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Scientific Support of the Organisation of State Regulation of Seed Production Development in Ukraine

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► **Abstract.** In recent years, Ukraine has seen rapid growth in agricultural business, which is a key sector of the Ukrainian economy. Farmers are well aware that to reduce production costs in crop production, improve product quality, and increase profitability, it is extremely crucial to use high-quality seed material. The purpose of the research - based on the results of the analysis of the state of the seed industry of the country and scientific support of the organisation of state regulation of seed development in Ukraine to substantiate proposals for its improvement, using the experience of advanced countries. Justify measures designed to improve the system of domestic legislation in the field of seed production, payment of breeding and licensing fees and proposals to reduce the dependence of agricultural production on seed imports. Methods used: monographic (analysis of the state of scientific support of the organisation of state regulation of seed product development in the country); statistical (to reflect the state of domestic seed production in quantitative and cost terms through a system of absolute and relative indicators); analysis of series of dynamics, structural changes (to analyse and identify trends in the development of seed production in Ukraine); tabular and graphical (visual display of research results in the form of tables and graphs), comparison (comparison of economic indicators); abstract-logical (generalisation and development of conclusions). The current state and prospects of scientific support of the organisation of state regulation of seed production in Ukraine are analysed. The problems of the development of domestic seed production are determined. The experience of leading countries in the field of seed production and the possibility of its use in Ukraine are highlighted. Summarised the current state of the organisation of state regulation of seed production in Ukraine. Proposals for improving its scientific support have been developed. New science-based approaches to improving the system of license fees, regulatory framework and ways to reduce import dependence on seeds were proposed. The proposed ways to overcome the existing problems in the industry will allow raising it to the level of world powers by changing approaches to royalty payments, increasing the productivity of seed production and improving the legislation regulating seed production in Ukraine

► **Keywords:** breeding, royalties, state regulation, plant variety, seeds and planting material, market, import, export

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Introduction

The key place in agricultural production belongs to such sectors as breeding and seed production. The development of domestic breeding and seed production, the entry of domestic varieties to the international market, attracting foreign investment to establish a seed infrastructure that would meet international requirements and provisions are impossible without the introduction in Ukraine of clear and understandable "rules of the game" in the seed market for its main participants, ensuring legal and transparent intellectual property rights to breeders and breeding institutions and determining the conditions of state support for breeding and seed production [1].

Therefore, the cultivation of conditioned seeds and planting material of high generations is considered an essential factor in the development of agriculture and the primary source of economic growth of the crop industry. It is evidenced by global development trends related to the food crisis, biotechnology, genetic engineering, reorientation to non-conventional fuels, adaptation to climate change, etc. Insufficiently satisfying demand in the world food markets requires further growth of agricultural potential, including through seed production. Currently, when the role of innovative factors has increased significantly, it will be strengthened in agriculture. The establishment of proper ownership of plant varieties and protection of breeders' rights will contribute to this.

Recently, the position of domestic seed production to satisfy the requirements of agricultural production with seeds of national origin is somewhat deteriorating due to the state of scientific farms due to imperfect legal support and the level of state support. In turn, this can result in unjustified dependence on seed imports and decrease the level of food security in the country. Therefore, the subject under study is extremely relevant, and the proposals substantiated in the research will contribute to the development of the seed industry and the growth of the provision of agriculture with seeds of highly productive varieties of national selection. Analysis of recent studies and publications. A significant contribution to the development of seed production, organisation of methodological and methodical principles of breeding and variety research work, investigation of the problems of royalty payment, the economics of seed production, further establishment of the seed production system and state support for scientific support of the industry was provided by such scientists as S.S. Bakay [2], M.I. Vavilov [3], V.V. Volkodav [4], M.V. Zubets [5], O.V. Zakharchuk [6, 7, 8], P.E. Marinich [9], E.D. Nettevich [10], V.A. Oreshnikov [11], L.M. Hudoliy [12], P.M. Tsibulov [13], V.V. Yurchishin [14] and others.

The purpose of the research – is based on the results of the analysis of the state of the seed industry of the country and scientific support of the organisation of state regulation of seed development in Ukraine to substantiate proposals for its improvement, using the experience of advanced countries. Justify measures designed to improve the system of domestic legislation in the field of seed production, payment of breeding and licensing fees and proposals to reduce the dependence of agricultural production on seed imports.

Summary of the main results of the study

The system of state regulation of seed production development in Ukraine is based primarily on the Laws of Ukraine's "On Seeds and Planting Material" [15] and "On Protection of Rights to Plant Varieties" [16], which generally comply with the main European canons.

Historically, the active development of seed production in Ukraine as part of the USSR began in 1923 (Table 1). After gaining independence in 1993, the first Laws of Ukraine "On Seeds" and "On Protection of Rights to Plant Varieties" were adopted. In 1995 Ukraine became a member of the International Union for the Protection of New Varieties of Plants. Thus, it was recognised that it is a state in which the individual rights of breeders and breeding institutions are protected.

In 2002 the Law of Ukraine "On Seeds and Planting Material" was adopted, which significantly expanded the provisions of the previously adopted Law "On Seeds". Over the past 12 years, Ukraine has joined 4 of the 7 OECD seed varietal certification schemes for grain, corn and sorghum seeds, cruciferous, oilseeds, bast crops, and sugar and fodder beet [17].

