Ministry of Agriculture of the Republic of Kazakhstan
S.Seifullin Kazakh Agrotechnical Research University

Considered at a meeting
of the Academic
Council of the University
Protocol No. 11
from February 24, 2023.

«APPROVED»
Chairman of the Board - Rector
NJSC "S.Seifullin Kazakh Agrotechnical
Research University"
_____ K.M. Tireuov
_____ 2023 г.

DOUBLE DIPLOMA EDUCATIONAL PROGRAM
7M08111 «AGROBIOTECHNOLOGY»

(OHPE - partner - Patrice Lumumba Peoples' Friendship University of Russia (Moscow, Russia)

Field of education: 7M08 Agriculture and bioresources
Direction of training: 7M081 Agronomy
Group of educational programs: M131 Plant growing
Educational program: 7M08111 Agrobiotechnology
Degree awarded: Master of Agricultural Sciences in the educational program «Agrobitechnology»
Duration of study: 2 years (scientific and pedagogical direction)

Astana, 2023

Members of the Academic Committee:

Full name	Place of work	Position, academic degree, title
Stybaev Gani Zhasymbekovich	NJSC "S. Seifullin KATRU", Kazakhstan	Dean of the Faculty of Agronomy, Candidate of Agricultural Sciences, Professor
Rysbekova Aiman Bokenovna	NJSC " S. Seifullin KATRU", Kazakhstan	Candidate of Biological Sciences, Associate Professor
Amantaev Bekzak Omirzakovich	NJSC " S. Seifullin KATRU", Kazakhstan	Candidate of Agricultural Sciences, Associate Professor
Sibataev Anuarbek Karimovich	NJSC " S. Seifullin KATRU", Kazakhstan	Head of the Department of Biology, Plant Protection and Quarantine, Doctor of Biological Sciences, Professor
Kipshakbaeva Gulden Amangeldinovna	NJSC " S. Seifullin KATRU", Kazakhstan	Candidate of Agricultural Sciences, Associate Professor
Basilova Dana Sansyzbaevna	LPP "A.I. Barayev RPCGF", Kazakhstan	Senior Researcher Laboratory of Genetic Resources, PhD
Gabdola Ademi Zhanatkyzy	NJSC " S. Seifullin KATRU", Kazakhstan	2nd year doctoral student of the EP "Genetics and selection of agricultural crops"

To develop a joint educational master's program "Agrobiotechnology" (direction "Agronomy"), the partner university of the Peoples' Friendship University of Russia (RUDN) involved:

Full name	Place of work	Position, academic degree, title
Pakina Elena Nikolaevna	Agrobiotechnological Department of Agricultural Technological Institute (ATI), RUDN University	Director of the Agricultural Biotechnological Department of ATI, Doctor of Agricultural Sciences, Professor
Vvedensky Valentin Valentinovich	Agrobiotechnological Department of ATI, RUDN University	Deputy Director of the Agrobiotechnological Department of ATI, Ph.D., Associate Professor
Ignatov Alexander Nikolaevich	Agrobiotechnological Department of ATI, RUDN University	Doctor of Biological Sciences, Professor
Zargar Maysam	Agrobiotechnological Department of ATI, RUDN University	Doctor of Agricultural Sciences, Associate Professor
Gins Murat Sabirovich	Agrobiotechnological Department of ATI, RUDN University	Doctor of Biology, Professor, Corresponding Member RAS
Orlov Yuri Lvovich	Agrobiotechnological Department of ATI, RUDN University	Doctor of Biological Sciences, Professor of the Russian Academy of Sciences
Lapshin Georgy Sergeevich	Agrobiotechnological Department of ATI, RUDN University	Assistant

The composition of the Academic Committee was approved by the Chairman of the Board of NJSC "KATRU named after S. Seifullin", order No. 374-Н dated "18" 10 2023.

The educational program "Agrobiotechnology" was considered at a meeting of the department "Agriculture and Plant Growing", protocol No. 5 from "20" 01 2023, approved by the Council of the Faculty of Agronomy, protocol No. 9 from "23" 01 2023.

CONTENT

1 Educational program passport

1.1 Purpose and objectives of the educational program

The goal of the educational program "Agrobiotechnology" is to train highly qualified specialists together with RUDN University (RF) at the international level, with in-depth knowledge of fundamental and applied problems in the study of plant objects, with the skills of scientific justification and a practical approach to solve them, in accordance with the requirements of employers and professional standards in the field of crop production.

