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Research article

Improving the phytosanitary control system of the Republic of Kazakhstan in the context of international obligations and digital transformation

Assel K. Kadyrbayeva , Azamat S. Zholamanov 

Academy of Public Administration under the President of the Republic of Kazakhstan
Astana, Kazakhstan

Corresponding author: Assel K. Kadyrbayeva: asel_k25@mail.ru

Co-authors: (1: AZh) azamat.zholmanov@gmail.com

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Abstract

Background and Aim. Phytosanitary control is a key element in ensuring the food, environmental, and economic security of the state. In the context of globalization and the intensification of international trade, the risk of the introduction and spread of quarantine pests is increasing.

The aim of this study is to analyse the current state of the phytosanitary control system of the Republic of Kazakhstan and to substantiate directions for its improvement, taking into account international obligations and digitalization.

Materials and Methods. The study employs methods of systems analysis, comparative legal analysis, and generalization of regulatory legal acts of the Republic of Kazakhstan, international agreements and FAO/IPPC standards, as well as analytical materials of the Committee of State Inspection in the Agro-Industrial Complex of the Ministry of Agriculture of the Republic of Kazakhstan.

Results. It was established that the existing phytosanitary control system generally complies with international requirements; however, it is characterized by an insufficient level of digitalization and the absence of end-to-end traceability of regulated products. Risks associated with the uncontrolled movement of products and the spread of quarantine pests were identified.

Conclusion. The implementation of the proposed measures will enhance the effectiveness of phytosanitary control, reduce phytosanitary risks, and strengthen the export potential of the Republic of Kazakhstan.

Keywords: native species; state inspector; quarantine measure; quarantine pest; phytosanitary control.

Introduction

Phytosanitary quarantine control represents a system of legal, organizational, and scientifically substantiated measures aimed at preventing the introduction, establishment, and spread of quarantine pests and plant pathogens capable of causing substantial damage to agricultural production, natural ecosystems, and international trade flows [1-4]. In the context of intensifying globalization, expanding international economic relations, and the steady growth of cross-border trade in agricultural commodities, the role of phytosanitary control has increased significantly. It is no longer limited to the sphere of agricultural regulation but has acquired strategic importance as an integral component of national food security, environmental protection, and economic stability [5, 6].

According to assessments by international organizations, global annual crop losses caused by quarantine pests and plant diseases may reach 30-40% of total production, which clearly demonstrates the high vulnerability of agricultural systems and the urgent need for effective preventive measures [7]. The uncontrolled spread of quarantine organisms leads not only to a reduction in crop yields but

also to deterioration of the quality of agricultural products, disruption of production chains, and an increase in financial expenditures related to pest management, eradication measures, and compensation for economic losses. In addition, phytosanitary incidents may result in trade restrictions, export bans, and a decline in the competitiveness of national agricultural products on international markets.

Under such conditions, systematic monitoring of phytosanitary risks, early detection of quarantine pests, and the timely implementation of response measures become critically important. Effective phytosanitary control requires a combination of regulatory enforcement, scientific support, modern diagnostic methods, and efficient information exchange between relevant authorities and stakeholders. Special attention should be paid to improving risk assessment procedures and forecasting models that make it possible to predict the potential spread of harmful organisms under changing climatic and economic conditions.

In the Republic of Kazakhstan, phytosanitary quarantine control is implemented in accordance with international obligations and standards, including the Agreement on the Application of Sanitary and Phytosanitary Measures of the World Trade Organization, the International Plant Protection Convention, as well as the regulatory framework of the Eurasian Economic Union [8-12]. The national phytosanitary system is designed to ensure the protection of agricultural lands and natural ecosystems while facilitating safe international trade in plant products. However, despite the existence of a comprehensive regulatory and legal framework, the current phytosanitary control system faces a number of challenges.

Among the most significant issues are the insufficient level of digitalization of control procedures, limited integration of information systems, and the lack of full traceability of regulated products throughout the supply chain. These factors reduce the efficiency of control measures, complicate data analysis, and hinder timely decision-making. The introduction of digital technologies, including electronic certification, geospatial monitoring, and centralized databases, is therefore considered a key direction for modernizing the phytosanitary control system.

