INSPECTION AND CERTIFICATION SYSTEMS ANALYSIS OF THE LEADING FRUIT CROPS PLANTING MATERIAL PRODUCER COUNTRIES

ANNOTATION
The fruit crops nursery system of Kazakhstan needs to be modernized in order to meet the conditions of agricultural products competitiveness. Strict supervision of fruit crops planting materials in the country is required, both for local production and import. Low-quality planting material is often found at local market as well as illegally exported from foreign countries, which leads to low yields and the spread of pathogens and pests, including quarantine ones in the country. The state needs to protect the rights of farmers who purchase planting material for the high-quality production, both for the domestic market and for export to the foreign market. The research is aimed at solving the problem of quality control of planting material of fruit, berry, and nut crops produced on the territory of the Republic of Kazakhstan, as well as imported to Kazakhstan. The comparative analyses of inspection and certification systems of the main seed and planting material producing countries for the transfer of the best elements to the inspection and certification system of Kazakhstan was carried out. An analysis of the systems of inspection and certification of fruit crops of the leading producing countries was carried out. As a result of the research, the transfer of the Netherlands inspection and certification system to the Republic of Kazakhstan was determined.

Key words: inspection, certification, planting materials, apple, walnut, raspberry, plum.

Introduction. The main approaches to conduct research are the analysis and comparison of the inspection and certification systems of the main seeds and planting material producers countries; transfer of the best technologies and methods to the inspection and certification system of Kazakhstan; the use of digital technologies to optimize the process of seeds and planting material quality control; application of DNA technologies for the creation of domestic detection systems of especially dangerous and quarantine diseases of agricultural crops.

The fruit crops nursery system of Kazakhstan needs to be modernized in order to meet the conditions of agricultural products competitiveness. The market for seeds and fruit crops planting material in the country requires strict control, both for domestic and import production.
Often, poor quality seed material is detected. This material is domestically produced and, in addition, appears on the country’s market due to contraband from abroad, thus leading to low yields and the spread of phytopathogens in the country, including quarantine ones [1].

It is necessary for the government to protect the rights of farmers who purchase seeds and planting material to produce the high-quality products for the local market and export. This program is an order of the state, which indicates its relevance and the urgent need for its implementation. The head of state in his message to the people has repeatedly stressed the priority of the development of the agro-industrial complex, which will lead to the protection of the country’s food sector [2].

In addition, domestic highly sensitive test systems for detecting the most dangerous and quarantine pathogens of fruit crops and an electronic database for monitoring inspections and certification are needed, the use of which will be integrated into the organizational-legal system for controlling seeds and planting material quality [3, 4].

The market of fruit crops planting material requires strict control in the country, both for local production and import. Low-quality planting material is often found at local market as well as illegally exported from foreign countries, which leads to low yields and the spread of pathogens and pests, including quarantine ones in the country. It is necessary to protect the rights of farmers who purchase seeds and planting material to produce high quality products for the local market and for export.

The reason of the program research area choice is the necessity to upgrade the seed production and nursery systems of fruit, berry, and nut crops in Kazakhstan, in order to be appropriate to present day conditions.

Developed countries have their own seeds and planting material certification and monitoring systems (ESCAA, EPPO, NAPPO, etc.). These systems are based on legal principles and economic conditions of the application area and do not correspond to the legal and economic conditions in Kazakhstan. Seed and planting material data are of commercial and strategic value and therefore needed to be centrally recorded and unified monitoring rules are to be developed. There is no such a system in Kazakhstan, and there is no monitoring and control of planting material of fruit, berry, and nut crops. During the implementation of the program, an inspection and certification system based on international standards will be developed and implemented for the first time [5, 6, 7, 8, 9].

The program is aimed at solving the problem of quality control of planting material of fruit, berry, and nut-fruit crops produced locally and imported to Kazakhstan.

