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Prospects for the Development of the Seed Industry in Ukraine

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► **Abstract.** Given the significant production and export potential of the crop sector in Ukraine, it is important to develop an effective national seed production system. Providing agricultural producers with seeds of national selection is one of the main factors of food security in the country. The development of an effective seed production system provides for the creation of appropriate conditions for increasing seed production and popularising national varieties and hybrids that have a significant yield potential and high-quality indicators for their wider use, which will ensure the competitive advantages of agricultural production and its development. The purpose of the study is to identify trends and outline development prospects for the seed industry of Ukraine. In the course of the study, the dialectical method, analysis and synthesis, system generalisation (establishing trends in the development of the Ukrainian seed industry; forming conclusions), and comparative analysis (determining the main problems of seed production development in Ukraine) were applied. Trends in the development of the seed industry in Ukraine are established. The main problems of seed production development are identified and measures to stimulate selection activities in Ukraine are proposed. Prospects for the development of Ukrainian seed production are outlined. Conclusions, suggestions, and practical recommendations can be used in the development of national programmes to support seed production in Ukraine

► **Keywords:** seed production, selection activities, seeds and planting material, certified seeds, variety, royalty, import, export

► Introduction

Despite the fact that Ukraine is one of the largest exporters of grain and oilseeds, a significant volume of seeds on the domestic market is imported. The annual volume of seed imports amounts to USD 0.5 billion annually. The share of imported sunflower, rapeseed, and sugar beet seeds reaches 70-90% [1]. Imported seeds of agricultural crops displace Ukrainian varietal resources from the market of seeds and planting material, which negatively affects the seed industry of Ukraine [1].

Every year, national and foreign applicants submit from 1,000 to 2,000 applications for conducting a qualification examination of plant varieties. According to registration, about 1,500 plant varieties are received, of which about 70% are submitted by foreign applicants. At the end of 2020, 8,871 varieties and hybrids were included in the Register of Plant Varieties, of which 4,991 (56%) were varieties of foreign selection and 3,880 (44%) were varieties of national selection [2].

Now almost half of the varieties registered in

the State Register of Plant Varieties of Ukraine are of foreign origin [2]. At the same time, their share is growing, which in conditions of instability and new risks caused by the war poses a threat to the country's food security. Food security and seed safety are closely related, and danger in one area leads to uncertainty in the other [3].

Issues of seed industry development and problems providing the agricultural sector of the economy with seeds and planting materials were studied and covered by many prominent researchers.

D. Nabuuma, C. Reimers, K. Hoang, T. Stomph, J. Raneri studied the impact of seed system measures on food security in low- and middle-income countries. They believe that agricultural activities that promote food production and consumption often lack detailed information about seeds and other agricultural resources. Thus, there is limited evidence to which seeds and seed systems directly (or indirectly) contribute to improving food quality [4].

S. McGuire and L. Sperling justify the need for

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a sustainable seed system, which is key to ensuring food security. The seed system includes technologies, organisational measures, market and non-market institutions that provide access to the use of seeds [5].

The development of the seed production system provides for a set of measures to create new varieties of agricultural crops to meet the needs of agricultural enterprises. The seed production system includes plant selection, a programme for the development of each variety to provide agricultural producers with high-quality seeds.

S. Gairhe, K. Timsina, Yu. Ghimire, J. Lamichhane, S. Subedi, and J. Shrestha, analysing the system of production and distribution of corn seeds, concluded that the state should support farmers in the introduction of modern technologies, seeds of high-performance varieties, and other materials for commercial seed cultivation. Low access to finance for small farmers and other participants in the value chain is one of the main obstacles in the seed sector [6].

Pushpa Singh notes that there are global problems in the development of national seed production systems. Multinational companies have contributed to the concentration of the market and the spread of monopolies in the development of the seed production system, introducing high licensing fees and royalties, and controlling the world's food supply. This leads to overpaid farmers and can lead to environmentally destructive agricultural systems. Private companies that dominate the seed market are changing the goals and orientation of seed sector selection, creating a new dynamic that now controls the market. They focus their research on innovations in selection activities that would develop those properties in seeds that could bring them the highest market profit. This applies to the hybrid selection of more profitable crops, in particular, vegetable crops [7].

