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THE NECESSITY OF PLANT PROTECTION AND THE ECONOMIC FOUNDATIONS OF ITS ORGANIZATION

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Abstract

Plant protection is one of the decisive conditions for maintaining agricultural productivity, preserving crop quality, and ensuring the stable economic functioning of farms. In modern agriculture, the impact of pests, diseases, and weeds is no longer limited to biological damage alone; it also causes serious financial losses through reduced yields, lower market quality, increased production costs, and unstable income. This article examines the necessity of plant protection from an economic perspective and analyzes the organizational principles required for its effective implementation. The study is based on the idea that plant protection should be considered not as an auxiliary technical activity, but as an integral element of agricultural management, resource allocation, and production planning. Particular attention is given to the relationship between preventive and curative measures, the role of integrated plant protection systems, and the economic justification of expenditures on monitoring, chemical and biological control, labor, and technical support. The article argues that well-organized plant protection reduces direct and indirect losses, improves the efficiency of land and water use, and strengthens the competitiveness of agricultural producers. It is concluded that the economic foundations of plant protection are formed through a rational combination of scientific recommendations, institutional support, cost optimization, and long-term sustainability goals in agricultural production.

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Keywords: Plant protection, economic efficiency, agricultural production, crop losses, pest management, disease control, weed management, integrated protection, farm profitability, resource optimization, preventive measures, sustainable agriculture.

O'SIMLIKLARNI HIMOYA QILISH ZARURIYATI VA TASHKIL ETISHNING IQTISODIY ASOSLARI

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Annotatsiya
O‘simliklarni himoya qilish qishloq xo‘jaligi ishlab chiqarishining barqarorligini ta’minlash, hosildorlikni saqlash va mahsulot sifatini oshirishning muhim omillaridan biridir. Zamonaviy dehqonchilik sharoitida zararkunandalar, kasalliklar va begona o‘tlar ta’siri faqat biologik zarar bilan cheklanmay, balki hosil miqdorining kamayishi, mahsulotning bozor qiymati pasayishi, ishlab chiqarish xarajatlarining ortishi hamda xo‘jalik daromadining beqarorlashuvi kabi iqtisodiy yo‘qotishlarni ham keltirib chiqaradi. Mazkur maqolada o‘simliklarni himoya qilish zarurati iqtisodiy nuqtai nazardan tahlil qilinib, uni tashkil etishning asosiy tamoyillari yoritiladi. Tadqiqotda o‘simliklarni himoya qilish yordamchi texnik tadbir emas, balki agrar boshqaruv, resurslardan oqilona foydalanish va ishlab chiqarishni rejalashtirishning ajralmas qismi sifatida talqin etiladi. Shuningdek, profilaktik va bartaraf etuvchi choralar o‘rtasidagi bog‘liqlik, integratsiyalashgan himoya tizimlarining ahamiyati, monitoring, kimyoviy va biologik vositalar, mehnat hamda texnik ta’minot xarajatlarining iqtisodiy asoslari ko‘rib chiqiladi. Maqolada samarali tashkil etilgan o‘simliklarni himoya qilish tizimi bevosita va bilvosita yo‘qotishlarni kamaytirishi, yer va suv resurslaridan foydalanish samaradorligini oshirishi, ishlab chiqaruvchilarning raqobatbardoshligini mustahkamlashi asoslab beriladi. Xulosa sifatida o‘simliklarni himoya qilishning iqtisodiy asoslari ilmiy tavsiyalar, institutsional qo‘llab-quvvatlash, xarajatlarni

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optimallashtirish va uzoq muddatli barqarorlik maqsadlarining uyg‘unlashuvi orqali shakllanishi ta’kidlanadi.

Kalit so‘zlar. O‘simliklarni himoya qilish, iqtisodiy samaradorlik, qishloq xo‘jaligi ishlab chiqarishi, hosil yo‘qotishlari, zararkunandalarga qarshi kurash, kasalliklarni nazorat qilish, begona o‘tlar boshqaruvi, integratsiyalashgan himoya, xo‘jalik rentabelligi, resurslarni optimallashtirish, profilaktik choralar, barqaror qishloq xo‘jaligi

Introduction

Plant protection occupies a central place in the contemporary system of agricultural production because the preservation of crops is directly connected with food security, farm income, market stability, and the rational use of production resources. In any agricultural economy, the cultivation of crops is accompanied by constant biological risks arising from insect pests, plant diseases, weeds, and unfavorable ecological interactions. These factors reduce the productive capacity of cultivated land and create serious barriers to obtaining stable yields of sufficient quantity and quality. For this reason, plant protection should be understood not only as a technical field within agronomy, but also as an economic necessity that supports the overall efficiency of agricultural management.

