

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF
UKRAINE**
Department of Plant Science

"APPROVED"
Agrobiological Faculty
"22" June 2026

**CURRICULUM OF ACADEMIC DISCIPLINE
PLANT SCIENCE**

Area of knowledge **Agricultural sciences and food**

Specialty H1 Agronomy

Educational programme Agronomy

Faculty Agrobiological

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Description of the discipline Plant Science

The course “Plant Science” provides students with knowledge of scientific and applied aspects of crop production, the history and role of crop production, as well as the current state and prospects of crop product production. The course covers the ecological and biological foundations of crop production, crop production specialization zones in Ukraine, classification of field crops, and the biological, botanical, and ecological characteristics of field crops.

Special attention is paid to the study of plant growth and development, including growth stages, stages of organogenesis, macrostages, and microstages of field crops. The course also considers methods for diagnosing plant growth and development, including field, laboratory, and remote sensing methods, as well as the photosynthetic activity of crop stands.

The syllabus includes the fundamentals of seed science and seed quality control, management of field crop productivity formation, and crop cultivation technologies for major groups of field crops, including cereals, pseudo-cereals, grain legumes, tuber crops, root crops, cucurbits, oilseed crops, essential-oil crops, melliferous crops, phytoenergy crops, and others.

Area of knowledge, academic degree, specialty, educational programme		
Area of knowledge	<i>H Agricultural Science</i>	
Academic degree	<i>bachelor's, master's</i>	
Specialty	<i>H1 Agronomy</i>	
Educational programme	<i>Agronomy</i>	
Characteristics of the discipline		
Type	compulsory	
Total number of hours	300	
Number of ECTS credits	10	
Number of modules	6	
Course project (work) (if any)	yes	
Form of assessment	<i>exam</i>	
Indicators of the discipline for full-time and part-time forms of university study		
	University study	
	Full-time	Part-time
Year of study	2-3	
Term	4-5-6	
Lectures	<i>90 hours</i>	<i>hours</i>
Practical classes and seminars	<i>hours</i>	<i>hours</i>
Laboratory classes	<i>105 hours</i>	<i>hours</i>
Self-study	<i>105 hours</i>	<i>hours</i>

Number of hours per week for full-time students	4/6/3 hours	
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1. Aim, prerequisites, competences and expected learning outcomes of the discipline

Aim. On a global scale, the main objective of crop production is to meet the growing demand of the population for food, to provide the livestock sector with feed, and to supply the light, food, and other industries with raw materials. Plant Science, as an academic and scientific field, studies various species, forms, and cultivars of field crops, as well as the theoretical foundations and practical measures required to obtain high and stable yields with minimal labour and material inputs. In a broad sense, crop production refers to the cultivation of various cultivated plants.

The main aim of the course is to prepare students for future independent professional activity involving an integrated set of objects: agricultural plants, soil, fertilizers, mechanization tools, land reclamation, and plant protection. As a result of studying the course, a young specialist should be able to develop, improve, and efficiently implement field crop cultivation technologies under different ownership and farming systems; monitor the condition of crop stands and manage yield formation processes; ensure high economic efficiency of the implemented technologies; and develop and carry out measures aimed at improving the quality and reducing losses of crop products.

Prerequisites of the discipline «Plant Science» (if any):

1. Plant Physiology with Fundamentals of Biochemistry, Agrometeorology, Soil Science with Fundamentals of Geology, Agricultural Entomology, Phytopathology, Agricultural Machinery and Machinery Use in Crop Production, and Agriculture

Acquisition of competences:

Integral competence (IC): The ability to solve complex specialized tasks and practical problems in agronomy, involving the application of theories and methods of the relevant science and characterized by complexity and uncertainty of conditions.

General competences (GC):

GC 6. Knowledge and understanding of the subject area and understanding of professional activity;

GC 7. Ability to apply knowledge in practical situations.

Special (professional) competences (SC):

SC 1. Ability to use basic knowledge of the main branches of agricultural science, including crop production, agriculture, plant breeding and seed production, agrochemistry, fruit growing, vegetable growing, soil science, forage production, mechanization in crop production, and plant protection;

SC 3. Knowledge and understanding of the main biological and agrotechnological concepts, rules, and theories related to the cultivation of agricultural and other plants;

SC 4. Ability to apply knowledge and understanding of physiological processes in agricultural plants to solve production-related technological tasks;

SC 9. Ability to manage complex actions or projects and take responsibility for

decision-making under specific production conditions.