Implementation of the following points is needed to address the above-mentioned issues:

- to create and implement an optimal model of the organizational and legal system for seeds and planting material quality control in the Republic of Kazakhstan;
- to create and introduce domestic detecting systems of the most dangerous pathogens of fruit, berry, and nut crops;
- to create and implement a database for monitoring and managing the quality of planting material of fruit, berry, and nut crops in the Republic of Kazakhstan;

The results obtained during the research will transfer the contemporary inspection and certification system of fruit crops planting material to the Republic of Kazakhstan.

The implementation of this system will ensure the transparency and objectivity of fruit crops planting material and will lead to a significant increase in seed production investment and the development of planting material export.

For the first time, the experience of progressive countries in the production of planting material of fruit crops were studied and on its basis, a system of inspection and certification system will be developed and implemented in the Republic of Kazakhstan, the implementation of which will ensure transparency and objectivity in growing planting material for fruit crops, which will create preconditions for a significant increase in investment in seed production and the development of exports of seeds and planting material.

The system of seed production of nursery of fruit crops in Kazakhstan needs significant modernization to reach a new advanced level. The market for planting material for fruit crops in the country requires stricter control, both on the domestic market and during import. Often, poor quality seed material, both domestically produced and smuggled from abroad, is detected, which ultimately leads to low yields and the spread of diseases. It is necessary to protect the rights of farmers who purchase seed and planting material for the production of a quality product, both for the domestic market and for export to the foreign market. This research is an order of the state, which speaks of its relevance, extreme necessity and urgency of its implementation.
The aim of the research is to develop and implement a science-based system for certification and inspection of fruit crops planting material in the Republic of Kazakhstan.

**Materials and methods.** The main approaches applied in the research are the comparative analysis of certification and inspection systems of the main seeds and planting material producing countries; transfer of the best practices to the certification and inspection system of Kazakhstan; application of digital technologies to the seeds and planting material quality control process optimization; application of DNA technologies to the development of the domestic detection systems for the identification of especially dangerous diseases.

The data obtained will be processed using accepted analytical and statistical methods. All results obtained during the research are reliable and reproducible, as international standards will be used for their acquisition and processing.

**Research results.** Legislation analysis of the countries with developed agriculture, in particular the European Union member states, the member states of the Commonwealth of Independent States, Canada, China, Brazil, the United States of America, has shown that certification of plants for planting is carried out by state services or services under the responsibility of the state (table 1) [10].

The competent authority responsible for the certification of planting material in Germany [11], Scotland [12], England and Wales [13], Italy [14], Poland [15], the Russian Federation [16], Belarus [17], and Moldova [18] is the public administration. In France [19] and the Kingdom of the Netherlands [20], the certification of planting material is carried out by the service under the state responsibility.

In England and Wales, the use of non-certified planting material is not permitted, while it is allowed to use in the countries such as Belarus, Poland, Moldova, the Russian Federation, Italy, Scotland, France and Germany.

Table 1 – Analysis of inspection and certification systems in leading countries for the production of fruit crops planting material

<table>
<thead>
<tr>
<th>Country</th>
<th>Competent authority responsible for the planting material certification</th>
<th>Permission to plant uncertified planting material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public administration</td>
<td>Service under the responsibility of the state</td>
</tr>
<tr>
<td>Germany</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>France</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Scotland</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Kingdom of Netherlands</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>England and Wales</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Italy</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Poland</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Moldova</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Belarus</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Compulsory licensing and the right of planting material certification for producers is available in almost all European countries except the Kingdom of the Netherlands and France (table 2).

Table 2 – Systems of inspection and certification systems of the leading fruit crops planting material producer countries

<table>
<thead>
<tr>
<th>Country of planting material origin</th>
<th>Compulsory licensing and the right to certification of planting material for producers</th>
<th>Mandatory registration and cataloguing of fruit and berry varieties</th>
<th>Methods of variety purity and identity proof as part of certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Documentatio...</td>
<td>Visual inspection to confirm the variety</td>
<td>Referen...</td>
</tr>
</tbody>
</table>
A license and manufacturers' right to certification is granted by an authorized body. No license is granted in France and the Kingdom of the Netherlands. Mandatory varieties registration and cataloguing exists in all leading producer countries.