Table 1. Development of seed production system in Ukraine

Year	Events
1923	The All-Ukrainian Seed Union was established
1993	The Laws of Ukraine «On Seeds», «On Protection of Rights to Plant Varieties» were adopted
1995	Ukraine became a member of the International Union for the Protection of New Varieties of Plants (UPOV)
2002	The Law of Ukraine «On seeds and planting material» was adopted
2009-2020	Ukraine's accession to the OECD seed variety certification schemes: (1) grains; (2) corn and grain sorghum; (3) cruciferous, oilseeds, spinning crops; (4) sugar and fodder beet
2015, 2018, 2019	The next amendments to the Law of Ukraine «On Seeds and Planting Material» were adopted in terms of compliance with European and international provisions and standards

Source: Systematised by the authors

In recent years, in particular in 2015, 2018 and 2019, new amendments to the Law of Ukraine on Seeds and Planting Material [15] were adopted in terms of compliance with European and international provisions and standards. Therefore, it can be assumed that national seed production has legislative support that corresponds to world practice. National seed production includes four main components. The first component is selection and innovation; the second – state qualification examination; the third – seed production (reproduction) and the fourth component – varietal and seed control. Each component of national seed production is assigned to subjects, and their main purposes and tasks are defined. All components are organised and function under the management of the Ministry of Agrarian Policy and Food of Ukraine.

The efficiency of seed production is characterised by using the data of conditioned varietal seeds. Ukraine is one of the last countries with developed seed production. The level of certified conditioned seeds in Ukraine does not exceed 5-8%, while in Poland – 18%, Germany – 43%, the average in Europe – 50%, and in such advanced EU countries as the Netherlands, Sweden and Denmark the level of certification reaches 75-90%. It is impossible to determine the USA, as for the plain regions of the country the level of use of certified seeds is 10%, in the East – 50, and in the Pacific Northwest – 85%.

The current state of national seed production is characterised by the main indicators (Table 2). These include: the potential value of seeds, at the level of 53 billion UAH in Ukraine; seed turnover – 36-40 billion UAH; seed production – 2.3-2.5 million tons; seed production entities operating in the seed market – about 500 units; the number of operating seed plants – 47 units; the number of varieties and hybrids – about 9 thousand; primary seed production, which is performed only for four thousand varieties [6]. In this regard, the question arises: whether the State Register of Plant Varieties suitable for distribution in Ukraine registers the so-called stillborn varieties. As the indicator demonstrates, only 40% of the varieties and hybrids of plants registered in the state register are used, and the rest are displayed only for statistics.

The varieties of plants registered in the state register include 2542 grains, 2291 industrial, 2719 potato-vegetable-gourds and mushrooms, 563 fruit and berry crops and grapes (Table 3).

During the years of independence, there has been a rapid development of the varietal composition of seed production. In the period 1991-2020, the number of varietal resources increased almost 5 times, and for some crops, in particular corn – 22 times, sunflower – 45 times. Significant growth is observed in all other crops, except grapes, decorative, oilseeds and medical plants. The decrease in the last two positions is due to the annexation in 2014. Crimea, parts of Donetsk and Luhansk regions, where they were most represented.

The increase in the number of varietal resources by 5 times should be considered a positive phenomenon, but the average yield of crops during

this period increased by only 30-40%, which indicates the lack of a strong correlation between these indicators. In general, national seed production has the potential to compete with foreign producers.

Table 2. Main indicators of seed production development in Ukraine

Indicator	Value of the indicator
Potential value of seeds, billion UAH	52.8
Seed turnover in Ukraine, billion UAH	36.0
Production volume, million tons	2300-2500
Seed production entities, pcs.	496
Seed plants, pcs.	47
The number of varieties and hybrids, pcs.	8871
Primary seed production (management), pcs.	4069
Export, mln USD	13-17
Import, mln USD	500
Royalty paid, UAH mln	80-100
Potential royalty value, UAH million	3000.0
Potential value of selection payments, UAH million	900-1000

Source: Calculated by the authors

Table 3. Structure of species composition of varietal resources of Ukraine

Crop	1991			2020			2020 to 1991, times
	number varieties	ua breedings	%	number varieties	ua breedings	%	
Winter crop	80	53	66	863	534	62	10.8
Including wheat	40	32	80	468	338	72	11.7
Yara	189	121	64	1679	821	52	8.9
Including corn, without parental components	54	38	70	1176	549	47	21.8
barley	21	13	62	154	89	58	7.3
Oilseed and spinning	65	37	56	2044	648	32	31.4
Including sunflower, without parental components	17	7	41	769	203	26	45.2
Fodder	214	165	77	459	332	72	2.1
Technical	33	24	73	247	54	24	6.8
Potato	37	22	59	165	67	41	4.5
Vegetables, gourds, mushrooms	265	100	38	2554	671	26	in 9.6
Fruit and berries	370	199	54	512	433	85	in 1.4
Grape	93	34	37	51	49	96	in 0.5
Decorative, essential oil and medical	549	225	41	297	271	91	in 0.5
Total varieties	**1895**	**890**	**47**	**8871**	**3880**	**44**	**in 4.7**

Source: Calculated by the authors

Despite significant improvements in the domestic seed market, Ukraine is still far from other European countries in providing production crops with high-quality certified seeds of the highest categories and unlocking its potential export opportunities. It is an extremely alarming phenomenon, due to which domestic agriculture loses the most, reducing its competitiveness in the European and world markets. Therefore, the author believes that by only using high-quality certified seed

material Ukraine has a chance to compete in the global food market along with the countries of the European Union [8]. The seed production system in Ukraine includes the selection and propagation of seeds of domestic varieties, imported seeds of foreign varieties and their propagation, testing and registration of varieties, seed certification, etc. The system operates on a competitive foundation and in general, ensures constantly growing production of crops and satisfaction of the demand for their products. With the total need to provide the sown areas under production crops, 1.5-1.6 million tons of winter wheat seeds are required. If assuming that only two-thirds of the produced conditioned seeds will be sold, that is, about 92 thousand tons, this will be only 5.8% of the total demand. The average European sales of conditioned seeds reach 50%.