1.2 Main objectives of the educational program:

1. To form the graduate's readiness for professional activity, mobility, continuous professional and moral improvement and growth throughout life, as well as the further development of scientific activity.

2. To prepare highly educated, entrepreneurial and competitive specialists at the international level who can use mathematical methods to study various processes in the field of agricultural biotechnology of plant production in accordance with the existing and future needs of the individual, society and the state.

3. Preparation of a master's degree for the field of plant biotechnology, with in-depth professional and pedagogical training, as well as adaptation of graduates to production, technological, organizational, managerial, scientific and pedagogical activities in accordance with the needs of the economy and labor market.

1.3 Learning outcomes

LR1 – Identify, describe, analyze and operate the tools and methods of modern science in professional activities, carry out pedagogical activities in organizations of higher and special education of the Republic of Kazakhstan and the Russian Federation, use special knowledge for critical analysis, evaluation and synthesis of new complex ideas and manage personnel in the field of agronomy and biotechnology.

LR 2 – Differentiate the variety of methods of modern "omics" technologies and molecular biology to solve applied problems and problems in the field of plant genomics. Organize proteomic and molecular studies, conduct experiments with analysis and interpretation of results to solve problems of agrobiotechnology.

LR 3 – Carry out scientific research and practical activities for the long-term development of crop production, based on a systematic scientific approach to the propagation and cultivation of safe plant products using the knowledge of genetic engineering, micropropagation and compounds of secondary metabolites.

LR 4 – Systematize, analyze, demonstrate and interpret information in a professional language from various sources. Expand and generalize the results of the analysis to solve the problem. Demonstrate the ability to have a sustained interest in developing new ideas or processes and a high level of process understanding. Analyze and assess risks and biosafety when solving problems of agricultural biotechnology and establish legal instruments for the distribution of rights.

LR 5 – Present, compare and formulate methodological knowledge on modern innovative technologies in agricultural production. Recognize and use modern instrumental and digital methods for processing analysis, interpretation and visualization of data in order to solve assigned problems. Summarize and use modern methods of mathematical statistics and modeling when processing the obtained data. Calculate the effectiveness of innovation implementation.

LR 6 – Analyze and rank agricultural plants according to the degree of development of mechanisms of stress resistance to the effects of harmful organisms and abiotic environmental factors in order to accelerate the diagnosis of resistance. Identification of highly productive varieties based on the use of a scientific approach and knowledge of the physiological and molecular mechanisms of plant resistance and immunity, identifying the conjugacy and mechanisms of interaction between agricultural plants and phytopathogens.

LR 7 – Analyze bioinformatic methods and approaches, make practical decisions using molecular phylogeny data for the future development of crop production.

LR 8 – Collect, systematize and determine technologies for searching for source material of agricultural crops. Use plant biodiversity when creating a variety model for crop cultivation technologies. Give reasons for the choice of selection methods. Analyze, interpret and apply molecular breeding methods to develop crop varieties.

2 General characteristics of the educational program

The educational program "Agrobiotechnology" of the scientific and pedagogical direction of the master's degree was developed jointly with the Russian University of Peoples' Friendship named after. Patrice Lumumba (Moscow, Russia), has a double diploma, and complies with the National Qualifications Framework and Professional Standards, agreed with the Dublin descriptors and the European Qualifications Framework, based on the State Compulsory Standard for Postgraduate Education (Order of the Ministry of Education and Science of the Republic of Kazakhstan No. 604 of October 31, 2018) .

The peculiarity of the implemented program lies in its orientation towards preparing graduates for professional activities, which combines knowledge and competencies in the field of general agriculture and crop production, mastering modern methods of organizing pedagogical and research work, a greater orientation in training is aimed at mastering fundamental disciplines, and also disciplines offered by employers, i.e. necessary in modern production.

The uniqueness of the educational program is a wide range of theoretical and practical knowledge in the professional field, they are able to independently develop and put forward various options for solving professional problems using theoretical and practical knowledge, they have the competencies of independent management and control over the processes of scientific and production activities within the framework of strategy, policy and goals of the organization, discussion of the problem, argumentation of conclusions and competent handling of information. Graduates of this educational program will be able to receive, during their first year of study at S. Seifullin KATRU, second year - on the basis of RUDN, two diplomas of samples from the above listed partner universities.