Expected Learning Outcomes (ELO):

ELO 4. Compare and evaluate modern scientific and technological achievements in the field of agronomy;

ELO 6. Demonstrate knowledge and understanding of fundamental disciplines to the extent necessary for mastering relevant skills in the field of agronomy;

ELO 7. Demonstrate knowledge and understanding of the principles of physiological processes in plants to the extent necessary for mastering fundamental and professional disciplines;

ELO 9. Possess, at an operational level, methods of observation, description, identification, classification, as well as cultivation of objects and maintenance of agroecosystem stability while preserving natural diversity;

ELO 10. Analyse and integrate knowledge from general and specialized professional training to the extent necessary for specialized professional work in the field of agronomy;

ELO 11. Initiate prompt and appropriate solutions to production problems in accordance with zonal conditions;

ELO 13. Design and organize measures for the production of high-quality agricultural products in accordance with current requirements;

ELO 14. Integrate and improve production processes for growing agricultural products in accordance with current requirements;

ELO 15. Plan economically profitable agricultural production.

2. Programme and structure of the discipline

Modules and topics	Number of hours													
	full-time							part-time						
	weeks	total	including					total	including					
			l	p	lab	ind	s.st		l	p	lab	ind	s.st	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Module 1. Fundamentals of Modern and Sustainable Crop Production														
1. Crop Production under Global Challenges: Food Security, Climate Change, and Sustainable Development		2	2					4						4
2. Ecological and Biological Mechanisms of Productivity Formation in Agrophytocenoses. Classification of Field Crops		2	2					4						4
3. Plant Growth and Development.		4	2				2	10	2					8

Identification of Plant Growth and Developmental Stages. Growth Phases, Stages of Organogenesis, Macrostages, and Microstages of Field Crops													
4. Management of Field Crop Productivity Formation Using Field and Remote Diagnostic Methods	5	2			3	10	2						8
5. Agrobiological Foundations of Intensive, Adaptive, and Resource-Saving Crop Cultivation Technologies	12	2	6		4	6		2					4
6. Seed Production, Seed Technologies, and the Genetic Potential of Varieties and Hybrids	12	2	6		4	6		2					4
Total for module 1			37	12		12		13	40	4	4		
Module 2. Cereal and Grain Legume Crops													
1. Winter Cereal Crops: Adaptability, Productivity, and Cultivation Technologies	38	12	16		10	40	6	8					26
2. Spring Cereals and Pseudo-Cereal Crops under Climate Change Conditions	40	14	16		10	36	6	6					24
3. Grain Legume Crops as a Basis for Biologization and Sustainable Crop Production	32	12	10		10	30	4	4					22
Total for module 2	110	38	42		30	108	18	18					72
Module 3. Root Crops, Tuber Crops, and Cucurbit Crops													
1. Tuber Crops: Modern Cultivation Technologies and Product Quality Management	14	2	4		8	12	2	2					8
2. Root Crops in Intensive Agrotechnologies	13	2	3		8	12	2	2					8
3. Cucurbit Crops: Biological Characteristics and Innovative Cultivation Technologies	8	2	2		4	8		2					6
Total for module 3	35	6	9		20	32	4	6					22
Module 4. Industrial Crops and Production of Strategic Crop-Based Raw													

Materials											
1. Sugar Crops in the System of Food Supply and Processing Industries		12	2	2		8	12	2	2		8
2. Sugar Beet: Modern Cultivation Technologies and Productivity Management		20	6	6		8	16	2	2		12
Total for module 3		32	8	8		16	28	4	4		20
Module 5. Oilseed and Essential-Oil Crops											
1. Oilseed Crops as a Basis of Modern Agricultural Exports and the Bioeconomy		32	10	10		12	14	2	2		10
2. Essential-Oil Crops: Production Prospects and Directions of Use		18	4	8		6	24	2	2		20
Total for module 5		50	14	18		18	38	4	4		30
Module 6. Fibre, Aromatic, Medicinal, and Phytoenergy Crops											
1. Fibre Crops and Prospects for Their Use		12	6	4		2	10	2	2		6
2. Aromatic Crops in Modern Crop Production		8	2	4		2	4				4
3. Medicinal Plants as a Component of Specialized Crop Production		8	2	4		2	4				4
4. Phytoenergy Crops and Their Role in the Development of a Sustainable Bioeconomy		8	2	4		2	6		2		4
Total for module 6		36	12	16		8	24	2	4		18
Total hours											
Course project (work “Development and Scientific Justification of a Cultivation Technology for Achieving a Programmed Yield of Agricultural Crops under Specific Soil and Climatic Conditions”)			-	-	-		-		-	-	-
Total hours	300		90	105		105	270	36	40		194