Most of the conditioned seeds of domestic selection are produced in Kharkiv (31.6 thousand tons), Dnipropetrovsk (11.8 thousand tons) and Odesa (7.7 thousand tons) regions, while foreign selection – in Ternopil (11.9 thousand tons), Khmelnytsky (8.8 thousand tons) and Kyiv (5.2 thousand tons) regions. Moreover, the Kyiv region receives the largest amount of certified foreign seeds from abroad – 0.9 thousand tons, of the total – 1.1 thousand tons, or 80.0%. Therewith, with using highly productive varieties of foreign breeding, it becomes urgent to intensify the development of domestic breeding and increase the production of own varieties in Ukraine, which will contribute to increasing the level of food security [20]. The situation is characterised by the production of certified conditioned seeds, which include: supplementary, basic and certified seeds (Table 4).

Table 4. Production of conditioned seeds of main crops in Ukraine in 2020 (additional, basic and certified)

Crop	Seeds of Ukrainian selection, thousand tons	Seeds of foreign selection, thousand tons		Seeds of foreign selection, thousand tons	Total seed production, thousand tons	Seeds of Ukrainian breeding, %
		imported to Ukraine	produced in Ukraine			
Winter wheat	93.6	1.1	46.7	47.8	141.4	66.2
Spring barley	19.3	0.2	13.9	14.1	33.4	57.8
Winter barley	10.5	0.3	10.5	10.8	21.3	**49.3**
Corn	32.2	24.4	54.4	78.8	111.0	**29.0**
Winter rye	1.0	0.4	4.9	5.3	6.3	**15.7**
Total grains	**156.6**	26.4	130.4	**156.8**	313.4	**50.0**
Soybean	2.3	0.4	18.7	19.1	21.4	**10.7**
Winter rape	0.5	3.9	0.2	4.1	4.6	**10.2**
Sunflower	3.4	31.3	11.4	42.7	46.1	**7.4**
Total oilseeds	**6.2**	35.6	30.3	**65.9**	72.1	**8.6**
Total grains and oilseeds	162.8	62.0	160.7	222.7	385.5	**42.2**
Potato	0.1	2.1	23.2	25.3	25.4	**0.5**

Source: Calculated by the authors based on the data of the State Statistics Service and the Customs Service of Ukraine [21, 22]

According to the Register of Certificates for Sowing and Commercial Quality of Seeds, 156 thousand tons of grain seeds of Ukrainian selection were produced in 2020. In addition, seeds of foreign selection of grain crops were imported and received in Ukraine in the same amount, that is, the ratio is 1:1. The situation with oilseeds, which include soybeans, sunflower, and winter rape, is more complicated, as the seeds of Ukrainian selection were produced only 6.2 thousand tons, while foreign selection – 65.9 thousand tons, or 90% of the total.

In total, in 2020, 162.8 thousand tons of conditioned seeds of main grains and oilseeds of Ukrainian selection were produced, or 42.2% of the total certified seeds. Seeds of foreign selection in the amount of 62.0 thousand tons were imported from outside Ukraine, and another 160.7 thousand tons of such seeds were produced and certified in Ukraine. The total amount of conditioned seeds of foreign selection reaches 222.7 thousand tons or 57.8%.

Although grain crops prevail in the structure of seed crops, the export of their seeds is only 20-26 thousand tons per year. Therewith, the volume of seeds of foreign selection produced in Ukraine has already reached 130 thousand tons, which is 6 times more than its export. All these seeds, getting to the market, develop the varietal seed supply of Ukraine. Seeds of potatoes and sugar beet of domestic selection are mostly compensated by seeds of foreign varieties.

High annual grain production in Ukraine at the level of 75-80 million tons is possible only by increasing the yield of major grain crops. The further harmonious development of the breeding and seed production sectors, where one of the main tasks of the latter is to bring domestic seed products to the level of world standards, increase their competitiveness and the widest possible implementation in Ukraine and abroad, is considered an essential component in ensuring productivity increase. The level of provision of agricultural production with products of domestic selection is insufficient (Fig. 1). Only seeds of buckwheat, millet, oats and triticale of Ukrainian selection are 100% used in agriculture.