F. Solfanelli, E. Ozturk, S. Orsini, F. Schäfer and R. Zanolì considered it important to create European national databases of organic seeds, which would contain a list of varieties for which organically produced seeds and vegetative propagation material are available on the market. The creation of such databases can facilitate the use and distribution of organic seeds [8], which will contribute to the development of organic agriculture.

This study aims to identify the competitive advantages of the seed industry in Ukraine that characterise its development potential and the threats that give rise to additional risks. Based on the analysis of current trends in the functioning of the national seed production industry, prospects for its further development are determined.

► Materials and Methods

The study was conducted on the basis of statistical data of the State Statistics Service of Ukraine, performance indicators of research institutes, research stations, and agricultural enterprises of the National Academy of Agrarian Sciences, and the State Register of Plant Varieties suitable for distribution in Ukraine

and the Register of certificates for sowing and commercial qualities of seeds for 2021, provided by Ministry of Agrarian Policy and Food of Ukraine. In addition, information from Internet resources was used, in particular, expert assessments and reports on important events that significantly affect the development of national seed production.

The research was based on the use of the dialectical method, which involved the analysis of processes and phenomena in their development, interrelation, and interdependence. For a deeper understanding of the problems of the development of the seed industry in Ukraine, such general scientific research methods as observation, scientific cognition, analysis, synthesis, comparative analysis, and system generalisation were also used. For a more visual representation of information and presentation of statistical data and their correlations, and for a better perception and understanding of economic processes and phenomena, the study also uses a graphical method.

Using the methods of system analysis and scientific generalisation, current trends in the development of seed production in Ukraine were identified. In addition, a number of provisions have been formed and substantiated that reveal the content of the study and have theoretical and practical significance for the development of the national seed industry. For scientific substantiation of the existing competitive advantages of seed production in Ukraine, which form the potential of the industry, as well as the main problems and threats that cause additional risks and hinder its development, the study uses methods of system analysis and generalisation.

The calculation of the need for seeds and the volume of certified seeds of the main agricultural crops to ensure sowing in 2022 was carried out using statistical data from the Register of certificates for sowing and commercial qualities of seeds for 2021, the sown areas of the main agricultural crops, the level of their yield, and seeding rates per 1 ha. At the same time, the need to create appropriate reserve stocks of agricultural seeds was considered.

► Results and Discussion

Currently, the production of certified seeds of the main grain and oilseeds in Ukraine does not fully meet the needs of agricultural producers. Thus, in 2021, 359 thousand tonnes of breeder, basic, and certified seeds were produced, with the need for 2,500-3,000 thousand tonnes. The volume of certified seeds of basic grain and oilseeds of Ukrainian selection amounted to 123.2 thousand tonnes, or 34.3% of the total volume of certified seeds, and the volume of seeds of foreign selection imported from abroad, respectively – 54.3 thousand tonnes. At the same time, another 182.5 thousand tonnes of seeds of foreign selection were produced and certified on the territory of Ukraine. Thus, the total volume of production of certified seeds of foreign selection produced in Ukraine and imported in 2021 amounted to 235.8 thousand tonnes, or 65.7% [1].

The decrease in seed production of major agricultural crops of Ukrainian selection is a negative trend in recent years, which hinders the development of national seed production. In 2021, the production of grain seeds of Ukrainian selection amounted to 118.4 thousand tonnes against 156.6 thousand tonnes in 2020 [1]. At the same time, 170.8 thousand tonnes of foreign-selected seeds were imported and produced in Ukraine, which accounted for almost 60% of the total seed fund of grain crops [1]. Compared to the previous year the share of grain seeds of foreign selection increased by almost 10 points [1]. Against the background of a decrease in the production of seeds of Ukrainian selection, there is an increase in the production of seeds of foreign selection of

Ukrainian production and a reduction in the import of seeds [1].