The educational program is focused on the formation of basic and professional competencies related to research and practical activities, taking into account the requirements of employers and partner universities, as well as the needs and interests of undergraduates.

Increased fundamental training within the educational program will allow graduates of the master's program to continue their studies in doctoral studies.

The educational program is designed on the basis of a modular system of studying disciplines that form basic (general cultural, special language) and professional competencies.

The volume of the educational program "Agrobiotechnology" is 120 credits, including: 112 credits - theoretical training, including 3 credits of pedagogical and 24 credits of research practice and research work; 8 credits - final certification.

3 Competency model (portrait) of a graduate

3.1 Areas of professional activity

The scope of professional activity is:

-local and republican government agencies, foreign laboratories, enterprises, as well as various types of agricultural entities (individual, collective, farms, joint-stock companies, limited liability partnerships, production cooperatives, etc.);

-educational activities in higher, secondary specialized, vocational and technical educational institutions of agrarian and biological profiles, scientific and management activities in scientific, industrial institutions, in the apparatus of local, district, regional, republican structures.

3.2 Types of professional activities

Graduates who studied under this educational program received two sample diplomas from S. Seifullin KATRU and RUDN, can carry out production - technological, organizational - managerial, scientific - research and scientific-pedagogical activities.

3.3 Basic competencies

The student must:

know: methodology, principles and structure of organization of scientific activity; psychological, pedagogical methods of increasing the efficiency of production activities and training; modern methods of proteomics and metabolomics, the main components of "omics" technologies and systems biology; patterns and classification of plant immunity; technology for searching for source material, as well as varieties, hybrids and mutants stored in Gene Banks; methods for creating models, technologies for cultivating agricultural crops, plant protection systems, varieties.

be able to: speak a foreign language fluently at a professional level, summarize the results of research and analytical work; conduct educational, research and other types of work with students; apply knowledge of pedagogy and psychology, interactive teaching methods; analyze information on breeding and seed production to create highly productive varieties and hybrids that are resistant to organisms, as well as clarify harmful plant protection systems from diseases and pests.

have the skills of*:* professional communication and intercultural communication, correct and logical presentation of your thoughts orally and in writing in a foreign language; research activities; carrying out teaching activities; in modern molecular genetic and genomic methods (PCR analysis, genome analysis, etc.); in the field of risk assessment and biosafety in changing various agricultural biotechnology research problems and related patent law issues.

be competent: in knowledge of a professional foreign language (English - level B2 or IELTS 6.0); in modern innovative technologies in agricultural production, using a systematic approach to solve the assigned problems, as well as using modern digital methods of processing, analysis, analysis and visualization of data in order to solve the assigned tasks; in the implementation of scientific projects and research in the field of agrobiotechnology, crop production, and the application of knowledge in professional agronomic activities.

3.4 Professional competencies

The master's student must:

know: the basics of fundamental and applied sciences in the field of genetics and breeding of agricultural plants; fundamentals of agriculture and crop production, methodology and methods of conducting scientific research and mathematical processing of its results; scientific foundations of seed production, variety replacement and variety renewal; fundamentals of technical regulation (standardization and confirmation of conformity) and requirements for quality and safety of crop products.

be able to: formulate and justify conclusions, make proposals in the field of genetics and selection of agricultural plants, agriculture and crop production; conduct patent searches within the research area; regulate the living conditions of plants in farming systems using agricultural technologies; apply acquired knowledge on the basics of product quality for practical work on documentation, examination and confirmation of conformity of crop products; plan, implement and conduct field experiments; maintain documentation; apply the results of statistical processing of scientific data to carry out scientific, apply theoretical knowledge of agronomy in practice.

have skills: theoretical and practical work with modern methods in the field of genetics and selection of agricultural plants, agronomy, documentation; conducting an independent patent search; working with scientific literature; in modern molecular genetics and genomic methods (PCR analysis,

genome analysis, etc.); organize technological processes in order to obtain high-quality crop products; planning and conducting own research work; development, implementation, control, evaluation and adjustment of technological process components.

be competent: in the practical use of in-depth knowledge in the field of genetics and selection of agricultural plants, scientific agronomy, in the application of modern molecular genetic and genomic methods, cultivation technologies; in managing a group of employees with acceptance of responsibility for the result of their actions at the technological process site.

