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Efficiency of seed production in the context of development of the southern region of Ukraine

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Abstract. The article presents the results of the analysis of the need to establish and operate the Center for the production of basic and certified seeds of new varieties of basic cereals in conditions of natural and artificial moisture on the basis of the Training-Scientific-Practical Center of MNAU. The implementation of the project will promote the development of domestic seed production, providing agricultural producers with high-quality sowing material of new varieties, as well as improving the quality of education during the training of specialists in agronomy

Keywords: seed production, grain crops, varieties, irrigation, economic efficiency, project

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INTRODUCTION

The southern region, with significant areas of fertile black soils, remains in last place in terms of yield of wheat and barley – the main cereals. Thus, according to the State Statistics of Ukraine in 2020, the average yield of wheat grain in Mykolayiv region was 2.70 t/ha, barley – 2.75 t/ha, while in Vinnytsia – 4.26 and 3.91 t/ha ; Kyiv – 4.28 and 3.79 t/ha; Poltava – 4.48 and 3.60 t/ha; Kharkiv – 5.05 and 4.02 t/ha;

Sumy – 5.23 and 4.15 t/ha, respectively [1]. The main reason for this is the lack of attention to seed development. At the same time, one of the most effective methods of increasing yields, resistance to abiotic and biotic environmental factors and increasing the production of high quality grain of major cereals in climate change is the selection of varieties and irrigation, which is especially needed in the Southern Steppe [2-5]. Timely variety replacement and renewal allows to ensure yield growth from 0.2 to 1.0 t/ha [6].

In addition, the maximum realization of the genetic potential of the variety is possible with strict compliance with the technological requirements of its cultivation. Productive varieties and conditioned seeds of cereals are one of the key and indispensable factors influencing the intensification and expansion of the grain production process. Achievements in breeding cannot be realized without well-established seed production, the main role of which is the accelerated reproduction of varietal seeds, introduction into production of new varieties, preservation of their valuable traits and properties and genetic identity [7, 8].

Therefore, a diverse study of the adaptive characteristics of new plant varieties and their seed propagation is the basis for increasing production, improving the quality of crop products, its competitiveness in domestic and foreign markets. However, the presence in the production of seeds in the southern region of more than 140 varieties of cereals leads to complications in seed production and is a consequence of improper implementation of special and mandatory measures [7, 9]. It is the post-registration study of varieties at the regional level that will help producers of seed material and commercial grain to choose the most adapted to different agri-environmental conditions varieties and receive scientific and methodological support on the technology of growing seeds of studied varieties. This is the close cooperation of all parties interested in the selection, use of varieties and processing of their own seeds [10-12].

The Law of Ukraine "On Higher Education" provides ensuring an organic combination in the educational process of educational, scientific and innovative activities, the main task of which is to acquire knowledge through research and development and their focus on creating and implementing new competitive technologies, innovative development of society and training of specialists of innovative type. Therefore, the urgent direction is the study and implementation of the most effective innovative methods of training in the agricultural sector [13, 14].

Selection and reproduction of the highly productive grades of the grain crops adapted to conditions of the southern zone, their reproduction and creation of modern seed plant on production and finishing of seeds of modern grades of wheat and barley of winter and spring forms on the basis of the Mykolayiv NAU will completely provide commodity producers. highly qualified personnel in the field of seed production and varietal science.

Analysis of recent research and publications

Polish researcher E. Gatsek and domestic scientists E. Radomska and N. Jakubenko [15] analyzed the post-registration study of plant varieties in the Republic of Poland and substantiated further prospects for its effective implementation in Ukraine.

O.V. Zakharchuk [16] developed scientifically sound proposals for the formation of a full-fledged market of plant varieties and improve the varietal and seed supply of the crop industry of agricultural enterprises.

A group of scientists from the Institute of Plant Breeding. V. Yuriev NAAS of Ukraine proved that the introduction of innovative breeding developments will increase the special fund for the development of science, seed and grain industries, and the rational use of existing scientific potential, material and technical base will give impetus to commercialization of

research, their effective introduction in domestic and foreign markets [17].

According to research by G. Chugriy et al. [18] identified the most adaptable to the conditions of the Northern Steppe of Ukraine varieties of winter wheat from different breeding centers of Ukraine. It was found that only the complex adaptive ability of the variety to resist negative factors in the critical phases of crop development helps to ensure the formation of high indicators of yield structure.