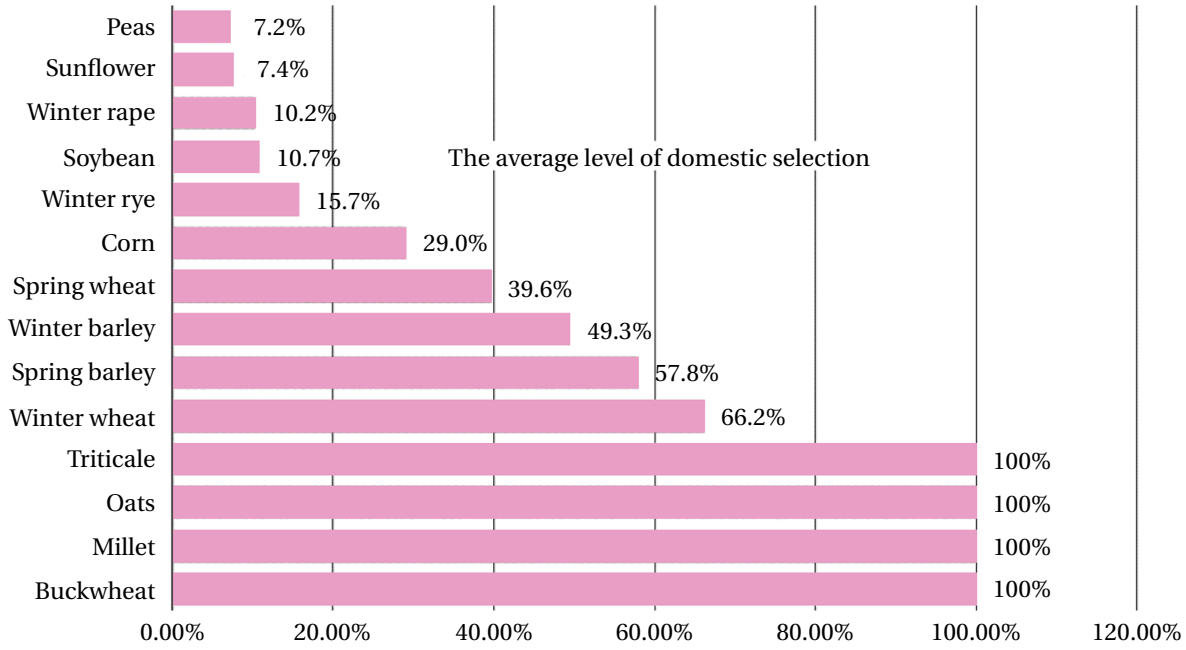

Figure 1. Level of domestic breeding in the production of conditioned seeds of major crops
Source: Calculated by the authors based on the data of the State Statistics Service and the Customs Service of Ukraine [21, 22]

Regarding other crops, the situation is as follows: winter wheat – 66%, spring barley – 58%, and for winter barley, spring wheat, winter rye, corn, soybeans, sunflower, and peas, the share of domestic varieties is below 50%.

The average level of provision of production with varieties of domestic selection for grains and oilseeds is about 40%. During 2005-2020, imports of seeds of grains and oilseeds only increased. Therewith, the prices of 1 ton of corn, sunflower, wheat and soybeans increased. That is when in 2005 wheat seeds could be purchased for 333 USD/t. USD/t, then in 2020 the price rose to 1562 USD/t or 4 times. USD/t, or 4.7 times. Soybeans in 2006 cost 1000 USD/t, then in 2020 – 1771 USD/t.

Therewith, prices for hybrid corn and sunflower increased even more significantly. In 2005, a ton of hybrid corn cost 2192 USD, in 2020 – already 4496

USD, or 2.1 times more expensive. If in 2005 hybrid sunflower could be bought for 6161 USD/t, then in 2020 – 10703 USD/t, or 1.7 times more expensive.

The increase in the cost of imports is due to the increase in prices for imported seeds, which are already several times higher than domestic selection. Thus, Ukrainian farmers annually sell 70-75 thousand tons of hybrid seeds of foreign corn, 27-30 thousand tons of sunflower, 5-7 thousand tons of rapeseed and 0.6-0.7 thousand tons of sugar beet. Among the main reasons for the demand for hybrids of foreign selection in comparison with domestic ones are the following: higher yield, higher quality of seeds of the EU and the USA compared to domestic seeds, trust in foreign seeds due to the presence of counterfeit in the domestic market, high brand, a brand of goods of breeding companies of the EU and the USA.

Seeds worth 400-500 million USD are imported to Ukraine annually, and the production of conditioned seeds of foreign selection, financed by foreign companies, is performed within the state for almost the same amount – about 500 million USD. It may eventually result in the complete displacement of domestic varietal resources from the market of seeds and planting material and even threaten the food security of Ukraine. Imports of seed corn in 2020 increased 4 times compared to 2005, wheat – 6 times, and sunflower – 11.4 times. Import of soybean, rapeseed, sugar beet and vegetable seeds to Ukraine is growing.

Over the past 15 years, the dynamics of imports of seeds of foreign selection, despite the instability of annual volumes, maintains a general upward trend. It is evidenced by the imports of corn and sunflower seeds (Fig. 2), and wheat and soybeans (Fig. 3).

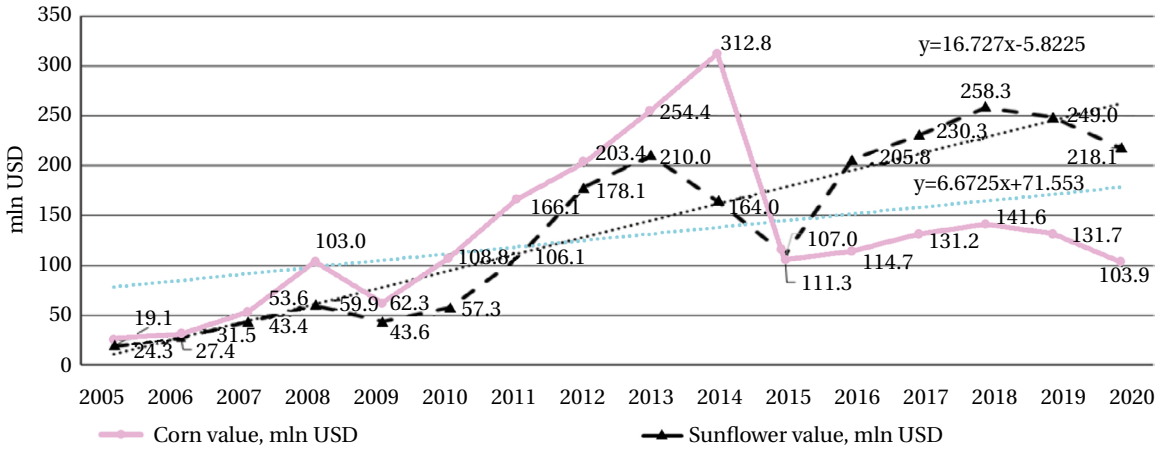

Figure 2. Dynamics of corn and sunflower seed imports to Ukraine in 2005-2020, USD mln

Source: Calculated by the authors based on the data of the State Statistics Service and the Customs Service of Ukraine [21, 22]

