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**Federal State Autonomous Educational Institution of Higher Education
Peoples' Friendship University of Russia named after Patrice Lumumba
RUDN University**

educational division (faculty/institute/academy) as higher education programme developer

COURSE SYLLABUS

BREEDING AND SEED PRODUCTION

course title

Recommended by the Didactic Council for the Education Field of:

35.04.04 AGRONOMY

field of studies / speciality code and title

The course instruction is implemented within the professional education programme of higher education:

GENERAL AGRICULTURE

higher education programme profile/specialisation title

1. COURSE GOAL(s)

The course "Breeding and Seed Production" is part of the Master's programme "General agriculture" in the field of study 35.04.04 "Agronomy" and is studied in the 3rd and 4th semesters of the 2nd year. The discipline is implemented by the Agrobiotechnology Department. The discipline consists of 12 sections and 32 topics and is aimed at studying plant breeding and the techniques of the breeding process.

The course aims to:

1. Address the development of students' awareness in modern methods of plant breeding and understanding of the organization and techniques of the breeding process;
2. Familiarize students with the theoretical background, terminology, and concepts of variety science, hybridization methods, mutagenesis, polyploidy, and population genetics in plant breeding;
3. Deepen students' knowledge in the initial material for breeding, selection methods, state testing of varieties, and seed production principles;
4. Enhance students' skills in applying breeding techniques and organizing seed production workflows through practical laboratory work and field exercises.

The goal of mastering the discipline is to obtain basic knowledge of plant breeding methods, the organization and techniques of the breeding process, and seed production of agricultural crops. This subject provides an advanced study of breeding strategies and seed production technologies for their implementation in agricultural production.

2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the course "Breeding and seed production" is aimed at the development of the following competences (or parts thereof) in students:

Table 2.1. List of competences that students acquire through the course study

Competence code	Competence descriptor	Competence formation indicators (within this course)
GPC-4	Ability to conduct scientific research, analyze results and prepare reporting documents	GPC-4.1 Analyzes methods and ways of solving research tasks;
		GPC-4.2 Uses information resources, scientific, experimental and instrumental base for conducting research in agronomy;
PC-1	Ability to organize experiments (field trials) to assess the effectiveness of innovative technologies (technology elements), varieties, and hybrids under production conditions	PC-1.1 Develops a research program to study the effectiveness of innovative technologies (technology elements), varieties, and hybrids; develops methodologies for conducting experiments; masters new research methods;

Competence code	Competence descriptor	Competence formation indicators (within this course)
PC-2	Ability to develop and implement environmentally safe practices and technologies for producing high-quality crop production, taking into account the properties of agro-landscapes and economic efficiency	PC-2.3 Substantiates specializations and types of products grown in an agricultural organization;
PC-3	Ability to identify directions for improving and increasing the efficiency of crop production technologies based on scientific achievements and best practices of domestic and foreign producers	PC-3.1 Identifies promising directions for improving the efficiency of crop production;
PC-4	Ability to create models of cultivation technologies for agricultural crops, plant protection systems, and varieties	PC-4.1 Creates models of cultivation technologies for agricultural crops, plant protection systems, and varieties;

3.COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course refers to the core component of Block 1 "Disciplines (Modules)" of the higher educational programme curriculum.

Within the higher education programme, students also master other disciplines and/or internships that contribute to the achievement of the expected learning outcomes as results of the course study.

Table 3.1. The list of the higher education programme components/disciplines that contribute to the achievement of the expected learning outcomes as the course study results

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
GPC-4	Ability to conduct scientific research, analyze results and prepare reporting documents	Scientific Research Work	
PC-1	Ability to organize experiments (field trials) to assess the effectiveness of	Scientific Research Work; Technological Training; Information Technology; Crop Production;	

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
	innovative technologies (technology elements), varieties, and hybrids under production conditions	Mechanization of Crop Production; Pests and Diseases; Soil Fertility Management	
PC-2	Ability to develop and implement environmentally safe practices and technologies for producing high-quality crop production, taking into account the properties of agro-landscapes and economic efficiency	Crop Production; Pests and Diseases; Technological Training; Scientific Research Work	
PC-3	Ability to identify directions for improving and increasing the efficiency of crop production technologies based on scientific achievements and best practices of domestic and foreign producers	Scientific Research Work; Technological Training; Crop Production	
PC-4	Ability to create models of cultivation technologies for agricultural crops, plant protection systems, and varieties	Crop Production; Scientific Research Work	

* To be filled in according to the competence matrix of the higher education programme.