R. Lonescu et al. [19] proposed a new model of management decision, which is based on the principles of sustainable economics and offers managers the opportunity to make smart decisions in socio-economic conditions caused by climate change and the global health crisis.

Paying tribute to the scientific and practical significance of the works of these authors on the seed production of a new generation of varieties of cereals in Ukraine and abroad, a number of issues are still insufficiently studied.

An extremely effective measure to promote and implement the achievements of science in production is the formation of scientific and technological landfills of modern varieties of innovation, adapted to environmental conditions, and modern varietal technologies for the production of high quality seeds. In this regard, the development of technology for growing seeds of major cereals (soft winter wheat, winter barley and spring barley), which will be based on improved basic technological (sowing dates and seeding rates) and agri-environmental, ecological plasticity of the variety, foliar nutrition, growth stimulants, etc.) elements are of regional importance.

The aim of the article is to solve the scientific problem of seed production in the main area of grain production – the southern region, improving the system of agricultural education, in particular in training specialists in "Seed Production", which consists in research and development and their focus on creating and implementing new competitive technologies for growing seed material of cereals and the introduction of the most effective innovative methods of teaching disciplines "Breeding and Seed Production", "Seed Science" on the basis of the Mykolaiv National Agrarian University (MNAU).

TASKS AND METHODS OF RESEARCH

To achieve this goal it is necessary to analyze the need to establish and operate a Center for the production of basic and certified seeds of new varieties of basic cereals in natural and artificial humidification of southern Ukraine on the basis of the Training and Research Center of MNAU with the participation of research institutions of the National Academy of Agrarian Sciences of Ukraine, industrial enterprises of Ukraine, members of the Training-Research-Production Consortium (TRPC) "Southern", the Southern

Interregional Research Center of NAAS and providing quality seeds to agricultural producers. Such integration of science, education and production will help improve the quality of education in the training of specialists in "Seed Production" in "Agronomy", providing producers with high quality seeds of new varieties recommended for distribution in the Southern region and providing them with scientific and practical recommendations on new seed technologies. .

RESEARCH RESULTS

Mykolayiv National Agrarian University, with 400 hectares of modern irrigation using the latest Zimmatic sprinklers, has created stable conditions for growing cereal seeds and a scientific basis for studying the adaptive characteristics of promising varieties for irrigated lands.

To ensure the work of the Center for Seed Production of the newest domestic varieties of grain crops in the conditions of natural and artificial moisture in the South of Ukraine, Mykolayiv NAU has created the appropriate scientific infrastructure: Research and Training Consortium "South" institutions of higher education and 22 industrial enterprises of Ukraine; Southern Interregional Research Center of NAAS, consisting of 6 institutions of higher education, 8 research institutions and 6 research farms of the southern region and Science Park "Agroperspective".

Long-term cooperation of the university with breeding centers of Ukraine, growing demand among farmers for quality seeds will ensure the success of the project to establish a Center for Seed Production and Circulation of the latest domestic varieties of cereals in natural and artificial moisture in southern Ukraine.

Since 2014, the University has been carrying out tests on more than 200 varieties of cereals of all breeding centers of Ukraine and foreign originators, holding international and all Ukrainian Field Days with the obligatory invitation of agricultural producers in the region. According to the results of research, the Catalog of Varieties is published annually. Recommended varieties with high productivity potential will be fully realized when grown under artificial and natural moisture in the southern region.

Preparatory work on the purchase and commissioning of a mobile universal cleaning machine SSC 60/10 based on Petcus P-12 for presowing preparation of cereal seeds. The specified equipment has high manufacturability:

- represented by a well-known German brand (high quality and reliability);
- the sorting machine allows to receive seeds of high quality (DSTU 2240-93);
- integrated pickling machine in the equipment;
- high productivity of the equipment – 25 t/h. primary seed cleaning and 6 t/h. finishing cleaning;
- mobility (equipment mounted on a cargo trailer);
- equipment does not require design work, permits, fixed connection to communications.

All this will contribute to the creation of the Center for Seed Production of the newest domestic regional varieties of grain crops in natural and artificial moisture in southern Ukraine, which aims to create an innovative environment and conditions for intensifying innovation processes in agricultural production under irrigation and natural moisture, growing new varieties of cereals such lands and their rapid promotion to agricultural producers, the spread and improvement of innovative technologies in the agricultural sector of the Southern region.