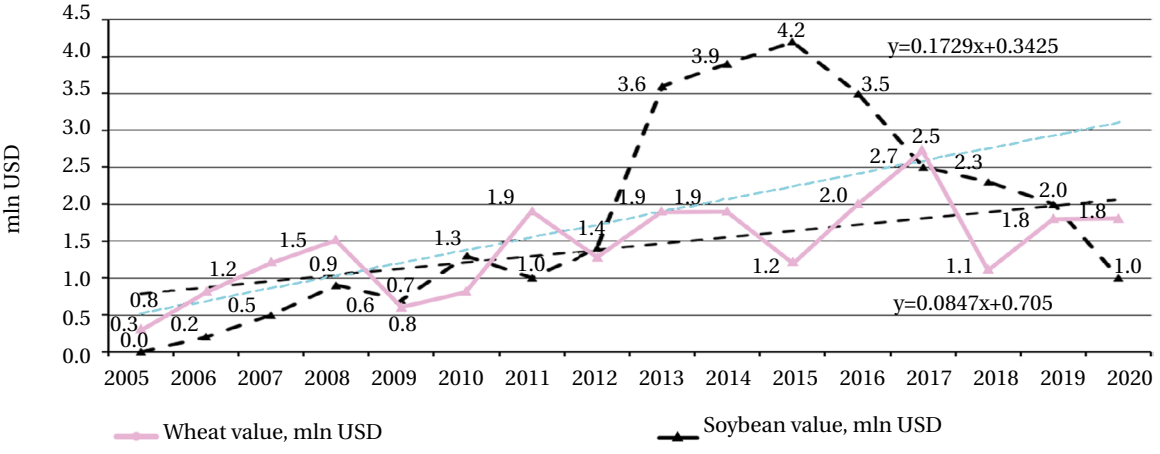

Figure 3. Dynamics of wheat and soybean seed imports to Ukraine, 2005-2020, USD mln

Source: Calculated by the authors based on the data of the State Statistics Service and the Customs Service of Ukraine [21, 22]

In 2020, only sunflower was imported at 218 mln USD. USD, corn –104, wheat – 1.8, soybeans – by 1.0 million USD. USD. If the linear trend of imports of these crops, based on the data of the last 15 years, continues in the future, it should be expected that in the future the cost of imported sunflower, rapeseed and corn seeds will only increase. Such growth will occur for wheat, soybeans, sugar beets and other crops, although at a slightly slower pace. A significant contribution to the provision of agriculture with domestic seeds is provided by research farms of the NAAS network (Fig. 4). The volume of seed sales has been slightly decreasing in recent years. The share of sales in recent years ranged from 55 to 60%, although in previous periods it reached 75% and more (Fig. 4).

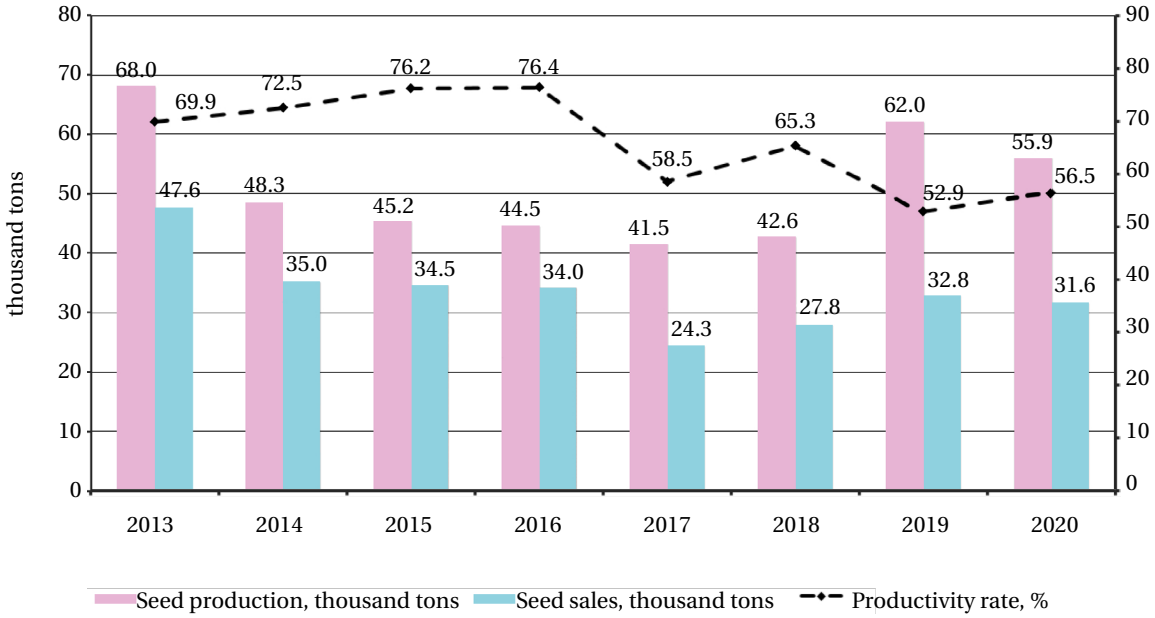

Figure 4. Production volumes of grain seeds in the research farms of the NAAS network in 2013-2020 thousand tons

Source: Estimated by the authors according to NAAS data

The production of conditioned seeds of major grains and oilseeds by scientific institutions, research stations and state enterprises of research farms of NAAS in 2020 amounted to about 45.9 thousand tons (additional, basic and certified). 31.6 thousand tons or 68.8% of all produced conditioned seeds were sold. Over the past eight years, there has been a decrease in both production and sales of licensed seeds. If in 2013 NAAS sold almost 50 thousand tons of it, in 2020 – only 30 thousand tons. The number of license agreements concluded by NAAS institutions is decreasing, but the payment of royalties on them is increasing (Fig. 5).