Competent authorities of Belarus, Scotland, Kingdom of the Netherlands, England, and Wales do not recognize accredited or authorized service providers for certification procedures. Some countries, such as Germany, France, Italy, partially recognize the services of accredited service providers, for instance, in sampling and laboratory analysis. Poland, Moldova, and the Russian Federation recognize accredited or authorized service providers for certification of planting material and nursery (table 3).

Table 3 – Certification and Inspection Service Providers for Fruit crops planting material

<table>
<thead>
<tr>
<th>Country</th>
<th>Germany</th>
<th>France</th>
<th>Scotland</th>
<th>Kingdom of Netherlands</th>
<th>England and Wales</th>
<th>Italy</th>
<th>Poland</th>
<th>Moldova</th>
<th>Belarus</th>
<th>Russian Federation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Analysis of the inspection and certification systems of the leading manufacturing countries allowed us to consider the advantages and disadvantages of each of them. Based on our analysis, we have chosen the model of the inspection and certification system of the Kingdom of the Netherlands, which is the most convenient to implement in the nursery system of Kazakhstan. First, the chosen model meets the requirements for administration and control ease. Secondly, it helps to minimize corruption risks. A great advantage of the Dutch model is the participation of all interested parties in the monitoring process - producers of planting material, public authorities and scientists.

Monitoring and certification of planting material led to the intensification of the agro-industrial complex (AIC). The main goal of state programs for the development of the agro-industrial complex in the field of crop production is to improve the quality and quantity of the crop. Increasing crop yields depends not only on the genetic potential of the variety but also on the growing environment, proper planting and disease monitoring. Pathogen-free certified planting material leads to stable yields, the ability to enter the international market with local varieties, where international standards for mandatory certification are supported. Certification of planting material allows you to control the spread of dangerous phytopathogens, the transition of pathogens to wild plants, weeds, which are natural reservoirs, the spread of new strains, races, isolates of phytopathogens in the country. Certification must also confirm
the genetic strain of the crop to prevent variation in productivity. Certification of potato seeds allowed China to increase potato yields from 30% to 50% [1]. Planting infected potato seeds with leaf-rolling viruses, viruses X, M, Y, S of potatoes can lead to 60% yield losses [3]. The generally accepted protocols for the certification of potato seeds have been developed by the European and Mediterranean Plant Protection Organization (EPPO), the North American Plant Protection Organization (NAPPO), and the United Nations Economic Commission for Europe (UNEC) [1, 5]. Planting material of fruit crops infected with pathogens leads not only to a decrease in yield but also to the spread of infection inside the local garden. The lack of monitoring of the soil of fields and gardens for the presence of pests leads to a constant circulation of infection since pests are the primary carriers of viral infections.

In Kazakhstan, there is no proper digital database system for monitoring and certification of potato seeds and planting material of fruit crops; there is a phytosanitary control department of the Ministry of Agriculture that assesses the phytosanitary status of all crop production. Genetic confirmation of the variety belonging to the planting material is not conducted at all, many varieties in the register of breeding achievements of the country do not contain genetic passports. Planting material moves within the country without certificates, so there is no way to enter the international market with local varieties, where there is a strict system of certification of planting material based on international standards.

Establishment of a specialized unit within the designated authority for the inspection and certification of fruit crops planting material:

The formation of the designated authority for inspection and certification of seeds and fruit crops planting material in Kazakhstan is the first step towards its implementation and is planned to be registered as a legal entity by the research.

Now, the draft preliminary regulations for the appointed body and its statutes have been developed. In consultation with the representatives of NAK [21] and Naktuinbouw [20], the statutes and regulations were finalized, as well as proposals for amendments to the Seed Production Act of the Republic of Kazakhstan to give the Designated Authority a proper status.