A similar trend is also observed in the market of certified oilseeds (soybeans, sunflower, winter rape). In 2021, Ukraine produced only 4.8 thousand tonnes of seeds of national selection and 65.0 thousand tonnes of seeds of foreign selection against 6.2 thousand tonnes and 65.9 thousand tonnes in 2020, respectively [1]. The decrease in the production of seeds of Ukrainian selection was conditioned by a reduction in the production of soybean and sunflower seeds [1]. At the same time, the production of seeds of these crops of foreign selection also decreased. In general, the share of oilseeds of Ukrainian selection in 2021 was 6.9% against 8.6% in 2020 (Table 1) [1].

Table 1. Production of certified seeds of the main agricultural crops in Ukraine in 2021

Cultures	Seeds of Ukrainian selection, thousand tonnes	Seeds of foreign selection, thousand tonnes		Seeds of foreign selection, thousand tonnes	Total seeds produced, thousand tonnes	Share of seeds of Ukrainian selection, %
		Imported to Ukraine	Produced in Ukraine			
Winter wheat	75.9	1.5	43.5	45.0	120.9	62.8
Spring barley	9.4	0.2	11.7	11.9	21.3	44.1
Winter barley	9.7	0.2	10.5	10.7	20.4	47.5
Corn	22.2	19.9	77.1	97.0	119.2	18.6
Winter rye	1.2	1.2	5.0	6.2	7.4	16.2
Total cereals	118.4	23.0	147.8	170.8	289.2	40.9
Soybean	1.5	0.4	16.6	17.0	18.5	8.1
Winter rape	0.5	4.7	0.2	4.9	5.4	9.3
Sunflower	2.8	26.2	16.9	43.1	45.9	6.1
Total oilseeds	4.8	31.3	33.7	65.0	69.8	6.9
Total cereals and oilseeds	123.2	54.3	182.5	235.8	359.0	34.3
Potatoes	0.3	3.6	29.8	33.4	33.7	0.9
Sugar beet	0	0.8	0.3	1.1	1.1	0

Source: calculated by the authors based on data of the Ministry of Agrarian Policy and Food of Ukraine [1]

In Ukraine, the production of seeds of only certain agricultural crops ensures an appropriate level of food security. In particular, the production of buckwheat, millet, oats, and triticale is fully provided with seeds of Ukrainian selection. The level of provision of seeds of Ukrainian selection for winter

wheat growing is 62.8%, winter barley – 47.5%, spring barley – 44.1%, spring wheat, winter rye, corn, soybeans, sunflower, and peas – less than 40%. The average level of providing production of grain and oilseeds with seeds of Ukrainian selection is only 34.3% (Table 1; 2).

Table 2. Production of certified seeds of niche agricultural crops in Ukraine in 2021

Cultures	Seeds of Ukrainian selection, thousand tonnes	Seeds of foreign selection, thousand tonnes		Seeds of foreign selection, thousand tonnes	Total seeds produced, thousand tonnes	Share of seeds of Ukrainian selection, %
		imported to Ukraine	produced in Ukraine			
Buckwheat	0.6	0	0	0	0.6	100.0
Millet	1.1	0	0	0	1.1	100.0
Oat	1.2	0	0	0	1.2	100.0
Triticale	1.1	0	0	0	1.1	100.0
Spring wheat	2.4	0.1	5.8	5.9	8.3	28.9
Peas	2.2	0.5	4.5	5.0	7.2	30.6
Total niche crops	8.6	0.6	10.3	10.9	19.5	44.1

Source: calculated by the authors based on data of the Ministry of Agrarian Policy and Food of Ukraine [1]

Significant demand for foreign-selected planting material increases the level of import dependence of the domestic seed market and creates additional risks in the production of agricultural products, in particular, due to possible restrictions conditioned by the war or the introduction of quarantine measures in the context of the covid-19 pandemic. Every year Ukraine imports USD 400-500 million worth of seeds [9]. In addition, the state produces certified

seeds of foreign selection, financed by foreign companies, for almost the same amount – about USD 500 million [9]. At the same time, the share of the main agricultural crop seeds of Ukrainian selection decreases annually. In particular, the share of winter wheat seeds of Ukrainian selection in 2021 compared to 2020 decreased from 66.2% to 62.8%, spring barley – from 57.8% to 44.1%, corn seeds – from 29% to 18.6% (Fig. 1).