The overall goal of the project is to develop innovation infrastructure, create a favorable innovation environment, conditions for intensifying innovation processes, rapid promotion of new breeding achievements in production, modernization of the agricultural sector through the introduction of new advanced seed production technologies in artificial and natural moisture, increase production, sowing material of modern varieties of grain crops adapted to cultivation in the conditions of climate change to meet the needs of the region, which fully meets the objectives of the State Development Strategy of Mykolaiv region for the period up to 2027 from 23.12.2020 by the decision of Mykolaiv regional council № 2.

Much attention in the activities of the Center will be paid to information and advisory support of the created innovation. The results of post-registration testing of newly registered varieties of soft winter wheat, winter barley and spring barley, which differ in ecological and genetic origin, will be of great scientific importance; establishing the regularity of improving their sowing qualities and yield properties of seeds by optimizing the sowing period, seeding rate and nutrients.

As a result of this project, new experimental data will be obtained, which will significantly increase grain yield, quality seed yield and profitability compared to conventional technologies, as well as provide farmers in the Southern region with high quality seeds of newly registered varieties for varieties and quantities.

The main activities of the project are the creation of the Innovation Landfill – a base for research to study the adaptive characteristics of cereals and testing of new varieties of breeding centers, establishing demonstration sites, development and implementation of innovative technologies for seed propagation under irrigation and natural hydration.

1. The list of expected results of the project includes:

2. Creation on the basis of Mykolayiv NAU Innovative landfill for production and circulation of seeds of modern varieties of grain crops for irrigated and non-irrigated lands of the South of Ukraine.

3. Development and implementation of innovative technology for propagation of seeds of winter and spring cereals in the conditions of artificial and natural humidification of the South of Ukraine.

4. Holding Field Days and scientific-practical conferences, publishing scientific-practical materials, Catalog of grain varieties recommended for the conditions of the Southern Steppe of Ukraine, providing recommendations to agricultural producers.

5. Commissioning of an innovative line for finishing seeds of newly registered varieties of grain crops to

high sowing conditions in the research and production department of the University.

6. Development of recommendations on the system of nutrition protection of seed crops of wheat and barley of winter forms and spring barley.

7. Preparation of practical recommendations and standards for the use of mobile universal cleaning machine SSC 60/10.

8. Development of economic and mathematical model of the transition from conventional commodity farming to seed production with specialization in seed propagation of new varieties of cereals; publication of research results in scientific journals.

The target groups of the project are agricultural producers of the South of Ukraine, research institutions of NAAS, breeding centers of Ukraine, members of TRPC "Southern", members of the Southern Interregional Research Center of NAAS, producers of agrochemicals and biologicals of agricultural machinery, Science Park "AgroUspective". The territory covered by the project results is Mykolayiv, Kherson and Odesa oblasts.

The total estimated cost of the project for three years of implementation is UAH 14,131.4 thousand. The main source of project funding is UAH 12,000.0 thousand – state budget funds received from the European Union, additional source of funding UAH 2,131.4 thousand – funds of the Mykolayiv National Agrarian University (Table 1).

Table 1. *Economic efficiency of the project on creation of the center of seed-growing of the newest domestic regionalized grades of grain crops*

Indexes	2021 p.	2022 p.	2023 p.	Together
1	2	3	4	5
Operational activity				
Area of winter wheat sowing, ha	200.0	200.0	200.0	X
winter barley, ha	77.0	77.0	77.0	X
Yield of winter wheat, t/ha		10.0	10.0	X
winter barley, ha		8.5	8.5	X
Gross harvest of winter wheat, t		2000,0	2000,0	4000,0
Gross harvest of winter barley, t		654.5	654.5	1309,0
Produced seeds of winter wheat, t (85%)		1700,0	1700,0	3400,0
Produced seeds of winter barley, t (85%)		556.3	556.3	1112,7
Used own seed material of winter wheat, t		45.0	0.0	
Used own seed material of winter barley, t		15.4	0.0	
Yield of grain waste, t (13% of total gross harvest)		345.1	345.1	690.2
Additional grain of entrepreneurs to be cleaned and calibrated, t		1000,0	1100,0	2100,0
Cost of winter wheat seeds (elite) for sale, thousand UAH/t (20% VAT)		10.0	10.5	X
Cost of winter barley seeds (elite) for sale, thousand UAH/t (20% VAT)		9.8	10.0	X
Cost of grain waste of wheat and barley, thousand UAH/t		3.0	3.2	X
The cost of providing services for cleaning, calibration and treatment of grain for other producers, thousand UAH/t		0.7	0.7	X
Revenue from the sale of wheat seeds, thousand UAH		16550,0	17850,0	34400,0
Revenue from the sale of barley seeds, thousand UAH		5301,1	5563,3	10864,3
Revenue from sales of grain waste, thousand UAH		1035,3	1087,0	2122,3
Revenue from grain seed cleaning and calibration services, UAH thousand		700.0	770.0	1470,0