The relevance of this topic has increased significantly under conditions of intensive farming, climate variability, water scarcity, and growing demand for high-quality agricultural products. Farmers are now expected to produce more output from limited land and water resources while also meeting sanitary, environmental, and commercial requirements. In such a situation, the absence of an effective plant protection system may lead to extensive losses at every stage of the production cycle. Damage caused by harmful organisms often results in lower yields, deterioration of product quality, additional labor expenditures, increased dependence on emergency treatments, and reduced profitability. In many cases, the losses associated with inaction or poorly organized protection measures exceed the cost of timely preventive management.

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From an economic perspective, plant protection is closely linked with the concept of loss prevention. Agricultural production involves substantial investments in seeds, fertilizers, irrigation, machinery, labor, and land preparation. If crops are damaged by pests, pathogens, or weeds, the expected return on these investments decreases sharply. Therefore, the organization of plant protection serves as a mechanism for preserving the value already embedded in the production process. It reduces uncertainty, protects expected income, and creates more predictable conditions for farm planning. This is especially important for agricultural enterprises operating within competitive markets where price fluctuations and quality standards strongly affect financial outcomes.

Another important aspect of plant protection is its role in improving resource efficiency. When protection measures are organized on the basis of economic calculation and scientific monitoring, farms can use pesticides, biological agents, labor, and machinery more rationally. This prevents wasteful expenditures and supports better allocation of available resources. In this regard, plant protection is not limited to the elimination of visible threats. It also includes monitoring, forecasting, prevention, timing of interventions, and the selection of methods that provide the highest benefit relative to cost. Such an approach is consistent with the principles of integrated plant protection, which combines biological, chemical, agrotechnical, and organizational measures within a single management framework.

The economic foundations of plant protection are especially important for countries with developing agricultural sectors, where crop production remains a major source of employment, raw materials, and export earnings. In these conditions, the effectiveness of plant protection influences not only individual farms but also broader rural development and national economic stability. A well-organized system of plant protection contributes to sustainable production, reduces avoidable losses, supports product competitiveness, and strengthens the long-term resilience of the agricultural sector. For this reason, the study of the necessity of plant protection and the economic principles of its organization has both theoretical and practical significance for modern agricultural education and management.

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Methods

This study is based on a qualitative and analytical research design aimed at revealing the economic necessity of plant protection and explaining the organizational principles that determine its effectiveness in agricultural production. The methodological framework combines theoretical analysis, comparative interpretation, and economic reasoning in order to assess plant protection not merely as a biological or technical field, but as an essential component of farm management and production efficiency. The study focuses on the interaction between crop preservation, cost control, yield stability, and sustainable organization of agricultural activity.

The primary method used in the research is a systematic review of scientific and educational literature related to plant protection, agricultural economics, farm management, and resource efficiency. Conceptual materials on pest management, plant disease control, weed regulation, and integrated crop protection were analyzed together with economic studies addressing production losses, cost-benefit relations, profitability, and risk reduction in agriculture. This approach made it possible to identify the key categories that connect plant protection with economic outcomes, including direct crop losses, indirect financial damage, preventive costs, treatment expenditures, labor demand, and long-term productive efficiency.

In addition to literature analysis, the research applies the method of economic interpretation. Through this method, plant protection measures are evaluated according to their capacity to preserve expected yield, maintain product quality, and reduce the probability of unforeseen losses. Economic interpretation allows the analysis to move beyond agronomic description and examine how decisions concerning monitoring, prevention, treatment timing, and method selection affect production costs and farm income. This method is especially important for understanding why plant protection should be organized on the basis of rational planning rather than reactive intervention. Within this framework, the study considers plant protection expenditures as economically justified when they prevent larger losses than the cost of implementation.

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The comparative method is also employed to distinguish between different organizational approaches to plant protection. Preventive and curative strategies are compared from the standpoint of efficiency, cost stability, and production risk. Preventive approaches include field observation, phytosanitary monitoring, resistant varieties, crop rotation, and timely agronomic operations, while curative approaches involve direct interventions after damage has become visible. Their comparison demonstrates that preventive systems often require lower cumulative expenditure and generate more stable outcomes over time. The same comparative logic is used to consider chemical, biological, agrotechnical, and integrated methods of plant protection in relation to economic rationality and sustainability.

Another methodological element of the study is functional analysis. This method is used to clarify the place of plant protection within the broader structure of agricultural production. Through functional analysis, plant protection is examined in relation to land use, irrigation, input management, labor organization, harvest quality, and market realization. Such a perspective helps to show that the economic role of plant protection is not isolated, but interconnected with the entire production chain. Any failure in protection influences not only the field itself, but also storage quality, transport value, marketability, and the financial condition of the farm.