4 Base for professional internships

The joint educational program "Agrobitechnology" of the scientific and pedagogical direction of the master's degree includes two types of practices that are carried out:

- in parallel with theoretical training (pedagogical);
- with a break from theoretical training (research).

Pedagogical practice of master's students, volume 3 credits, is carried out at the Department of Agriculture and Plant Growing of the S.Seifullin Kazakh Agrotechnical Research University. As part of their teaching practice, master's students are involved in conducting classes in undergraduate disciplines, participating in lectures by experienced lecturers, studying the practical application of various teaching methods, as well as conducting supervisory hours in order to familiarize themselves with educational work at the university.

Research practice, amounting to 15 credits, is carried out at the place where research is carried out, with the aim of becoming familiar with the latest theoretical, methodological and technological achievements of domestic and foreign science, with modern methods of scientific research, processing and interpretation of experimental data in the field of agriculture and crop production and conducting one’s own research.

Depending on the chosen topic of the master's thesis, the bases for research practice are the fields of large agricultural enterprises and farms, experimental fields of research institutes, fields of regional experimental stations, regional variety testing inspectorates, which have a complex of modern agricultural machines and implements that allow the implementation of modern methods of agricultural technologies, opportunities for conducting research (land area, laboratory facilities), the presence of qualified scientific mentors for students during internship, etc., as well as in the laboratory of the Agroecological Test Center at S. Seifullin KATRU, RSE “National Center of Biotechnology” of the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan, for the possibility of in-depth scientific and practical training. These are the following enterprises: LLP “Research and Production Center for Grain Farming named after. A.I. Baraeva", LLP "Kazakh Research Institute of Agriculture and Plant Growing", LLP "Karabalyk Agricultural Experimental Station", LLP "Karaganda Experimental Station", LLP "Experimental Farm of Oilseed Crops", State Institution "Republican Scientific and Methodological Center of Agrochemical Service", State Institution “Tselinnaya Regional Inspectorate for Agricultural Variety Testing” crops", "Baiserke Agro" LLP, "Rodina" LLP, "Atameken Agro" LLP, "TNK Agrofirm" LLP, "Akmola Phoenix" LLP, "Alibi Agro" LLP, "SC Food" LLP.

5 Structure of the educational program

No	Name of the discipline	Total labor intensity	
		in academ. hours	in academ. credits
	Theoretical training	**3360**	**112**
1	**Cycle of basic disciplines**	**1050**	**35**
1.1.	**University component**	**600**	**20**
	History and philosophy of science	120	4
	Higher education pedagogy	90	3
	Psychology of management	90	3
	English for Academic Purposes	120	4
	Teaching practice	90	3
	Foreign language (professional).	90	3
1.2.	**Component of choice**	**450**	**15**
	Working with scientific literature	90	3
	Fundamentals of Scientific Communication	90	
	Clonal micropropagation of plants	90	3
	Secondary metabolites and their production	90	
	Introduction to Bioinformatics	120	4
	Molecular phylogeny	120	
	Genetics with the basics of selection and seed production	150	5
	Physiological and molecular mechanisms of resistance to stress conditions	150	
2	**Cycle of major disciplines (PD)**	**1590**	**53**
2.1.	**University component**	**1290**	**43**
	Instrumental research methods-1	90	3
	Risk assessment, biosafety and patent law	90	3
	Research practice	420	14
	Instrumental research methods-2	150	5
	Mathematical modeling and design	180	6
	Molecular biology and plant genomics	90	3
	Plant proteomics and metabolomics	90	3
	Genetic engineering-1 (genome editing)	90	3
	Genetic engineering-2 (genome editing)	90	3
2.2.	**Component of choice**	**300**	**10**
	Plant immunity	150	5
	Mechanisms of interaction between plants and phytopathogens	150	
	Genetic biodiversity of plants, gene banks	150	5
	Molecular breeding	150	
3	**Research work**	**720**	**24**
3.1.	Research work of a master's student, including completion of a master's thesis	30	1
	Research work of a master's student, including completion of a master's thesis	120	4
	Research work of a master's student, including completion of a master's thesis	210	7
	Research work of a master's student, including completion of a master's thesis	360	12
4.	**Additional types of training (ADE)**	**0**	**0**

5.	**Final certification (FC)**	**240**	**8**
5.1.	Preparation and defense of a master's thesis (PDMT)	240	8
	Total	**3600**	**120**