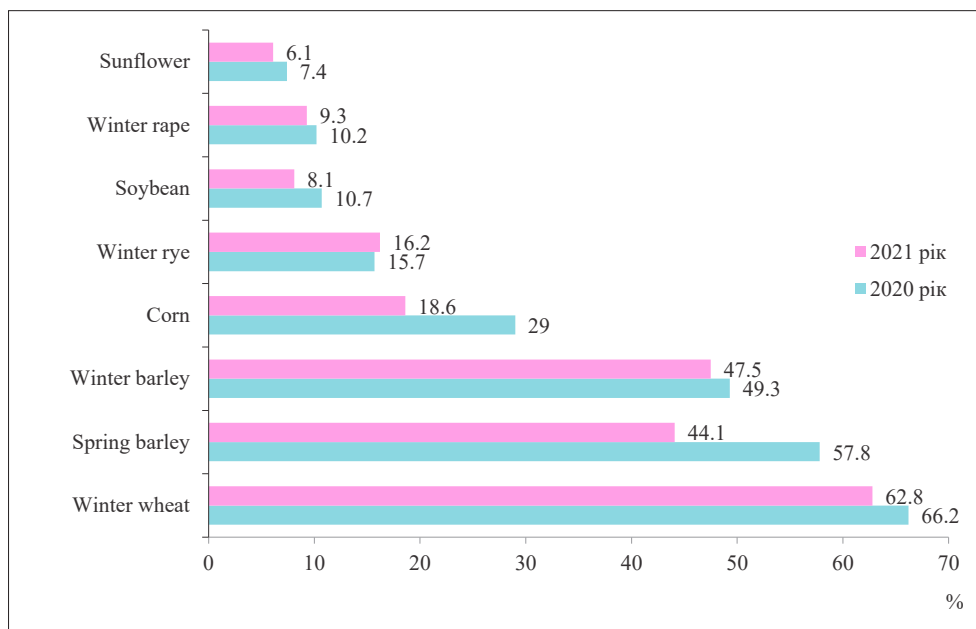


Figure 1. Share of seeds of major agricultural crops of Ukrainian selection

Source: compiled based on data of the Ministry of Agrarian Policy and Food of Ukraine [1]

Increased import dependence may lead to the decline of Ukrainian seed production and the complete displacement of Ukrainian varietal resources from the seed and planting material market, which will pose a threat to Ukraine's food security. Researchers and specialists of the agricultural sector reasonably believe that the variety provides an increase in yield and stability of agricultural production [10]. It is the variety and seeds, according to V.M. Sokolov, that are an important factor in the intensification of agricultural production, which significantly increases its economic efficiency [11].

The tendency to increase imports of seed material, which has been observed in Ukraine since 2015 and continued in 2021, is the result of increased demand due to an increase in its consumption by holding companies and large and medium-sized producers who have sufficient financial support [12]. In addition, quarantine restrictions in 2020-2021 gave an impetus to the development of foreign selection companies in Ukraine, including Syngenta SIDS, Maisadur Semans, Dow AgroSciences, Limagrain Europe, and the expansion of production of certified seeds of many agricultural crops to meet the needs of Ukrainian producers.

According to the decision of the European Parliament, the seed certification system that operates

in Ukraine has been recognised by the EU countries. Thus, Ukraine is included in the list of non-EU countries that have the right to export grain seeds such as oats, barley, rice, rye, wheat, triticale, corn, and sorghum to the European market [13]. Ukrainian seeds have gained access to the European market – one of the most attractive and at the same time the most protected markets in the world from foreign seeds. The world market sells seeds produced on the territory of Ukraine – both of Ukrainian selection and selection of foreign seed companies operating in Ukraine.