3. Topics of lectures

№	Topic title	Hours
1	Crop Production under Global Challenges: Food Security, Climate Change, and Sustainable Development	2
2	Ecological and Biological Mechanisms of Productivity Formation in Agrophytocenoses. Classification of Field Crops	2
3	Plant Growth and Development. Identification of Plant Growth and Developmental Stages. Growth Phases, Stages of Organogenesis, Macrostages, and Microstages of Field Crops	2
4	Management of Field Crop Productivity Formation Using Field and Remote Diagnostic Methods	2
5	Agrobiological Foundations of Intensive, Adaptive, and Resource-Saving Crop Cultivation Technologies	2
6	Seed Production, Seed Technologies, and the Genetic Potential of Varieties and Hybrids	2
7	Winter Cereal Crops: Adaptability, Productivity, and Cultivation Technologies	12
8	Spring Cereals and Pseudo-Cereal Crops under Climate Change Conditions	14
9	Grain Legume Crops as a Basis for Biologization and Sustainable Crop Production	12
10	Tuber Crops: Modern Cultivation Technologies and Product Quality Management	2
11	Root Crops in Intensive Agrotechnologies	2
12	Cucurbit Crops: Biological Characteristics and Innovative Cultivation Technologies	2
13	Sugar Crops in the System of Food Supply and Processing Industries	2
14	Sugar Beet: Modern Cultivation Technologies and Productivity Management	6
15	Oilseed Crops as a Basis of Modern Agricultural Exports and the Bioeconomy	10
16	Essential-Oil Crops: Production Prospects and Directions of Use	14
17	Fibre Crops and Prospects for Their Use	6
18	Aromatic Crops in Modern Crop Production	2
19	Medicinal Plants as a Component of Specialized Crop Production	2
20	Phytoenergy Crops and Their Role in the Development of a Sustainable Bioeconomy	2

4. Topics of laboratory (practical, seminar) classes

№ з/п	Назва теми	Кількість годин
1	Forecasting the yield of agricultural crops. Calculation of photosynthetically active radiation (PAR) utilization coefficients by crop stands and potential yield based on incoming solar radiation.	2
2	Calculation of phytometric indicators for programmed yield.	2
3	Preparation of the agronomic section of a technological chart for programmed cultivation of a field crop.	2
4	Determination of seed sowing qualities. Sampling.c	2
5	Determination of seed sowing qualities: purity and impurities, germination capacity, viability, moisture content, thousand-seed weight, disease infection, and pest infestation.	2