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the course "Breeding and Seed Production" amounts to 7 credits (252 academic hours).

Table 4.1. Types of academic activities during the periods of higher education programme mastering (**full-time training**)*

Type of academic activities	Total academic hours	Semesters/training modules	
		3	4
Contact academic hours	88	68	20
including:			
Lectures (LC)	44	34	10
Lab work (LW)	44	34	10
Seminars	0	0	0

Type of academic activities		Total academic hours	Semesters/training modules	
			3	4
(workshops/tutorials) (S)				
<i>Self-studies</i>		137	58	79
<i>Evaluation and assessment (exam/passing/failing grade)</i>		27	18	9
Course workload	academic hours	252	144	108
	credits	7	4	3

* To be filled in regarding the higher education programme correspondence training mode.

5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents (topics)	Academic activities types
Module 1: Breeding as a science on methods of developing varieties and hybrids	Topic 1.1. Breeding as a science and branch of agricultural production.	LC, LW
	Topic 1.2. Economic significance of breeding	LC, LW
Module 2: Doctrine of variety	Topic 2.1. Standards and regulatory/technical documents, their categories. Methods for determining crop product quality	LC, LW
	Topic 2.2. Varieties of folk selection	LC, LW
	Topic 2.3. Variety and agrotechnics	LC, LW
Module 3: Initial material in breeding	Topic 3.1. Concept of initial material for breeding	LC, LW
	Topic 3.2. Centers of origin of cultivated plants	LC, LW
	Topic 3.3. World collections of VIR, their use	LC, LW

Course module title	Course module contents (topics)	Academic activities types
Module 4: Hybridization	Topic 4.1. Concept of analytical and synthetic breeding	LC, LW
	Topic 4.2. Intraspecific hybridization. Selection of pairs for crossing	LC, LW
	Topic 4.3. Distant hybridization. Significance and difficulties in distant hybridization	LC, LW
Module 5: Mutagenesis in plant breeding	Topic 5.1. Brief history of mutational breeding	LC, LW
	Topic 5.2. Physical and chemical mutagens	LC, LW
	Topic 5.3. Detection of mutants in self- and cross-pollinated and vegetatively propagated crops	LC, LW
Module 6: Polyploidy and haploidy in plant breeding	Topic 6.1. Obtaining autopolyploids for breeding purposes using colchicine and other agents	LC, LW
	Topic 6.2. Reduced seed productivity of autopolyploids and methods of its improvement	LC, LW
	Topic 6.3. Methods of obtaining haploids. Significance of haploidy in distant hybridization	LC, LW
Module 7: Tea and main quality requirements	Topic 7.1. Main types of selection: Individual from homozygous populations in self-pollinators	LC, LW
	Topic 7.2. Mass selection in self-pollinators and cross-pollinators. Selection from cell populations	LC, LW
Module 8: Population genetics	Topic 8.1. Genetic processes in populations	LC, LW
	Topic 8.2. Genetic foundations of evolution	LC, LW
Module 9: Organization and technique of breeding process	Topic 9.1. Creating populations	LC, LW
	Topic 9.2. Types of breeding sowings	LC, LW

Course module title	Course module contents (topics)	Academic activities types
	Topic 9.3. Typicality, accuracy of experiment and principle of single difference in breeding process	LC, LW
	Topic 9.4. Technique of field work	LC, LW
Module 10: Breeding of heterotic hybrids	Topic 10.1. Brief history of breeding for heterosis	LC, LW
	Topic 10.2. Combining ability	LC, LW
Module 11: State testing and protection of breeding achievements	Topic 11.1. Tasks and organization of state variety testing	LC, LW
	Topic 11.2. Procedure for including varieties in state variety testing and zoning of varieties	LC, LW
Module 12: Seed production as a branch of agricultural production. Tasks and goals of seed production	Topic 12.1. Organization of seed production in modern conditions	LC, LW
	Topic 12.2. Variety replacement and variety renewal as the most important tasks of seed production	LC, LW
	Topic 12.3. Requirements for sowing and planting material. Standards (GOSTs) for sowing qualities of seeds	LC, LW

* - to be filled in only for **full**-time training: LC - lectures; LW - lab work; S - seminars.