Appendix 1. Study schedule

Schedule of the educational process for the 2023-2025 academic year for the educational program 7M08111 Agrobiotechnology in the field of preparation 7M081 Agronomy

Schedule of the educational process for the 2023-2024 academic year for the educational program Agronomic faculty
MASTER'S DEGREE

Courses	September					October					November				December				January					February				Mart				April				May					June				July					August			
	28	4	11	18	25	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	5	12	19	26	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26
	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	2	9	16	23	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30
M131 Crop production. Educational program 7M08101 -"Field crop selection", educational program 7M08102 -"Agrotechnology"																																																					
I	PW	.	./U	./U	./U	./U	./U	.	.	.	./TP	./TP	./TP	./TP	.	.	E/P	E/P	H	H	H	H	./U	./U	./U	.	.	./RP	./RP	./RP	./RP	./RP	./RP	RP	RP	RP	RP	E/P	E/P	TD	S/H	S/H	S/H	S/H	S/H	S/H	H	H	H	H	RP	RP	RP
II	RP	RP	RP	RP	.	./U	./U	./U	./U	./U	./U	./U	./U	./U	./U	./U	E/P	E/P	H	H	H	H	./U	./U	./U	./U	./U	./U	./U	./U	.	E/P	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE									
M131 Crop production. Educational program 7M08101 -"Field crop selection", educational program 7M08102 -"Agrotechnology" winter 2023-2025 yy.																																																			
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M131 Crop production. Educational program 7M08111-"Agrobiotechnology"																																																		
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M131 Crop production. Educational program 7M08104 -"Phytosanitary monitoring"																																																	
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II	H	RP	RP	./U	./U	./U	./U	./U	./U	./U	./U	./U	./U	./U	./U	./U	E/P	E/P	H	H	H	H	.	.	.	.	.	.	./U	./U	./U	./U	./U	./U	.	.	.	E/P	FE	FE	FE	FE	FE	FE	FE									
M131 Crop production. Educational program 7M08104-"Phytosanitary monitoring" winter 2023-2025 yy.																																																	
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M131 Crop production. Educational program 7M08110 -"Phytosanitary control in ornamental crop production"																																																	
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M131 Crop production. Educational program 7M08104 -"Agro soil science and plant nutrition"																																																	
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II	RP	RP	RP	RP	RP	.	./U	./U	./U	./U	./U	./U	./U	./U	./U	./U	E/P	E/P	H	H	H	H	./U	./U	./U	./U	./U	./U	./U	./U	.	E/P	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE	FE									
M131 Crop production. Educational program 7M08104 -"Agro soil science and plant nutrition" winter 2023-2025 yy.																																																	
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M131 Crop production. Educational program 7M08104 -"Agro soil science and plant nutrition" winter 2022-2024 yy.																																																	
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Conventions:

PW	- presentation week	P	- passing FX	TP	- teaching practice
●	- theoretical training	H	- holidays	RP	- research practice
TD	- enrollment in disciplines	S	- summer semester	U	- undergraduate research work
E	- examination session	FE	- final examination		

*** Reviewed and approved at the beginning of the school year

Appendix 2. Working curriculum

WORKING CURRICULUM
for 2023-2025 academic year
For the modular education program "Agrobiotechnology"
by the speciality/group of educational programmes M131 – Plant growing
Degree: Master's program by specialization (Scientific & pedagogical direction)
Form of education: Full-time (MS 2 years) semester
Entry year: 01-09-2023