Together with the establishment and registration of the Designated Authority, a specialized unit (SU) for inspection and certification of fruit crops planting material within the authority will be established. The SU structure - the board composition, the management, the principles of interaction between the internal structures, the principles of interaction with the planting material producers and other people involved in the production process will be finalized after consultation with competent authorities such as Naktuinbouw, National Plant Protection and Quarantine service and Ministry of Agriculture of the Republic of Kazakhstan. Documented procedures and work instructions are currently being developed. The procedures describe the objective to be achieved, determine the responsible persons, the steps to be taken to complete the task and the records to be kept.

The system of inspection and certification starts with a pre-basic material and ends with a certified tree (figure 1).

Figure 1 – Classification of planting material for fruit crops

Inspection algorithm:
1) at least 2 field inspections and lot inspection are carried out during the year. If the requirements are according to the standard for a given species and class of plants, a decision is done/not done to issue a certificate;

2) the lot inspection includes the check of planting material, its storage and transportation. When deciding to issue a certificate, the manufacturer marks the lot with the appropriate label under the control of the inspector. When deciding not to issue a certificate, the inspector indicated the reason in the database;

3) the inspector has the right to conduct an inspection without warning the producer of planting material, in case of a violation of the production process or detection of diseases, the inspector notifies the producer, and if quarantine objects are found, notifies the quarantine service of the Republic of Kazakhstan and stops the inspection process [22]. The producer, after notifying the inspector, follows all his instructions until the violation is eliminated, and if quarantine objects are found, all plants are subject to destruction.

Conclusion. The inspection and certification systems for fruit crops of the leading producing countries have been analyzed. An analysis of the inspection and certification systems of the leading producer countries allowed us to consider the advantages and disadvantages of each of them. Based on the analysis, it has been decided to transfer to the Republic of Kazakhstan the model of the inspection and certification system of the Kingdom of the Netherlands, which is the most convenient to implement in the seed and nursery production system of Kazakhstan. First, the chosen model meets the requirements of ease of administration and control. Secondly, it minimizes the risk of corruption. A big advantage of the Dutch model is the involvement in the control process of all stakeholders - planting material producers, public authorities and scientists.

Funding. This research was funded by the Science Committee of the Ministry of Agriculture of the Republic of Kazakhstan (Grant No. BR10765038).

REFERENCES


ТУЙІН
Қазақстандағы жеміс дақылдырышын тәлімбік жүйесі агроөнеркәсіптік кешен ойнімдерінің боскеге кабілеттілік шарттарының сыйқы қолу мақсатында жаңғыртуды қажет етеді. Елиңдізгі жеміс дақылдырышының отырғызуы материадары нарығы ішкі нарықтың импорттарына таңдалып, енді балаларға өндірістің орташа құқықтары мен кәсіпорындардың тәуелділігін қамтамасыз етеді. Елдің іс адамдары, сауда және өндірістің өндірістік тәрізді құқықтарына қауіпсіз етуді қажет етеді, сондықтан оның құқықтарын қамтамасыз етуді қажет етеді.

РЕЗЮМЕ
Система питомникводства плодовых культур в Казахстане нуждается в модернизации с целью соответствия условиям конкурентоспособности продукции агропромышленного комплекса. Рынок посадочного материала плодовых культур в стране требует более строгого контроля, как на внутреннем рынке, так и при экспорте. Нередко выявляется посадочный материал низкого качества, как отечественного производства, так и за счет контрабанды из-за рубежа, что в конечном счете ведёт к низким урожаям и распространению фитопатогенов и вредителей, в том числе карантинных, на территории страны. Государству необходимо защищать права фермеров, приобретающих посадочный материал для производства качественного продукта, как для внутреннего рынка, так для экспорта на внешний рынок. Исследование направлено на решении проблемы контроля качества посадочного материала плодовых, ягодных и орехоплодных культур, производимых на территории Республики Казахстан, а также импортируемых в Казахстан.
Проведен анализ и сравнение систем инспекции и сертификации стран основных производителей семян и посадочного материала для трансфера наилучших элементов в систему инспекции и сертификации Республики Казахстан. В результате исследований модель системы Королевства Нидерландов определена в качестве основы для трансфера.