The amount of total royalties paid in Ukraine is UAH 80-100 million, although it could potentially be up to UAH 3 billion. Thus, only 1/30 of the royalty potential is used, and breeding payments, the value of which could reach about UAH 900 million, are not made at all. These funds could serve the development of the seed industry and breeding. Therefore, the implementation of measures to fully use the mechanisms of royalty and breeding payments will largely solve the problems of domestic seed production [7].

The recognition by the European Parliament of Ukraine's seed certification system as equivalent to EU requirements last year allowed Ukraine to export seeds to EU countries such as Germany, Romania, Poland, France and Hungary in small batches as early as 2021. Ukrainian seeds gained access to the European Union market – one of the most attractive and the most protected from foreign seeds markets in the world. Seeds that will be produced on the territory of Ukrainet – both domestic selection and selection of foreign seed companies operating in Ukrainet – will be sold.

The tendency to increase the import of seed material in Ukraine since 2015 has continued this year and is the result of a rapid increase in demand due to the increase in its consumption by holding

companies and large and medium-sized producers. In addition, quarantine restrictions and the reduction of logistics operations in 2020-2021 gave impetus to the development of foreign breeding companies within the country to provide agricultural producers with products.

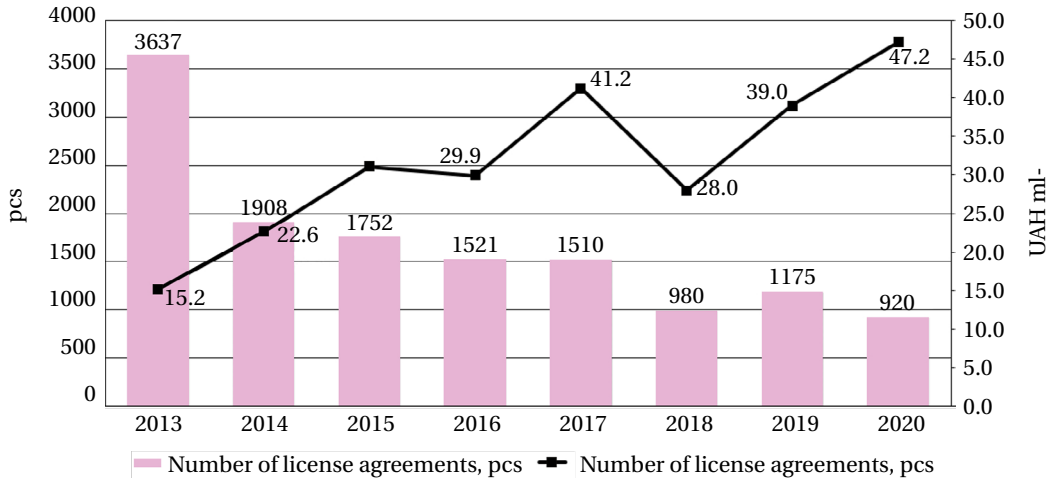

Figure 5. Commercialisation of scientific and knowledge-intensive products of research institutions of the NAAS, 2013-2020

Source: Estimated by the authors according to NAAS data

The development of national seed production in the future will depend, first of all, on the organisation of the system of collection of breeding payments, which should be developed considering the world experience. An example is the system of collection of selection payments in such leading countries as France, Germany and Canada. Thus, the system of selection payments in France is focused on the indicators of sales of commercial grain by farmers. The amount of selection payments here is determined by the product of the farmer's sales volume of commercial grain and 0.7 euros for each ton sold. The amount of breeding payments determined in this way is transferred to the private breeding organisation **GNIS**, which controls the quality of varieties. There, this amount is distributed to the **SICASOV** organisation, which controls the payment of royalties and, accordingly, breeding payments, where these funds are used for the requirements of the breeder. That is, from each ton of grain sold, 0.7 euros are allocated for the development of breeding and innovative research [23].

The German royalty system is more in line with the European model. Here, a license fee is taken for certified seeds, that is, a royalty of 15 euros/t is paid, and this is almost 50% of the area sown with certified seeds. In Germany, only due to this approach, 47 million euros of license fees (royalties) are collected. Therewith, for the remaining 50% of crops, selection payments are performed for non-certified seeds, in which the selection fee is paid for each variety for 4.4 euros/ha of crops. Thus, an additional 14-15 million euros [24; 25, p. 5-12].

In Canada, there is a mechanism of selection fees similar to the French one. The program of commodity deductions for 1 ton of sold commercial grain provides for payment of 1 Canadian dollar. For information, the Canadian dollar is lower in value than the US dollar, its converted value into Ukrainian currency is about 20 UAH [26].

If this Canadian mechanism was introduced in Ukraine, which annually sells 50-60 million tons of grain, then at a rate of 20 UAH per 1 ton, 1.0-1.2 billion UAH would be allocated for the development of national breeding. Such funds would allow the development of a modern material and technical base for breeding and a system of royalties for breeders.

The system of breeder liability in Poland is quite interesting and, in principle, simplified. It considers that there are certified seeds for their requirements (farmer's seeds). If certified seeds are not subject to breeding payments and are free of charge, then seeds for their requirements are divided into two types: by protected plants (except potatoes) and by protected potato species (PL/UE level). Thus, if a Polish farmer does not bear royalty obligations, he pays breeding payments when the size of his sowing

area exceeds 25 hectares for all grain crops, and for potatoes – more than 10 hectares [27, 28].

The legislative and regulatory framework for the payment of royalties in Ukraine is based on the following international and national regulations: UPOV Convention [29], the Law "On Protection of Rights to Plant Varieties" [16], the Law "On Seeds and Planting Material" [15], the Resolution of the Cabinet of Ministers of Ukraine "On Measures for Implementation of the Law of Ukraine "On Protection of Rights to Plant Varieties" [30], the Resolution of the Cabinet of Ministers "On Approval of the Procedure for Maintaining the State Register of Seed and Nursery Subjects" No. 882 [1].