Table 1, Continued

Indexes	2021 p.	2022 p.	2023 p.	Together
1	2	3	4	5
Cost of commodity wheat grain, thousand UAH/t		5.1	5.1	X
Cost of commodity grain of barley, thousand UAH/t		4.5	4.5	X
Revenue from the sale of wheat seeds as comrade. grain, thousand UAH		10200,0	10200,0	X
Revenue from the sale of barley seeds as a trade grain, thousand UAH		2945,3	2945,3	X
Additional income from the sale of grain as an elite seed of winter wheat, thousand UAH		6350,0	7650,0	14000,0
Additional income from the sale of grain as an elite seed of winter barley, thousand UAH		2355,8	2618,0	4973,8
Additional income from the sale of grain as an elite seed – total, thousand UAH		8705,8	10268,0	18973,8
Income from services for cleaning and calibration of grain seeds and sale of grain waste, thousand UAH		1735,3	1857,0	3592,3
Total gross income from the operation of the seed plant, thousand UAH		10441,1	12125,0	22566,1
Production costs - total, thousand UAH	668.7	817.9	644.8	2131,4
Operating profit, thousand UAH	-668.7	9623,2	11480,2	20434,7
Discount rate (discount rate 11%)	1.00	0.90	0.81	-
Discounted cash flow from operating activities, UAH thousand	*-668.70*	*8669,51*	*9317,34*	*17318,2*
Investment activity				
Capital investments - total, thousand UAH	12 000,0	0.0	0.0	12000,0
including: - Petkus P-12 mobile universal cleaning machine	12000,0			12000,0
Total costs, thousand UAH	12668,7	817.9	644.8	14131,4
Discounted cash flow from investing activities, UAH thousand	*12000,00*	*0.00*	*0.00*	*12000,0*
Discounted free cash flow, UAH thousand	-12668,70	8669,51	9317,34	5318,2
Cumulative discounted free cash flow, UAH thousand	-12668,70	-3999,19	5318,16	X
Net present value (NPV), thousand UAH	5318,17		X	
Internal rate of return (IRR),%	40.5		X	
Return on investment (PI),%	144.32		X	
Discounted payback period of DPP, years	2.6		X	

Tax revenues to the budget for the years of project implementation will amount to UAH 3,958.5 thousand (Table 2).

The implementation of the project will contribute to a significant increase in economic, social and energy efficiency of agricultural production in the southern region; increasing the production of high quality seed material in conditions of natural and artificial moisture; increasing the manufacturability of production and productivity; meeting the needs of agricultural producers in the South of Ukraine, members of TRPC "Southern" and the Southern Interregional Research Center NAAS in high-quality sowing material of domestic varieties of cereals and the needs for services for cleaning, calibration and pre-sowing treatment of seeds of their own production; establishment of a regional information and logistics seed center for cooperation between grain producers and scientific institutions.

Sustainability of the project results is ensured due to the functioning of the Seed Production Center for the production and circulation of the latest domestic varieties of grain crops for the South of Ukraine on the basis of the Mykolayiv National Agrarian University.

Table 2. *Receipts to the state budget from the project implementation, thousand UAH*

Indexes	2021 p.	2022 p.	2023 p.	Together
1	2	3	4	5
Cash proceeds, UAH thousand	0.0	10441,1	12125,0	22566,1
Tax liability, UAH thousand	0.0	1740,2	2020,8	3761,0
Total costs, including:	12668,7	817.9	644.8	14131,4
- investment costs (mobile universal cleaning machine SSC 60/10 based on Petcus P-12), thousand UAH	12000,0	-	-	12000,0
- project implementation costs	668.7	817.9	644.8	2131,4
including: - salary with accruals	335.8	359.9	384.7	1080,4
- material costs	309.3	409.3	211.4	930.0
- serves	10	40	40	90.0
Tax credit, thousand UAH	53.2	74.9	41.9	170.0
Receipt of VAT in the budget, thousand UAH	-53.2	1665,3	1978,9	3591,0
Personal income tax (18%), UAH thousand	49.5	53.1	56.8	159.4
Single social contribution (22%), UAH thousand	60.6	64.9	69.4	194.9
Military fee (1.5%), thousand UAH	4.1	4.4	4.7	13.2
Total payments, thousand UAH	61.0	1787,7	2109,8	3958,5
Budget efficiency,%				28.0

Introduction of modern irrigation on the lands of the University for varietal testing of promising varieties of grain crops created in NAAS institutions under conditions of risky agriculture will provide the region with high quality seeds adapted to the conditions of the South of Ukraine, introduce the latest technologies will provide an opportunity to increase grain yields to 30%, provide agricultural producers in southern Ukraine, members of TRPC "Southern" and the Southern Interregional Research Center with modern services for cleaning, calibration and presowing seed treatment in accordance with DSTU 2240-93.