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom equipment and technology support requirements

Type of academic activities	Classroom equipment	Specialised educational / laboratory equipment, software, and materials for course study (if necessary)
Lecture	A lecture hall for lecture-type classes, equipped with a set of specialised furniture; board (screen) and technical means of multimedia presentations.	Set of specialised furniture; technical facilities: EPSON EB-965 multimedia projector, Laptop, internet access. Software: Microsoft products (OS, office applications package, including MS Office/Office 365, Teams, Skype)
Lab work	A classroom for laboratory work, individual consultations, current and mid-term	Set of specialised furniture, MIKMED-5 binocular

Type of academic activities	Classroom equipment	Specialised educational / laboratory equipment, software, and materials for course study (if necessary)
	assessment; equipped with a set of specialised furniture and equipment.	medical microscope, microscopic preparations. Technical facilities: interactive whiteboard
Self-studies	A classroom for independent work of students (can be used for seminars and consultations), equipped with a set of specialised furniture and computers with access to the electronic information and educational environment.	

* The premises for students' self-studies are subject to **MANDATORY** mention

7. RESOURCES RECOMMENDED FOR COURSE STUDY

Main readings:

1. General Plant Breeding / Yu. B. Konovalov, V. V. Pylnyev, T. I. Khupatsaria, V. S. Rubets. — 5th ed., ster. — Saint Petersburg: Lan, 2023. — 480 p. — ISBN 978-5-507-45737-3. — Electronic text // Lan: electronic library system. — URL: <https://e.lanbook.com/book/282386>

2. Pylnyev, V. V. Fundamentals of Breeding and Seed Production / V. V. Pylnyev, A. N. Berezkin; edited by V. V. Pylnyev. — 2nd ed., ster. — Saint Petersburg: Lan, 2023. — 216 p. — ISBN 978-5-507-45402-0. — Electronic text // Lan: electronic library system. — URL: <https://e.lanbook.com/book/267383>

Additional readings:

1. Workshop on Breeding and Seed Production of Field Crops: teaching aid / V. V. Pylnyev, Yu. B. Konovalov, T. I. Khupatsaria [et al.]. — Saint Petersburg: Lan, 2022. — 448 p. — ISBN 978-5-8114-1567-0. — Electronic text // Lan: electronic library system. — URL: <https://e.lanbook.com/book/211478>

2. Tsatsenko, L. V. Innovative Technologies in Agronomy: Breeding and Seed Production: teaching aid / L. V. Tsatsenko. — Krasnodar: KubSAU, 2020. — 88 p. — ISBN 978-5-907294-48-6. — Electronic text // Lan: electronic library system. — URL: <https://e.lanbook.com/book/171561>

Internet sources

1. **1. Electronic libraries (EL) of RUDN University and other institutions, to which university students have access on the basis of concluded agreements:**

- RUDN Electronic Library System (RUDN ELS): <https://mega.rudn.ru/MegaPro/Web>
- EL "University Library Online": <http://www.biblioclub.ru>
- EL "Yurait": <http://www.biblio-online.ru>
- EL "Student Consultant": www.studentlibrary.ru
- EL "Znanium": <https://znanium.ru/>

Databases and search engines:

- Techexpert (information and reference system of GOSTs): <http://www.cntd.ru/>
- "Selkhoztehnika" (automated reference system): <http://www.agrobase.ru>

- Sage: <https://journals.sagepub.com/>
- Springer Nature Link: <https://link.springer.com/>
- Wiley Journal Database: <https://onlinelibrary.wiley.com/>
- Bibliometric database Lens.org: <https://www.lens.org>

Training toolkit for self- studies to master the course *:

1. The set of lectures on the course "Breeding and Seed Production".

* The training toolkit for self- studies to master the course is placed on the course page in the university telecommunication training and information system under the set procedure.

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