In each region, there is an attestation commission of the Ministry of Agrarian Policy and regional commissions, certification of producers on royalties paid, that is, license and labour agreements are concluded, and verification of compliance with certification requirements is performed. According to the assessments, the legal and regulatory framework for royalty payments in Ukraine is sufficient but can be improved. For this purpose, a document on amendments to the Resolution of the Cabinet of Ministers of Ukraine No. 1183 [30] was prepared, which more clearly defines the property rights of the authors of the variety in terms of breeding payments.

The volumes of royalty and breeding payments in Ukraine and EU countries are quite different. For example, compare France, Germany and Ukraine, which are close both in terms of area and crops. The amount of royalties and breeding fees paid in France is 125 million euros, in Germany – 65, while in Ukraine – only 3 million euros. Thus, if compared with the best practices, royalties and breeding payments in Ukraine are practically non-existent, and ten times less money is paid for the protection of intellectual property. The calculation of the amount of license and breeding payments in Ukraine is as follows: royalties are paid for UAH 100 million from the area of 350 thousand hectares. If selection payments in Ukraine were paid for the entire area of crops, which is about 9 million hectares, and at a rate of approximately 3 euros or more, the amount to support selection could reach 900 million UAH.

If the Canadian or French model of collecting breeding payments (per ton of marketable grain), or Polish or German (per 1 ha of marketable crops) is used as a foundation, in all cases, the budget of domestic breeders and breeding institutions could be replenished by almost 1 billion UAH. Therewith, full protection of intellectual property should be provided for each variety.

Despite this, there is a requirement to improve the mechanism of obtaining license payments based on the real reflection of using the cost of seeds and planting material, applying for a license and sublicense agreements, and breeding payments for Farm Saved Seed – seeds for own requirements, and their registration by an independent accounting, supervision and control body.

To this end, first of all, it is necessary to resolve the issue of introducing mandatory declaration of varietal production crops by agricultural producers who own agricultural land of 25 hectares or more, increasing the role of professional public organisations of Ukraine in terms of registration of license agreements and royalties, and control, registration and maintenance of the database of seed and commercial crops by varieties and hybrids.

These changes can increase revenues through the payment of licensing and breeding fees for the production of new highly productive and high-quality varieties of domestic breeding in a civilized, transparent, state-regulated market circulation of seeds and planting material and the protection of intellectual property rights of breeders and breeding institutions.

Recent amendments to the Laws of Ukraine "On Seeds and Planting Material" [15] and "On Protection of Rights to Plant Varieties" [16], which passed the first reading in the Verkhovna Rada of Ukraine, somewhat simplify the overregulation of the seed production system in terms of state registration. Therewith, in the current version, they place the national breeding in unequal conditions regarding the state qualification examination, practically exempting the registration of foreign varieties without testing in Ukraine (Article 27 part 3 paragraph b). But the proposals of NAAS were not considered in the modified form of amendments in the first reading to the laws of Ukraine "On Protection of Rights to Plant Varieties" [16] and "On Seeds and Planting Material" [15] in 2021. The law mentioned first in the text contains several fundamental contradictions and without their elimination, in the author's opinion, its action will be ineffective (Table 5).

Table 5. The main contradictions of the Law "On Protection of Plant Variety Rights", were not considered in the first reading

Provisions of the law	Proposed NAAS revision	Commentary
Consider the results of qualification examination studies conducted by the Competent Authority of any other State Party	To consider the results of qualification examination studies on distinctiveness, homogeneity and stability performed by the Competent Authority of any other Member State	It should be considered that the International Convention on the Protection of New Varieties of Plants provides for the possibility of considering only the results of the examination of the variety for distinctiveness, uniformity and stability, conducted by the Competent Authority member of the international union UPOV
To consider as the results of the various examination for one year the data of the pre-registration variety study, if such pre-registration variety study was performed by the expert institution or the applicant under the control of the expert institution Disagree, please state in the revision	Consider as the results of the various examination for one year of the data before the registration variety study, if such a pre-registration variety study was conducted by an expert institution	The examination should be conducted for at least two years in one place of research in the same conditions. It is impossible to compare the results of the examination (yield, productivity, product quality) if the conditions of the research have changed. Such studies cannot be statistically processed
The information database has the status of an official publication and an official source of information on plant variety applications and information on their legal status	To leave unchanged in the previous version	The database of plant varieties is a huge array of data, and part of the information (breeding scheme) is confidential, all information about applications is not obligatory for public disclosure
Importation to Ukraine of samples of varieties intended for qualification examination shall be performed based on the notification of the Competent Authority on acceptance of the application for consideration, importation of research samples of the variety for qualification examination	To leave unchanged in the previous version	Samples are imported for a qualification examination, and storage of the official sample - must be considered in the title of the notification. The question arises: are these two forms of notifications or one?
Varieties of vegetable crops, applications for which have been submitted to the Competent Authority for state registration of the variety, may be distributed for exhibition in Ukraine until the decision on state registration of such varieties is adopted according to the procedure determined by the Cabinet of Ministers of Ukraine	To leave unchanged in the previous version	Corruption scheme of importing unregistered varieties from abroad. Why such privileges to varieties of vegetable crops? Contradicts the provisions of international and European legislation. What is the control over seeds imported for exhibition purposes?

Source: Authors' development

In addition, the Government Resolution "On Amendments to the Resolution of the Cabinet of Ministers of Ukraine No. 1183 dated August 19, 2002" [28] in the part of "conditions for observance of the legitimate interests of the patent holder", which may resolve the issue of collection of breeding payments for seeds for own requirements.