The purpose of this study is to analyse the current state of the phytosanitary quarantine control system of the Republic of Kazakhstan and to substantiate scientifically grounded directions for its improvement. The novelty of the research lies in a comprehensive assessment of phytosanitary control as an essential element of national security, with particular emphasis on the role of digital transformation in enhancing transparency, efficiency, and sustainability of phytosanitary measures.

Materials and Methods

The study is based on a comprehensive analysis of the regulatory and legal framework of the Republic of Kazakhstan governing plant quarantine and phytosanitary control. This includes national legislative and subordinate regulatory acts governing quarantine measures, inspection procedures, and the circulation of regulated products. In addition, the research draws upon international phytosanitary standards and guidelines developed under the auspices of the Food and Agriculture Organization of the United Nations and the International Plant Protection Convention, including International Standards for Phytosanitary Measures (ISPM) No. 6 (Surveillance), ISPM No. 11 (Pest Risk Analysis for Quarantine Pests), and ISPM No. 12 (Phytosanitary Certificates), as well as relevant documents and agreements of the World Trade Organization and the Eurasian Economic Union [8-16].

The methodological framework of the study is based on an interdisciplinary approach combining elements of legal, institutional, and systems analysis. Methods of systems analysis were applied to assess the structure and functioning of the phytosanitary quarantine control system as an integrated element of national agricultural and biosecurity policy. Comparative legal analysis was used to identify similarities and differences between national phytosanitary regulations and international requirements, as well as to evaluate the degree of harmonization of Kazakhstan's legislation with global and regional standards. Logical generalization and synthesis were employed to formulate conclusions and substantiate proposals aimed at improving the effectiveness of phytosanitary control mechanisms.

The empirical basis of the research includes official statistical data and analytical materials provided by the Committee of State Inspection in the Agro-Industrial Complex of the Ministry of Agriculture of the Republic of Kazakhstan. These materials reflect the results of control and supervisory activities, including inspections, detection of quarantine organisms, enforcement measures, and trends in phytosanitary compliance over a number of years. The use of official data ensured the reliability and representativeness of the analytical conclusions.

Phytopsanitary risk analysis within the study was conducted in accordance with the methodological requirements of ISPM No. 11 and followed internationally recognized procedures applied in global phytopsanitary practice [14]. The applied risk assessment methods are transparent, reproducible, and based on the evaluation of the probability of pest introduction and spread, as well as the potential economic and environmental consequences. This methodological approach allows for objective assessment of phytopsanitary risks and supports evidence-based decision-making in the field of plant quarantine and phytopsanitary security.

Results and Discussion

The results of the analysis demonstrate that the phytopsanitary control system of the Republic of Kazakhstan generally complies with internationally accepted requirements and principles established under global and regional phytopsanitary frameworks. The system covers the main stages of movement of regulated products, including importation, transit, and domestic circulation, which makes it possible to implement preventive and control measures at different levels of the supply chain. Special attention is given to border control, as it plays a key role in preventing the introduction of quarantine pests into the national territory.

Along the perimeter of the state border, a total of 77 phytopsanitary control posts are currently in operation. These posts are strategically located on the borders with the Russian Federation, the Kyrgyz Republic, the People's Republic of China, the Republic of Uzbekistan, and Turkmenistan, which ensures comprehensive coverage of major trade routes and contributes to minimizing phytopsanitary risks associated with cross-border movement of plant products.