The seed market in Ukraine has a significant development potential. According to experts, most Ukrainian varieties and hybrids are not inferior in economic and biological characteristics to foreign ones, they are quite competitive, and foreign analogues often predominate in such characteristics as winter hardiness, drought resistance, disease resistance, and taste qualities [14].

The share of certified seeds to ensure the sowing of such important agricultural crops as winter wheat, winter barley, spring barley, soybeans in 2022 does not exceed 10%, which is explained by the use of varietal seeds for 5-7 years with a decrease in its quality. Hybrid corn, sunflower, and winter rapeseed crops are 100% provided with certified seeds due to their use only for one year (Table 3).

Table 3. Seed demand and volume of certified seeds of major agricultural crops to ensure sowing in 2022

	Sale of certified seeds, thousand tonnes	Farm Saved Seed, thousand tonnes	Seed requirement, total thousand tonnes	Share of certified seeds, %
Winter wheat	80.6	1,526.7	1,607.3	5.0
Winter barley	13.6	232.4	246.0	5.5
Spring barley	14.2	287.2	301.4	4.7
Winter rye	4.9	25.2	30.1	16.4
Corn	110.0	0	110.0	100.0
Soybean	12.3	163.3	175.6	7.0
Winter rape	4.5	0	4.5	100.0
Sunflower	45.2	0	45.2	100.0

Source: calculated by the authors based on data of the Ministry of Agrarian Policy and Food of Ukraine [1]

Increasing the level of competitiveness of national seed production requires the popularisation of national varieties and hybrids that have significant yield potential, high quality indicators, and are resistant to climate change and environmental stress for their wider use by agricultural producers. According to experts, it is possible to achieve an increase in yield by 20-30% only at the expense of the variety. This is the cheapest lever of influence on stabilising production and increasing crop yields, especially in the current conditions [15].

The development of national seed production in the future will primarily depend on an objective assessment of the market value of each variety, and, accordingly, the payment for its growth [16]. The organisation of the system for collecting selection fees should be developed considering world experience. If a similar system is not applied in Ukraine in the near future, this may lead to a loss of priorities, a chronic lag in the selection industry, and the dominance of foreign varieties.

In addition to the need to introduce a system of royalties and fees in Ukraine, which is an important measure to support and protect the interests of plant breeders, the priority should be to ensure appropriate funding for selection centres and scientific institutions of the appropriate profile.

Currently, state support for Ukrainian selection is completely absent. National programmes for financing selection in crop production were in effect until 2011. In 2018 and 2019, financial support for agricultural producers was provided in the form of "partial compensation for the cost of seeds of agricultural plants of Ukrainian selection purchased from seed production facilities", but then it was cancelled [17; 18].

O.V. Shubravska draws attention to the fact that the deplorable state of selection activity is also a consequence of the presence of a complex of problems in the field of Ukrainian science and education (in particular, it is recognised that Ukrainian agricultural science has lagged behind foreign science by 20-30 years, and scientific discoveries and breakthroughs of Ukrainian researchers remain on experimental sites and in the walls of offices). However, despite the identification of these problems, there

are no effective mechanisms for solving them, which only worsens the current situation [19].

For the effective functioning of the National Seed Production System, it is necessary to conduct scientific and technical expertise of crop varieties, which is characterised by high cost-efficiency. However, institutions of expertise cannot ensure not only the development, but also the preservation of the resources and facilities and the corresponding reimbursement of their own expenses. Therefore, It is necessary to ensure that the costs of scientific and technical evaluation of plant varieties are financed from the state budget at the level of their normative need [20].

In this regard, it is important to involve all interested parties, namely: the state, selectionists, seed producers, researchers, and other specialists. Among the priorities: improvement of the legal standards of any royalty in Ukraine considering the positive experience of the EU countries and other leading countries of the world; compulsory declaration of varietal production crops agricultural producers, who are the owners of agricultural land with an area of 25 ha or more (for potatoes – from 10 ha); development of an effective mechanism to receive royalties based on real reflection of the seed and planting material using the license and sublicense agreement, and selection fees for Farm Saved Seed (FSS) – the seeds for their own use, and registration of an independent body of accounting supervision and control; enhance the role of professional associations in terms of registration of license agreements and royalty payments, as well as monitoring, recording, and compiling the base of the seed and commodity crops in varieties and hybrids; increase the receipt of funds for the payment of royalties and payments breeding for the production of new highly productive and high quality varieties of the national selection; introduction of proof of payment of royalty and/or payments for FSS as a condition of state support for the reimbursement of the cost of seed/planting material of national selection; development and implementation of state protectionist measures for the protection of the Ukrainian market of seeds from foreign domination; introduction of state support for the Ukrainian seed production and breeding in