Module code	Module name	Discipline cycle	Discipline	Code of subject	Subject name	Academic credits	Control in the academic period					Volume of hours							Distribution of credits per			
							Exams	Differentiated test(practi	Differentiated test(course paper)	Practice/SRW	Term paper/project	Total	In-class learning	including			Self-study work of Ms	Self-study work of Ms	1 course		2 course	
														Lectures	Practice	Lab practicals			1	2	3	4
																			Number of weeks in the			
																			15	15	15	15
Modules of specialty/education programm																						
1	Methodology of scientific research	AS	U	IMI 5304	Instrumental methods of research-1	3	2					90.0	30.0	15	15	0	12	48		3.0		
2		AS	UC	ORBPP 5315	Risk assessment, biosecurity and patent law	3	2					90.0	30.0	15	15	0	12	48		3.0		
3		AS	U	IP 5301	Research practice	14				420		420.0		0	0	0	0	0		14.0		
4		AS	U	IMI 6305	Instrumental methods of research-2	5	3					150.0	45.0	15	30	0	20	85			5.0	
5		AS	UC	MMP 6306	Mathematical modeling and design	6	3					180.0	60.0	30	30	0	24	96			6.0	
6		BS	E	RNL 5206	Scientific literature review	3	1					90.0	30.0	15	15	0	12	48	3.0			
7		BS	E	ONK 5207	Basics of scientific communication		1						30.0	15	15	0	12	48				
8		AS	E	IR 6309	Plant immunity	5	4					150.0	45.0	15	30	0	20	85				5.0
9		AS	E	MVRF 6310	Mechanisms of interaction between plants and phytopathogens		4						45.0	15	30	0	20	85				
10	Social and pedagogical	BS	U	IFN 5201	History and philosophy of science	4	1					120.0	45.0	15	30	0	16	59	4.0			
11		BS	U	PVSH 5202	Pedagogics of higher school	3	1					90.0	30.0	15	15	0	12	48	3.0			
12		BS	U	PU 5203	Psychology of management	3	1					90.0	30.0	15	15	0	12	48	3.0			
13		BS	U	AYaDAC 5216	English for Academic Purposes	4	1					120.0	45.0	0	45	0	16	59	4.0			
14		BS	UC	PP 5205	Pedagogical training	3				90		90.0		0	0	0	0	0	3.0			
15		BS	U	IYaP 6204	Foreign language (professional).	3	3					90.0	30.0	0	30	0	12	48			3.0	
16	Fundamentals of biotechnology	AS	U	MBGR 5303	Molecular biology and plant genomics	3	1					90.0	30.0	15	15	0	12	48	3.0			
17		BS	E	KMR 5210	Plant clonal micropropagation	3	2					90.0	30.0	15	0	15	12	48		3.0		
18		BS	E	VMIP 5211	Secondary metabolites and their production		2						30.0	15	0	15	12	48				
19		BS	E	VB 6208	Introduction to bioinformatics	4	3					120.0	45.0	15	30	0	16	59			4.0	
20		BS	EC	MF 6209	Molecular phylogenies		3						45.0	15	30	0	16	59				
21		BS	E	GOSS 6215	Genetics with the basics of selection and seed breeding	5	3					150.0	45.0	15	30	0	20	85			5.0	
22		BS	E	FMMUSU 6214	Physiological and molecular mechanisms of resistance to stress conditions		3				3		45.0	15	30	0	20	85				
23	Modern methods of biotechnology in the	AS	U	PMR 5313	Proteomics and metabolomics of plants	3	1					90.0	30.0	15	0	15	12	48	3.0			
24		AS	U	GIRG 5307	Genetic engineering (genome editing) - 1	3		1				90.0	30.0	15	0	15	12	48	3.0			
25		AS	U	GIRG 5308	Genetic engineering (genome editing)-2	3	2					90.0	30.0	15	0	15	12	48		3.0		
26		AS	E	GBRG 6311	Plant genetic biodiversity, genebanks	5	4					150.0	45.0	15	30	0	20	85				5.0
27		AS	EC	MS 6312	Molecular selection		4						45.0	15	30	0	20	85				
Scientifically research																						
28	Research	R	U	NIRMVVMD	Master student's research work, including implementation of master's thesis	1				30		30.0		0	0	0	0	0	1.0			
29		R	U	NIRMVVMD	Master student's research work, including implementation of master's thesis	4				120		120.0		0	0	0	0	0		4.0		
30		R	U	NIRMVVMD	Master student's research work, including implementation of master's thesis	7				210		210.0		0	0	0	0	0			7.0	
31		R	U	NIRMVVMD	Master student's research work, including implementation of master's thesis	12				360		360.0		0	0	0	0	0				12.0
Total of theoretical course						112	18	1	0	1230	0	3360	705	270	375	60	284	1141	30.0	30.0	30.0	22.0
AC	**Additional courses**												0									
FA	**Final attestation**					8						240.0										
	Master dissertation design and defence					8				4		240										
	Total					120				1234		3600	705	270	375	60	284	1141				

Appendix 3. Relationship between the achievability of the formed learning outcomes in the educational program and academic disciplines (matrix of the influence of disciplines on the formation of learning outcomes)