The world market of grains and oilseeds is oversaturated. This is especially true for the European market, where there is fierce competition between leading seed producers and breeding institutions. Only the country whose breeding science and seed companies provide the highest quality seeds can survive in such a struggle and emerge victorious. Without the intensification of breeding activities, it is impossible to compete for the best quality seeds [30].

All developed countries finance fundamental research from the budget as the most expensive. Private breeding institutions enter the competition to improve discovery, usually only after a fundamental discovery has been made. It is particularly typical for the process of breeding hybrids. According to the laws of most Western countries, only the first breeder of a new variety (hybrid) of seeds has the right to reproduce and sell it. The processes in breeding are extremely intensified. Sufficient state funding, protection of rights to varieties, royalties (payment for using the intellectual property for new varieties),

their use provides high protection to the Western breeder in the competition, allows actively conducting research. Therewith, competitors get the opportunity to use the results of previous studies in their research. The expectation of the possibility of monopoly profits extremely accelerates the supply of more and more new varieties and hybrids to the market.

If Ukraine fails to apply a similar system shortly, it may result in a loss of priorities, a chronic backlog of the breeding industry and dominance of foreign varieties. Under conditions of lack of budget funding, a radical measure to support and protect the interests of breeding centres and breeders in Ukraine should be the introduction of a system of royalty and breeding payments. The lack of appropriate market conditions of legal regulation of relations related to new plant varieties adversely affects the efficiency of domestic breeding, reduces the supply of quality and high-yielding seeds of new varieties and hybrids on the market, and ultimately hinders the efficiency of the development of the crop industry and agriculture in general.

Therewith, state support for domestic breeding is constantly decreasing, which adversely affects the efficiency of domestic seed production. Such a situation may minimise the presence of domestic varietal resources in the market of seeds and planting material, which will pose a threat to the food security of Ukraine.

Conclusions

The research results demonstrate that it is extremely important for the successful balanced development of seed production in Ukraine:

– to improve the legal provisions and aspects of royalty payment in Ukraine, considering the experience of their use in the EU and other leading countries of the world;

– to introduce mandatory declaration of varietal production crops by agricultural producers who own agricultural land of 25 hectares or more (for potatoes – 10 hectares or more);

– develop a clear mechanism for receiving license payments based on the real reflection of using the cost of seeds and planting material, using license and sublicense agreements, and breeding payments for Farm Saved Seed – seeds for own requirements, and their registration by an independent accounting, supervision, and control body;

– to increase the role of professional public organisations of Ukraine in terms of registration of license agreements and royalty payments, and control, registration, and introduction of seed and commercial crops database by varieties and hybrids;

– to increase revenues through the payment of licensing and breeding fees for the production of new highly productive and high-quality varieties of national selection; to provide for confirmation of royalties and/or FSS payments as a condition of state support for reimbursement of the cost of seeds/planting material of national selection;

– to outline and implement state protectionist measures to protect the domestic seed market from foreign expansion;

– introduce state support for Ukrainian seed production and breeding in the domestic market through breeding and seed programmes;

– to identify further ways to improve the quality of Ukrainian seeds, particularly hybrid seeds, where domestic selection is noticeably losing in comparison with foreign ones;

– to develop and implement mechanisms to combat seed counterfeiting in the domestic market;

– to develop a state program for the development of domestic breeding and seed production.

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Наукове забезпечення організації державного регулювання розвитку насінництва в Україні

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► **Анотація.** За останні роки в Україні спостерігається стрімке зростання аграрного бізнесу, який є ключовою галуззю української економіки. Аграрії добре розуміють, що для зниження виробничих затрат у рослинництві, поліпшення якості продукції, підвищення її прибутковості надзвичайно важливим є застосування якісного насіннєвого матеріалу. Мета статті – на основі результатів аналізу стану галузі насінництва країни та наукового забезпечення організації державного регулювання розвитку насінництва в Україні обґрунтувати пропозиції щодо його поліпшення, використовуючи досвід передових країн. Обґрунтувати заходи, спрямовані на удосконалення системи вітчизняного законодавства у галузі насінництва, виплати селекційних та ліцензійних платежів і пропозиції щодо зменшення залежності аграрного виробництва від імпорту насіння. Використано методи: монографічний (аналіз стану наукового забезпечення організації державного регулювання розвитку насінництва в країні); статистичний (для відображення стану вітчизняного насінництва у кількісному і вартісному виразі через систему абсолютних і відносних показників); аналізу рядів динаміки, структурних зрушень (для аналізу й виявлення тенденцій показників розвитку насінництва в Україні); табличний та графічний (наочне відображення результатів дослідження у вигляді таблиць та графіків), порівняння (зіставлення економічних показників); абстрактно-логічний (узагальнення та формулювання висновків). Проаналізовано сучасний стан і перспективи наукового забезпечення організації державного регулювання розвитку насінництва в Україні. Визначено проблеми розвитку вітчизняного насінництва. Висвітлено досвід провідних країн у галузі насінництва та можливість його використання в Україні. Узагальнено існуючий стан організації державного регулювання розвитку насінництва в Україні. Розроблено пропозиції щодо покращення його наукового забезпечення. Запропоновано нові науково обґрунтовані підходи до удосконалення системи ліцензійних платежів, нормативної бази та визначено шляхи зменшення імпортозалежності стосовно насіння. Запропоновані шляхи подолання існуючих в галузі проблем дозволять підняти її до рівня світових держав через зміну підходів до виплат роялті, збільшення продуктивності насінництва та удосконалення правових актів, що регулюють виробництво насіння в Україні

► **Ключові слова:** селекція, роялті, державне регулювання, сорт рослин, насіння і садивний матеріал, ринок, імпорт, експорт