	Determination of seed authenticity through laboratory varietal control.	
6	Determination of seed conformity and preparation of seed quality documents.	2
7	general characteristics of cereal crops. Morphological and biological differences between cereal crops of the first and second groups. Generic differences between cereal crops of the first and second groups based on grain characteristics and the anatomical structure of the caryopsis. Generic differences between cereal crops of the first and second groups based on seedlings, young plants, auricles, and ligules. Growth phases and stages of organogenesis of cereal crops.	4
8	Wheat. Taxonomy and morphological characteristics. Wheat species. Identification of varieties of common wheat and durum wheat. Economic and biological characteristics of the most common and promising wheat cultivars.	2
9	Rye. Taxonomy and morphological characteristics of plants. Species and varieties. Economic and biological characteristics of the most common cultivars.	2
10	Triticale. Taxonomy and plant morphology.	2
11.	Barley. Taxonomy and morphological characteristics. Subspecies and groups. Identification of barley varieties. Economic and biological characteristics of cultivars.	2
12	Oat. Taxonomy and plant morphology. Oat species. Determination of oat grain type, colour, and hull content. Varieties. Economic and biological characteristics of cultivars.	2
13	Millet. Taxonomy and morphological characteristics. Species, subspecies, and varieties of millet. Economic and biological characteristics of common millet cultivars.	2
14	Maize. Botanical characteristics. Taxonomy and morphological characteristics of plants. Structural features of the panicle and ear. Determination of ear productivity. Identification of maize subspecies and varieties. Maize hybrids and cultivars and their economic and biological characteristics.	2
15	Sorghum and soriz. Botanical characteristics. Taxonomy and morphology. Economic and biological characteristics of groups, cultivars, and hybrids.	2
16	Rice. Taxonomy and morphological characteristics. Structural features of the root system. Subspecies, groups, and varieties. Cultivars.	2
17	Buckwheat. Taxonomy and plant morphology. Identification of species and varieties. Economic and biological characteristics of cultivars.	2
18	Development of the agronomic section of technological charts for the cultivation of cereal crops, including winter wheat, spring barley, maize, buckwheat, and others, using specific farms in Ukraine as examples.	2
19	General characteristics of grain legume crops. Morphological features. Identification of grain legume crops by seeds, seedlings, leaves, and fruits.	2
20	Pea. Taxonomy and morphological characteristics. Identification of species and varieties. Economic and biological characteristics of cultivars.	2
21	Soybean. Taxonomy and plant morphology. Subspecies, varieties, and field inspection groups. Economic and biological characteristics of cultivars.	2
22	Bean. Taxonomy and morphological characteristics. Species and varieties. Economic and biological characteristics of cultivars.	2
23	Lupin. Taxonomy and morphology. Species and varieties. Determination of seed alkaloid content. Cultivars and their economic and biological characteristics.	2
24	Faba bean and lentil. Taxonomy and morphological characteristics. Species, subspecies, varieties, cultivars, and their characteristics.	2
25	Chickpea and grass pea. Taxonomy and morphological traits. Species, subspecies, varieties, cultivars, and their characteristics.	2
26	Development of the agronomic section of technological charts for pea and soybean cultivation using a specific farm as an example.	2
27	Potato. Taxonomy and morphological traits of plant organs. Tuber structure. Economic and biological characteristics of potato cultivars. Determination of dry matter and starch content in tubers.	3
28	Jerusalem artichoke. Morphological traits.	2
29	Development of the agronomic section of a technological chart for potato cultivation using a specific farm as an example.	2
30	Fodder beet, fodder carrot, rutabaga, and turnip. Taxonomy and morphological	2

	characteristics. Anatomical structure of root crops. Identification of root crops by seedlings, fruits, and seeds. Determination of plant density, biological yield, and yield structure.	
31	General characteristics of cucurbit crops. Identification of pumpkins, watermelons, and melons by seeds, seedlings, and fruits.	2
32	General characteristics of root crops. Sugar beet. Features of the morphological and anatomical structure of first-year sugar beet plants.	2
33	Sugar beet. Features of the morphological and anatomical structure of second-year sugar beet plants.	4
34	Sugar beet. Technological chart for sugar beet cultivation. Biological yield and its structure; determination of plant density, seeding rate, sowing unit, juice purity, and factory sugar yield.	2
35	General features of oilseed crops. Identification of oilseed crops by fruits, seeds, seedlings, stems, and leaves.	2
36	Botanical and morphological characteristics of sunflower. Structural features of sunflower plants; identification of sunflower groups, achene armour layer, and hull content. Technological chart for sunflower cultivation.	2
37	Botanical and morphological characteristics of mustard, rapeseed, and camelina.	2
38	Botanical and morphological characteristics of poppy, safflower, and castor bean.	2
39	Botanical and morphological characteristics of sesame, peanut, perilla, and Lallelantia.	8
41	Botanical and morphological characteristics of essential-oil crops.	2
42	Fibre crops. Fibre flax. Botanical and morphological characteristics.	2
43	Botanical and morphological characteristics of hemp, cotton, and kenaf.	4
44	Botanical and morphological characteristics of tobacco, makhorka, and hop.	4
45	Botanical and morphological characteristics of medicinal crops.	4

5. Topics of self-study

№	Topic title	Hours
1	Agrobiological Foundations of Intensive Technologies for Growing Agricultural Crops	2
2	Agrotechnological Foundations of Crop Production	3
3	Fundamentals of Programmed Yield Formation in Agricultural Crops	4
4	Fundamentals of Seed Science	4
5	Winter Cereals. General Characteristics	10
6	Spring Cereals and Pseudo-Cereal Crops	10
7	Grain Legume Crops	10
8	Tuber Crops	8
9	Root Crops	8
10	Cucurbit Crops	4
11	Sugar Crops	8
12	Sugar Beet	8
13	Oilseed Crops	12
14	Essential-Oil Crops	6
15	Fibre Crops	2
16	Aromatic Crops	2
17	Medicinal Plants	2
18	Phytoenergy Crops	2

6. Methods of assessing expected learning outcomes:

- oral or written survey;
- interview;
- test;
- defending practical, design/graphical works, projects;
- self-assessment;
- other types.