The study also uses general scientific methods such as observation, classification, synthesis, and logical generalization. These methods support the identification of major economic principles underlying plant protection organization, including efficiency, proportionality of costs, timeliness, adaptability, and sustainability. On this basis, the research develops a coherent understanding of plant protection as a management system whose economic value lies in preventing losses, preserving resources, and strengthening the long-term viability of agricultural production.

Results

The analysis demonstrated that plant protection has a direct and measurable influence on the economic stability of agricultural production. The obtained results show that the timely and rational organization of protective measures significantly reduces the scale of yield losses caused by pests, diseases, and weeds. In economic

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terms, this means that plant protection functions as a mechanism for preserving the productive value of land, labor, water, seeds, fertilizers, and other inputs already invested in the cultivation process. Where plant protection is weak, irregular, or poorly planned, the probability of production losses increases sharply, and this creates negative consequences not only for output volume but also for product quality and market returns.

The research results also indicate that the economic effect of plant protection is most evident when preventive measures are prioritized over delayed intervention. Monitoring, field observation, forecasting of phytosanitary threats, crop rotation, resistant varieties, and compliance with agrotechnical requirements produce more stable and cost-effective outcomes than emergency treatment after visible damage has already spread. Preventive organization reduces the need for repeated chemical application, lowers labor intensity in crisis situations, and allows farms to maintain better control over production expenses. As a result, the overall cost of protection becomes more predictable, and the risk of sudden financial losses decreases.

Another important result of the study is that integrated plant protection provides greater economic efficiency than a narrow reliance on a single method. The combination of biological, chemical, organizational, and agrotechnical approaches creates more balanced protection with lower long-term costs. Chemical methods alone may provide short-term effects, but excessive dependence on them increases input expenses, may lead to resistance among harmful organisms, and can reduce ecological sustainability. By contrast, integrated systems improve the ratio between expenditure and outcome because they are based on the selective use of methods according to actual field conditions. This increases the productivity of each intervention and prevents unnecessary consumption of resources.

The results further revealed that plant protection strongly affects the commercial quality of agricultural products. In addition to preserving physical yield, effective protection reduces visible damage, contamination, infection, and deterioration that lower market value. Products grown under properly organized protection regimes are more likely to meet quality requirements for storage, processing, and sale. This creates an additional economic advantage because higher-quality produce

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generates better prices and reduces losses during post-harvest handling. Therefore, the benefit of plant protection should not be measured only by the amount of saved crop, but also by improved product competitiveness and more stable access to markets.

The analysis also confirmed that plant protection contributes to better resource efficiency in agricultural enterprises. When protection measures are based on timely diagnostics and economic calculation, the use of pesticides, labor, machinery, and financial resources becomes more rational. Farms avoid both underuse and overuse of protection inputs. This balance is especially important in conditions where production resources are limited and the margin for economic error is small. Under such circumstances, the organization of plant protection becomes an essential part of broader farm optimization and sustainable resource management.

Finally, the study showed that the economic foundations of plant protection are closely connected with institutional and managerial capacity. The highest efficiency is achieved where plant protection is supported by professional knowledge, advisory systems, planning discipline, and access to modern protective tools. Thus, the results confirm that plant protection is not an isolated agronomic operation but a strategic economic component of agricultural production, capable of reducing losses, improving profitability, and strengthening long-term production resilience.

Discussion

The findings of this study confirm that plant protection must be interpreted not only as a biological safeguard for crops but also as an economically grounded management system that directly influences farm sustainability. In agricultural production, every stage of cultivation requires financial inputs, labor effort, and organizational coordination. When plant protection is weak or delayed, the losses caused by pests, diseases, and weeds are not limited to reduced crop mass. They extend to lower product quality, higher treatment expenses, unstable supply, and reduced confidence in planning future production cycles. Therefore, the economic

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role of plant protection becomes visible in its capacity to protect both biological productivity and the financial logic of farming.

One of the central issues arising from the results is the clear advantage of preventive organization over reactive intervention. This has important theoretical and practical implications. Preventive plant protection shifts the focus from crisis response to risk management. Instead of waiting for harmful organisms to cause visible damage, preventive systems rely on observation, forecasting, agronomic discipline, and scientifically grounded timing of measures. Such an approach reduces the probability of large-scale losses and allows producers to distribute expenditures more rationally over the production season. In economic terms, this means that prevention supports cost stability, reduces uncertainty, and improves the predictability of outcomes. Reactive measures, by contrast, often require urgent decisions, higher doses of inputs, repeated treatments, and additional labor, all of which can disrupt farm budgets and reduce overall efficiency.