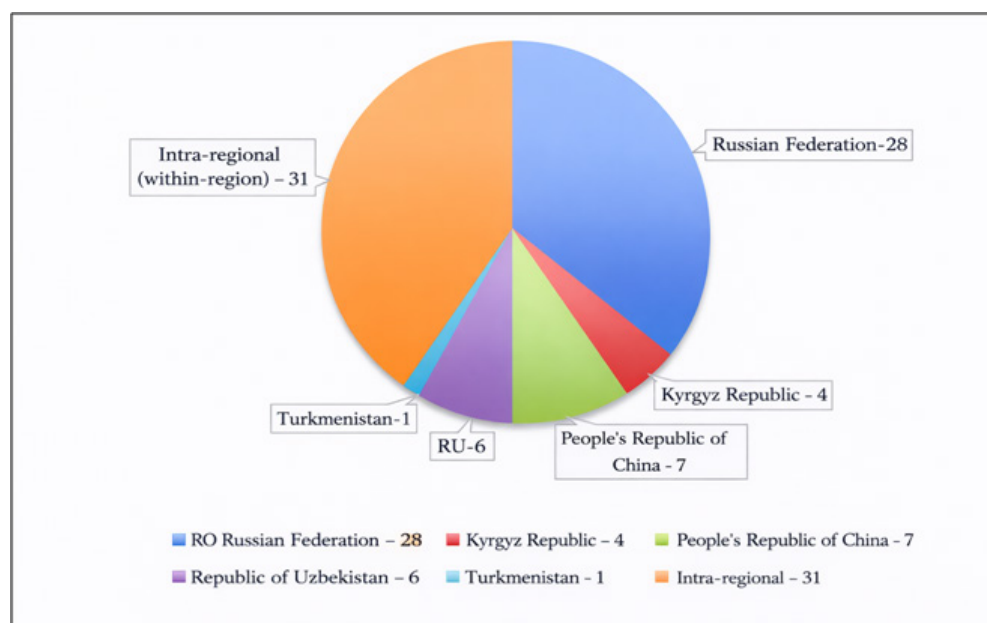


Figure 1 – Distribution of Phytopsanitary Control Posts by Direction

Figure 1 illustrates the spatial distribution of phytopsanitary control posts along the main segments of the state border of the Republic of Kazakhstan. The analysis of their placement indicates a differentiated approach to the organization of border control, taking into account the intensity and structure of cross-border trade flows. The highest concentration of phytopsanitary control posts is observed in border areas characterized by the largest volumes of movement of regulated plant products. This distribution is due to elevated phytopsanitary risks associated with intensive import and transit operations, as well as with the diversity of plant commodities entering the country through these routes. Such an approach allows phytopsanitary authorities to focus resources on the most vulnerable border areas and to strengthen preventive protection against the introduction of quarantine pests.

An assessment of current control practices revealed differences in the scope and depth of phytopsanitary measures depending on the customs procedure applied to regulated products. During the transit of plant

products through the territory of the Republic of Kazakhstan, phytosanitary control is generally limited to documentary verification and external inspection of vehicles and cargo units. This includes checking the availability and validity of accompanying documents, as well as a visual assessment of transport conditions. While this approach facilitates the rapid movement of goods and reduces administrative barriers, it may also limit the effectiveness of early detection of quarantine organisms under certain conditions.

In contrast, phytosanitary control applied to imported regulated products is more comprehensive. It includes direct inspection of plant products, sampling, and subsequent laboratory identification of quarantine pests and pathogens. Laboratory diagnostics play a crucial role in ensuring the reliability of phytosanitary decisions, as they allow for the detection of harmful organisms that cannot be identified through visual inspection alone. This differentiation of control procedures reflects a risk-based approach that prioritizes imports as the most significant pathway for the introduction of quarantine pests.

According to official data from the Committee of State Inspection in the Agro-Industrial Complex of the Ministry of Agriculture of the Republic of Kazakhstan, since the beginning of 2025, a total of 2,176 violations of phytosanitary requirements have been identified. Figure 2 presents the structure and quantitative distribution of these violations. The most common non-compliances include the absence of phytosanitary certificates, inconsistencies or inaccuracies in accompanying documentation, and the detection of quarantine pests. The revealed structure of violations indicates systemic weaknesses in compliance with phytosanitary regulations and highlights the need for further improvement of control mechanisms, particularly in terms of documentation verification, traceability, and preventive risk management.