No	Name of the discipline	Brief description of the discipline	Number of credits	Learning results							
				ON 1	ON 2	ON 3	ON 4	ON 5	ON 6	ON 7	ON 8
Cycle of basic subjects / University component											
1	History and philosophy of science	Forms the skills of a methodological and dialectical approach to research, generalizes philosophical knowledge, studies issues of historical development, its structure, analyzes the patterns and regularities of scientific knowledge, systematizes the effectiveness of scientific research work.	4	+							
2	Higher education pedagogy	Let's consider for master's students studying in the scientific and pedagogical direction an understanding of general problems, methodological and theoretical foundations of higher education pedagogy, analysis of teaching and upbringing skills, elements of modern planning and organization technologies.	3	+							
3	Psychology of management	Forms skills in managing the organized sphere of people through the study of psychological laws and laws of management and quality of work, develops skills in making scientifically based decisions, structuring the actions of other people, and managing an organization.	3	+							
4	English for Academic Purposes	Comprehensive theoretical-linguistic, practical and information-analytical training with the performance of functions, obligations using a foreign language in professional and scientific activities: mastery of public speaking skills, conducting a discussion, ability to work with information from various sources, strict texts of professional revolutionary content in foreign language.	4				+				
5	Foreign language (professional)	Forms foreign language communicative competence as a significant component of professional competence and culture of scientific writing in students, allows integration into international scientific activities, allows you to freely operate with the scientific and conceptual apparatus of your specialty, develop a scientific information base, master broad areas of development, identify promising areas of professional and scientific activity.	3				+				
Cycle of basic disciplines / Component of choice											
6	Working with scientific	The course is aimed at methods of teaching students sources of scientific	3				+				

	literature	information and their classification, basic methods of searching, processing and storing information, its systematization and analysis, methods of reading literature and keeping working notes.									
7	Fundamentals of Scientific Communication	Performs a search for the necessary information, thoroughly analyzes it and summarizes the results of the analysis to solve the problem. Formulates the results obtained in the course of solving research problems. Knows how to correctly compose the obtained research results in articles, textbooks and monographs.					+				
8	Clonal micropropagation of plants	The course will consider the features of the technique of cultivating isolated plant cells, tissues and organs in vitro, the advantages, main stages and methods of clonal micropropagation of plants, factors influencing the effectiveness of clonal micropropagation, its application in plant growing and agriculture, achievements and development prospects	3			+					
9	Secondary metabolites and their production	The discipline course includes the main characteristics of secondary metabolites, properties of chains of secondary compounds (phytoalexins, secondary metabolism), alkaloids, phenolic compounds, terpenes and terpenoids, production of secondary metabolites (BAS products, stages of creating industrial technologies for the production of BAS).				+					
10	Introduction to Bioinformatics	Course disciplines examine the scientific and practical foundations of bioinformatics approaches for the genetic basis of plant breeding, biotechnology, increasing crop yields and the quality of crop products using bioinformatics methods. The course teaches how to work with genetic data, analysis of genetic information, methods of bioinformation analysis, construction of phylogenetic trees and their analysis.	4							+	
11	Molecular phylogeny	Course disciplines examine the principles of evolutionary analysis of genetic information, theoretical foundations and practical approaches to solving problems of molecular evolution and phylogenetic analysis; methods for constructing molecular phylogenetic methods, using modern software for evolutionary analysis.								+	
12	Genetics with the basics of selection and seed production	The course examines the basic methods of research of genomic and chromosome analysis and directions of research of the plant gene pool, analysis of world achievements in the field of genetics and selection of lower traits of agricultural plants. The goals of mastering the disciplines are methods for a master's student of a scientific worldview, based on knowledge of the processes of preservation, transmission and implementation of hereditary information at the molecular, cellular, organismal and population levels of biological systems, as well as				+					

