 p.
3. Drebot O. I., Dobryak D. S., Melnik P. P. (2023). Scientific foundations of natural and agricultural zoning of the territory of Ukraine under modern conditions. *Balanced Nature Management*, no. 2, pp. 5–12. DOI: <https://doi.org/10.33730/2310-1679.2.2023.282745>
4. Balyuk S. A., Kucher A. V., Maksimenko N. V. (2021). Soil Resources of Ukraine: State, Problems and Strategy of Sustainable Management. *Ukrainian Geographical Journal*, no. 2, pp. 3–11. DOI: <https://doi.org/10.15407/ugz2021.02.003>.
5. Savchuk O. I., Kovalchuk N. S., Pashkevich I. M. (2022). Agroecological condition and degradation processes of the soil cover of Ukrainian Polissia. *Agroecological Journal*, no. 3, pp. 28–35.
6. Luca Montanarella, Panos Panagos, & Cristiano Ballabio (2021). Soil degradation and land productivity in Europe. *Land Use Policy*, p. 100.