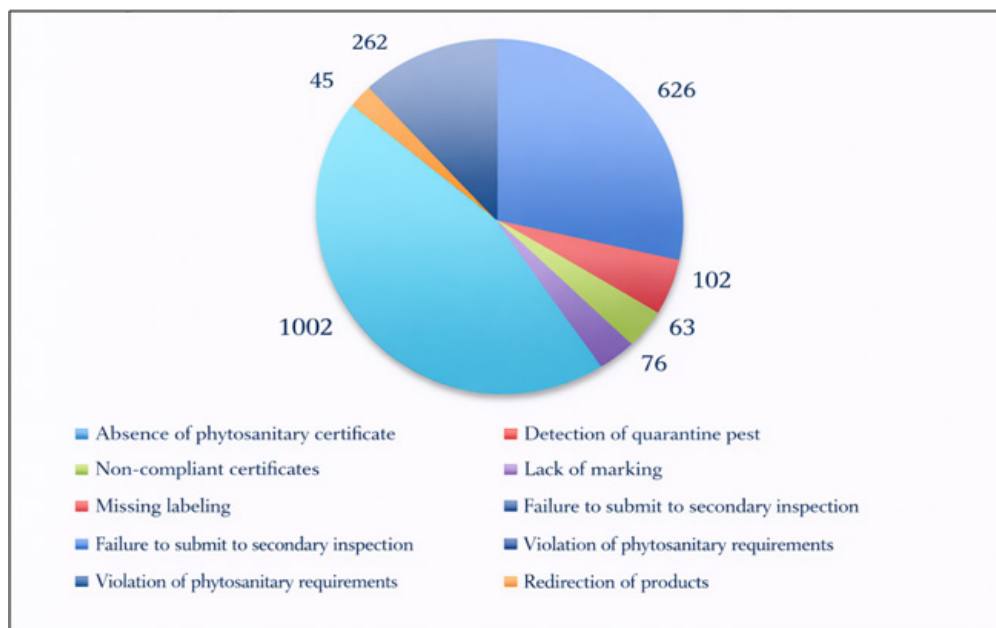


Figure 2 – Types and Number of Identified Violations of Phytosanitary Requirements

A comparison of the obtained results with data from foreign studies demonstrates that the growth of phytosanitary risks represents a global and sustained trend under conditions of intensified trade globalization and steadily increasing volumes of international movement of plant products [5, 7]. The liberalization of trade regimes, expansion of international transport corridors, and acceleration of logistics processes have significantly increased the permeability of national borders for biological threats. As a result, quarantine pests and plant pathogens are able to spread more rapidly across regions and continents, posing serious challenges to national phytosanitary systems.

The expansion of trade routes and the diversification of supply chains substantially increase the likelihood of the introduction and further dissemination of quarantine pests, including through indirect pathways that are difficult to control using traditional inspection methods. Under these conditions,

conventional phytosanitary control measures, based primarily on documentary checks and selective inspections, often prove insufficient without the support of modern information and digital technologies. The growing complexity of trade flows requires a transition to risk-oriented and data-driven approaches that make it possible to identify potentially dangerous consignments and routes in a timely manner.

One of the key systemic problems identified in the course of the study is the absence of a unified digital information system capable of ensuring end-to-end traceability of regulated products throughout all stages of their movement, from import and transit to internal circulation and final distribution within the country. The fragmentation of information resources and the limited integration between control authorities significantly reduce the transparency of phytosanitary control processes. This situation complicates comprehensive risk assessment, hinders timely managerial decision-making, and increases the probability of the uncontrolled spread of quarantine pests within the national territory. Consequently, the lack of digital traceability mechanisms represents a critical constraint on the effectiveness and sustainability of the national phytosanitary control system.

Conclusion

Phytosanitary control constitutes a critical component of ensuring the food, environmental, and economic security of the Republic of Kazakhstan, as it is directly related to the protection of agricultural production, natural ecosystems, and the stability of domestic and foreign trade. Although the existing phytosanitary control system generally complies with international standards and obligations, the results of the analysis indicate the need for its further improvement and modernization. The primary areas requiring enhancement include the level of digitalization of control procedures and the establishment of effective mechanisms for ensuring the traceability of regulated products throughout the entire supply chain.

The prospects for further research are associated with the development, implementation, and evaluation of the effectiveness of digital tools designed for internal plant quarantine. Particular attention should be paid to their integration into the unified state control system, as well as to assessing their impact on improving transparency, risk management, and the overall efficiency of phytosanitary measures.