The discussion also highlights the importance of integrated plant protection as a model that best corresponds to the economic needs of modern agriculture. A purely chemical approach may appear effective in the short term, but it often increases dependency on external inputs and may create long-term costs associated with resistance, environmental stress, and declining efficiency of repeated applications. The integrated approach is economically stronger because it combines biological, agrotechnical, organizational, and chemical elements according to actual need. This creates flexibility and reduces unnecessary expenditure. It also improves the sustainability of production systems by linking protection measures with soil management, crop rotation, varietal policy, and rational input use. As a result, the farm becomes less vulnerable to both biological threats and financial shocks.

Another important point concerns the relationship between plant protection and product competitiveness. In market-oriented agriculture, quality often determines profitability as much as quantity. Even when yield volume remains acceptable, visible pest damage, infection, contamination, or post-harvest deterioration can reduce selling prices and restrict access to more profitable market channels. This means that plant protection influences value formation beyond the field itself. It

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supports marketability, storage stability, processing suitability, and consumer confidence. From this perspective, expenditures on plant protection should not be interpreted narrowly as costs of defense, but more broadly as investments in preserving the commercial value of agricultural output.

The study also suggests that the economic success of plant protection depends on institutional conditions. Farmers require access to knowledge, extension services, quality inputs, monitoring information, and organizational support. Where such conditions are weak, even technically correct measures may be poorly timed or economically inefficient. Thus, the discussion expands the issue beyond the farm level and points to the need for coordinated systems involving education, advisory structures, research institutions, and agricultural policy. In this sense, plant protection becomes part of a wider economic infrastructure that supports productivity and rural stability.

Overall, the discussion demonstrates that the necessity of plant protection is rooted in the economic nature of agriculture itself. Crop production always involves risk, and plant protection is one of the main instruments through which that risk is managed. Its value lies in preserving yield, maintaining quality, optimizing resource use, supporting profitability, and strengthening the long-term resilience of agricultural enterprises. For this reason, the organization of plant protection must be based on economic reasoning as much as on agronomic knowledge.

Conclusion

The necessity of plant protection is determined by the fundamental economic logic of agricultural production. Crop cultivation requires considerable investments in land preparation, seeds, fertilizers, irrigation, machinery, labor, and time. If pests, diseases, and weeds are not effectively controlled, these investments lose their value because the expected yield decreases, product quality deteriorates, and market returns become unstable. For this reason, plant protection should be regarded not as a secondary agronomic procedure, but as an essential economic instrument for safeguarding production results and ensuring the sustainability of farm activity.

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The study has shown that plant protection performs several interconnected economic functions. First, it preserves the productive potential of crops by reducing direct biological damage. Second, it protects the financial resources already committed to production by preventing avoidable losses. Third, it contributes to higher market value by maintaining the external and internal quality of agricultural products. Fourth, it allows more rational use of labor, pesticides, machinery, and other inputs when protection measures are organized on the basis of monitoring and planning. In this way, plant protection strengthens the efficiency of the entire production cycle rather than solving only isolated field problems.

A major conclusion of the study is that the organization of plant protection must be based on preventive and integrated principles. Preventive systems are economically more justified than delayed curative interventions because they reduce the need for emergency measures, lower the probability of mass damage, and create more predictable expenditure patterns. Likewise, integrated plant protection is more sustainable than dependence on a single method. The rational combination of agrotechnical, biological, chemical, and organizational measures improves efficiency, reduces unnecessary resource consumption, and supports long-term production stability. Such an approach enables agricultural producers to balance immediate protection needs with broader economic and ecological interests.

The research also confirms that plant protection has strategic significance for the competitiveness of agriculture. In modern production systems, economic success depends not only on gross harvest volumes but also on product quality, storage capacity, sanitary condition, and market acceptance. Properly protected crops are more likely to meet commercial standards and provide higher income for producers. Therefore, expenditures on plant protection should be interpreted as productive investments aimed at preserving income, reducing risk, and increasing the reliability of agricultural output. From this perspective, well-organized plant protection supports both microeconomic efficiency at the farm level and broader sectoral stability.

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Another important conclusion is that the economic effectiveness of plant protection depends on management quality and institutional support. Scientific recommendations, field diagnostics, access to effective inputs, professional training, and advisory services all influence how successfully plant protection measures are planned and implemented. Without these organizational conditions, even technically available methods may fail to deliver the desired economic outcome. This means that plant protection is not only a field-level practice but also a component of agricultural policy, education, and extension systems.

In general, the economic foundations of plant protection are formed through the rational coordination of costs, benefits, timing, and management decisions. Its necessity arises from the need to preserve yields, protect product quality, optimize resource use, and reduce production risks. Therefore, the successful organization of plant protection should be understood as one of the main conditions for sustainable agricultural development, efficient farm management, and the long-term resilience of the crop production sector.

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