the national market due to the action of selection and seed programmes; identification of further measures to improve the quality of Ukrainian seeds, especially hybrid, where Ukrainian breeding noticeably inferior to foreign ones; development and implementation of effective mechanisms to combat the adulteration of seeds in the Ukrainian market; creation of the national programme for the development of Ukrainian breeding and seed production.

► Conclusions

The seed production system plays a leading role in the development of farming industry and is an important condition for ensuring national food security. The production of seeds of national selection should be a priority area for the development of the seed production system, which will help to increase the level of competitiveness of the seed industry.

In the process of creating the seed production system, there is a tendency to increase the share of seeds of foreign selection. The growth of import dependence on the seed market in Ukraine negatively affects the level of food security and hinders the development of selection activities. In addition, insufficient funding for national selection can lead to the minimisation of the presence of Ukrainian varietal resources on the seed and planting material market.

Moreover, imperfect legal regulation of economic relations in selection activities negatively affects the

efficiency of Ukrainian selection, reduces the supply of high-quality and high-yielding seeds of new varieties and hybrids on the market, which causes additional risks for crop-growing agricultural sectors.

At the same time, the national seed industry has a fairly strong potential for its development. A significant share of Ukrainian varieties and hybrids in terms of individual characteristics and properties even prevail over foreign analogues. Therefore, it is important to popularise national competitive varieties and hybrids in order to spread them more widely.

It is necessary to provide sufficient funding for research institutions and selection centres to create new highly productive varieties and hybrids. It is also important to increase the level of training of specialists in the seed industry and support them in the process of selection activities.

In the state programme for the development of Ukrainian selection and seed production, it is necessary to provide: full reimbursement of the costs of carrying out work on the selection of agricultural crops in the links of primary seed production; partial compensation for the costs of seed production of primary links, state support for the development of the resources and facilities of selection and seed production, improving the activities of selection and seed production complexes; covering the share of costs associated with scientific research.

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Перспективи розвитку насінневої галузі України

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► **Анотація.** Враховуючи значний потенціал виробництва та експорту сільськогосподарської продукції галузей рослинництва в Україні, важливим є розвиток ефективної національної системи насінництва. Забезпечення сільськогосподарських товаровиробників насінням національної селекції є одним із основних факторів продовольчої безпеки країни. Формування ефективної системи насінництва передбачає створення відповідних умов для збільшення виробництва насіння та популяризації національних сортів і гібридів, які мають значний потенціал урожайності та високі показники якості для більш широкого їх використання, що забезпечить конкурентні переваги сільськогосподарського виробництва та його розвиток. Мета статті – встановити тенденції та окреслити перспективи розвитку насінневої галузі України. У процесі дослідження використано діалектичний метод наукового пізнання, аналізу й синтезу, системного узагальнення (встановлення тенденцій розвитку української насінневої галузі; формування висновків), порівняльного аналізу (визначення основних проблем розвитку насінництва в Україні). Встановлено тенденції розвитку української насінневої галузі. Виявлено основні проблеми розвитку насінництва та запропоновано заходи щодо стимулювання селекційної діяльності в Україні. Окреслено перспективи розвитку українського насінництва. Запропоновано заходи щодо стимулювання розвитку насінневої галузі в Україні. Висновки, пропозиції та практичні рекомендації можуть бути використані під час розробки національних програм підтримки насінництва в Україні

► **Ключові слова:** насінництво, селекційна діяльність, насіння і садивний матеріал, кондиційне насіння, сорт, роялті, імпорт, експорт