		conducting research with modern methods of the gene pool, genome, chromosomes and genes of plants.									
13	Physiological and molecular mechanisms of resistance to stress conditions	The main goal of this course is to thoroughly familiarize undergraduates - agrobiotechnologists - with the mechanisms of plant survival in extreme conditions, without knowledge of which it is impossible to create stress-tolerant plants using genetic engineering and cell selection methods. This course aims to preserve the latest scientific advances in the evolution of molecular and cellular principles of plant resistance and survival and the creation of stress-tolerant forms.						+		
Cycle of major disciplines / University component											
14	Instrumental research methods-1	Course disciplines are aimed at attracting highly qualified specialists who have the theoretical foundations and practical skills in modern innovative technologies in agricultural production. Methods of sampling, preparing them for analysis and determining basic agrophysical, agrophysical indicators of soil and plant fertility using modern chemical instruments and equipment are considered.	3				+			
15	Risk assessment, biosafety and patent law	Course subjects include competencies in risk assessment and biosafety in changing various agricultural biotechnology research problems and related patent law issues. Measures to ensure biosafety and biosecurity in laboratory conditions and the state of legislation in the field of biosafety in the world, legal instruments for the distribution of rights to intellectual property, the advantages of joint legal ownership, prerequisites for its application are also studied.	3			+				
16	Instrumental research methods-2	The course of the discipline forms students' initial qualifications in mastering theoretical methods and practical skills in modern innovative technologies in agricultural production, using a systematic approach to solve assigned problems, as well as using modern digital methods of data processing, analysis, analysis and visualization in order to solve assigned problems, applications. modern types and methods of conducting	5				+			
17	Mathematical modeling and design	The main goal of this course is to create basic understanding of obtaining and processing information for human analysis and making decisions based on it to perform management tasks related to production activities in the field of agriculture. Training skills for assessing information, its reliability, constructing logical conclusions based on the receipt of information and data; uses methods of mathematical statistics when processing data and preparing reports, studies methods for calculating agronomic, energy and economic efficiency, innovation, innovation.	6				+			
18	Molecular biology and	The discipline studies modern molecular genetic and genomic methods	3		+					

	plant genomics	(PCR analysis, genome analysis, etc.), the organization of plant genomes, molecular mechanisms of transmission of hereditary information in plants, regulation of the expression of plant genomes, as well as technologies based on information from DNA, cell and tissue cultures. (genetic engineering of plants).									
19	Plant proteomics and metabolomics	Course disciplines take into account modern methods of proteomics and metabolomics, the main components of "omics" technologies and systems biology. Students gain knowledge of the basic systems approach to the analysis of living organisms and the integral study of the behavior and functions of proteins in a living cell.	3		+						
20	Genetic engineering-1 (genome editing)	Course disciplines take into account systemic theoretical knowledge and practical skills in the field of agricultural biotechnology. He studies changes in the properties of genes, their location in chromosomes and regulation of their activity in accordance with human needs, methods of genetic engineering of plants through somatic hybridization of plant cells, fusion of subcellular structures, introduction into plant cells, as well as transformation of plants using vectors.	3			+					
21	Genetic engineering-2 (genome editing)	Course disciplines take into account legislation and biosafety in the field of bioengineering and biotechnology, the impact of genetically modified products on biosafety, accounting for transgenic organisms, requirements for standard procedures, procedures, testing and distribution of transgenic plants.	3			+					
Cycle of major disciplines/Elective component											
22	Plant immunity	Course disciplines take into account general patterns and classification of plant immunity; concepts of immunity, resistance, tolerance, stability and their types; characteristics of the manifestation of plant immunity to diseases; taking into account immunogenesis, specialization and variability of pathogens; types of parasitism; types of pathogen specialization; artificial immunity and methods of increasing health resistance; methods for assessing plant disease resistance; general principles of plant infection; methods for basic improvement of plant resistance.	5						+		
23	Mechanisms of interaction between plants and phytopathogens	A course on developing skills in collecting and analyzing information on breeding and seed production to create highly productive varieties and hybrids that are resistant to organisms, as well as clarifying harmful plant protection systems from diseases and pests. Uses resources, scientific, experimental and instrumental base to conduct research in agronomy, students learn popular primary and secondary components of models in							+		

		order to speed up their development.									
24	Genetic biodiversity of plants, gene banks	The discipline considers the technology of searching for source material, as well as varieties, hybrids and mutants stored in Gene Banks, in which both seeds and seedlings are preserved, the genetic diversity of plants is preserved, increasing measures for cultural restoration after a disaster, etc.; methods for creating models, technologies for cultivating agricultural crops, plant protection systems, varieties	5								+
25	Molecular breeding	The discipline represents modern methods of selection; students study selection using molecular markers, which allows for targeted hybridization of plants with given valuable methods, significantly reducing the time for creating varieties or hybrids. Methods for searching for initial information, its thorough analysis and generalization of the analysis results to solve the problem are considered, the biological and economic characteristics of agricultural and domesticated plants are studied as the basis for the development of technologies for their cultivation.									+

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