The multiplier effect of the project is to increase the production of high quality sowing material of new promising varieties of cereals for irrigated and non-irrigated lands, will be provided by publishing scientific and methodological, informational materials, publications in scientific journals and a group of agricultural producers in the region. cultivation of seed crops of cereals under irrigation of the southern region. It is also planned to support the media and post information about the project on the website of the project customer. The results of the project will be verified through questionnaires and disseminated among other interested agricultural producers, scientists and graduates.

Within the framework of the project implementation, monitoring of the achievement of goals is introduced by comparing the actually obtained values of indicators with their forecast values, which is conducted every year by the Ministry of Education and Science of Ukraine and Mykolayiv National Agrarian University.

Assessment of the achievement of project objectives is based on the results of the calendar plan for each stage of activity. A generalized evaluation of the effectiveness of the project is conducted by the Ministry of Education and Science of Ukraine one year after the completion of the project. The procedure for monitoring and evaluating the effectiveness of the project is determined by the Ministry of Education and Science of Ukraine.

The internal monitoring procedure will be carried out according to quantitative and qualitative indicators,

provides a detailed description of the project activities at its respective stage; identification of those responsible for the task; division of responsibilities between performers.

Information on monitoring and reporting on the status of the project will be reflected in the documents:

- Bulletin on indicators of the state of works (to be filled in by the customer).
- Minutes of meetings (to be filled in by the customer).
- Internal report on the status of the project (to be filled in by the customer).
- External report on the status of the project (to be filled in by the customer).

To ensure control in the project, the main monitoring and control procedures will be implemented:

- work plan control procedure;
- financial plan control procedure;
- quality control procedure;
- document control procedure.

The following project evaluation technologies have been introduced:

- control at the end of the work (method "0-100");
- control during 50% readiness of works (method "50-50");
- regular operational control (at regular intervals);
- expert assessment of the degree of execution of works and readiness of the project.

In case of occurrence of unforeseen or negative results or side effects during the project implementation, the procedure of corporate settlement is provided in the operative way.

A separate important criterion for the internal evaluation of the achievement of project results is the economic efficiency of the project.

Upon completion of the project, a survey of agricultural managers and specialists on the results of the introduction into production of innovative technologies obtained under this project for growing winter wheat and winter barley under irrigation and in conditions of natural moisture.

The following project evaluation technologies have been introduced:

- control at the end of the work (method "0-100");
- control during 50% readiness of works (method "50-50");
- regular operational control (at regular intervals);
- expert assessment of the degree of work implementation and project readiness.

CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

The development of irrigation in the South of Ukraine is an important condition for the formation of a favorable innovation and investment environment in the region, the realization of the country's agricultural potential, increase agricultural production, exports and food security.

The project to establish the Center for Seed Production of the newest domestic regional varieties of grain crops in the conditions of natural and artificial moisture in the South of Ukraine is aimed at developing seed growing technology for each studied variety and innovation.

Implementation of the project on the area of 277 hectares for 2021-2023 will allow to obtain budget efficiency at the level of 28% and will stimulate the development of irrigation in Mykolayiv region, which is a guarantee of high yields of major crops, stability of revenues to the state budget and strengthening leadership the world.

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Ефективність насінництва в контексті розвитку Південного регіону України

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Анотація. У статті представлено результати аналізу необхідності створення та функціонування Центру з виробництва базового та сертифікованого насіння нових сортів основних зернових колосових культур в умовах природного та штучного зволоження на базі Навчально-науковопрактичного центру МНАУ. Реалізація проекту сприятиме розвитку вітчизняного насінництва, забезпечення агровиробників високоякісним посівним матеріалом нових сортів, а також підвищення якості освіти під час підготовки фахівців з агрономії

Ключові слова: насінництво, зернові культури, сорти, зрошення, економічна ефективність, проєкт