Authors' Contributions

AK: development of the research concept, analysis of the regulatory and legal framework, data processing, and manuscript preparation. AZh: preparation of the literature review, synthesis of research results, data analysis, and joint preparation of the article text.

All authors have read, reviewed, and approved the final version of the article.

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Қазақстан Республикасының фитосанитариялық бақылау жүйесін халықаралық міндеттемелер мен цифрлық трансформация жағдайында жетілдіру

Қадырбаева Ә.Қ., Жолманов А.С.

Түйін

Алғышарттар мен мақсат. Фитосанитариялық бақылау мемлекеттің азық-түлік, экологиялық және экономикалық қауіпсіздігін қамтамасыз етудің негізгі элементтерінің бірі болып табылады. Жаһандану және халықаралық сауданың қарқынды дамуы жағдайында карантиндік объектілердің ел аумағына енуі мен таралу қаупі арта түсуде.

Зерттеудің мақсаты – Қазақстан Республикасындағы фитосанитариялық бақылау жүйесінің қазіргі жағдайын талдау және халықаралық міндеттемелер мен цифрландыруды ескере отырып, оны жетілдіру бағыттарын негіздеу.

Материалдар мен әдістер. Зерттеу барысында жүйелік талдау, салыстырмалы-құқықтық талдау әдістері қолданылды, сондай-ақ Қазақстан Республикасының нормативтік құқықтық актілері, халықаралық келісімдер мен FAO/IPPC стандарттары, Қазақстан Республикасы Ауыл

шаруашылығы министрлігінің Агроөнеркәсіптік кешендегі мемлекеттік инспекция комитетінің аналитикалық материалдары жинақталып, қорытыла қарастырылды.

Нәтижелер. Қолданыстағы фитосанитариялық бақылау жүйесінің жалпы алғанда халықаралық талаптарға сәйкес келетіні анықталды, алайда оның цифрландыру деңгейінің жеткіліксіздігі және карантинге жатқызылатын өнімнің сквоздық (үздіксіз) қадағалану жүйесінің болмауы байқалады. Өнімнің бақылаусыз орын ауыстыруы мен карантиндік объектілердің таралу қаупі бар екені айқындалды.

Қорытынды. Ұсынылған шараларды іске асыру фитосанитариялық бақылаудың тиімділігін арттыруға, фитосанитариялық тәуекелдерді төмендетуге және Қазақстан Республикасының экспорттық әлеуетін нығайтуға мүмкіндік береді.

Кілт сөздер: аборигендік түр; мемлекеттік инспектор; карантиндік шара; карантиндік объект; фитосанитариялық бақылау.

Совершенствование системы фитосанитарного контроля Республики Казахстан в условиях международных обязательств и цифровой трансформации

Қадырбаева Ә.Қ., Жолманов А.С.

Аннотация

Предпосылки и цель. Фитосанитарный контроль является ключевым элементом обеспечения продовольственной, экологической и экономической безопасности государства. В условиях глобализации и интенсификации международной торговли возрастает риск заноса и распространения карантинных объектов. Целью исследования является анализ современного состояния системы фитосанитарного контроля Республики Казахстан и обоснование направлений её совершенствования с учётом международных обязательств и цифровизации.

Материалы и методы. В работе использованы методы системного анализа, сравнительно-правового анализа, обобщения нормативных правовых актов Республики Казахстан, международных соглашений и стандартов FAO/IPPC, а также аналитические материалы Комитета государственной инспекции в агропромышленном комплексе МСХ РК.

Результаты. Установлено, что действующая система фитосанитарного контроля в целом соответствует международным требованиям, однако характеризуется недостаточной цифровизацией и отсутствием сквозной прослеживаемости подкарантинной продукции. Выявлены риски неконтролируемого перемещения продукции и распространения карантинных объектов.

Закключение. Реализация предложенных мер позволит повысить эффективность фитосанитарного контроля, снизить фитосанитарные риски и укрепить экспортный потенциал Республики Казахстан.

Ключевые слова: Аборигенный вид; государственный инспектор; карантинная мера; карантинный объект; фитосанитарный контроль.