7. Teaching methods:

- practice oriented studying method;
- case method;
- learning discussions and debates method;

8. Results assessment.

The student's knowledge is assessed by means of a 100-point scale converted into the national grades according to the "Exam and Credit Regulations at NULES of Ukraine" in force

8.1. Distribution of points by types of educational activities

Educational activity	Results	Assessment
Module 1._ SCIENTIFIC FOUNDATIONS OF MODERN AND SUSTAINABLE CROP PRODUCTION.		
Laboratory work 1-2.	Assess the potential yield of agricultural crops, calculate the photosynthetically active radiation (PAR) utilization coefficient, and forecast yield based on incoming solar radiation.	15
Laboratory work 3.	Prepare the agronomic section of a technological chart for cultivating a field crop, taking into account crop requirements, zonal characteristics, and elements of programmed yield.	10
Laboratory work 4-6.	Determine seed sowing qualities (purity, impurities, germination capacity, viability, moisture content, thousand-seed weight, disease infection, and pest infestation) and conduct laboratory varietal control to establish seed authenticity.	15
Independent work 1-4.	Understand the agrobiological and agrotechnological foundations of growing agricultural crops, possess knowledge of seed science and yield programming, and apply intensive technologies to increase crop productivity, taking into account varietal characteristics and growing conditions.	30
Module control work 2.	Compare and evaluate modern scientific and technological achievements in the field of agronomy. Demonstrate knowledge and understanding of fundamental disciplines to the extent necessary for mastering relevant skills in agronomy. Demonstrate knowledge and understanding of the principles of physiological processes in plants to the extent necessary for mastering fundamental and professional disciplines. Possess, at an operational level, methods of observation, description, identification, classification, as well as cultivation of objects and maintenance of agrocenosis stability while preserving natural diversity.	30
Total for module 1		100
Module 2. CEREAL AND GRAIN LEGUME CROPS.		
Laboratory work 7.	Identify cereal crops by morphological and biological traits; determine generic and group differences among cereals based on grain structure, sprouts, seedlings, auricles, and ligules; and determine growth phases and stages of organogenesis of cereal crops in practice.	5
Practical work 8-17.	Conduct taxonomic identification of cereal crops, determine their morphological traits, classify species and varieties, and analyse the economic and biological characteristics of leading cultivars, taking into account their prospects for intensive cultivation.	25
Laboratory work 18.	Based on the analysis of soil and climatic conditions, develop agronomic sections of technological charts for intensive cultivation of cereal crops adapted to the regional conditions of specific agricultural enterprises in Ukraine.	5
Laboratory work 19.	Identify grain legume crops by morphological traits of seeds, seedlings, leaves, and fruits, and characterize them with due consideration of their biological features.	5
Laboratory work 20-25.	Know the classification of grain legume crops, determine their morphological traits, identify species and varieties, and analyse the economic and biological characteristics of cultivars, considering their adaptive and productive properties.	20
Laboratory work 26.	Master the methodology for developing technological charts for grain legume crop cultivation, taking into account regional soil and climatic characteristics, biological properties of crops, and the production specifics of a particular agricultural enterprise.	5
Independent work 5-7.	Identify cereal and grain legume crops, understand their biological characteristics, and develop elements of cultivation technology.	5
Module control work 2.	Demonstrate knowledge and understanding of fundamental disciplines to the extent necessary for mastering relevant skills in agronomy. Possess, at an operational level, methods of observation, description, identification, classification, as well as cultivation of objects and maintenance of agrocenosis stability while preserving natural diversity. Analyse and integrate knowledge from general and specialized professional training to the extent necessary for specialized professional work in agronomy. Initiate prompt and appropriate solutions to production problems in accordance with zonal conditions. Design and organize measures for growing high-quality agricultural products in accordance with current	30

	requirements. Integrate and improve production processes for growing agricultural products in accordance with current requirements. Plan economically profitable agricultural production.	
MODULE 3 - ROOT CROPS, TUBER CROPS, AND CUCURBIT CROPS		
Laboratory work 27.	Master the morphological and biological features of potato, analyse tuber structure, characterize the economic and biological properties of cultivars, and carry out laboratory determinations of dry matter and starch content in tubers.	10
Laboratory work 28.	Know the morphological traits and biological features of Jerusalem artichoke, and develop a technological chart for potato cultivation with consideration of soil and climatic conditions.	10
Laboratory work 29.	Master the morphological traits of fodder beet, fodder carrot, rutabaga, and turnip; study the anatomical structure of their root crops; identify crops by seedlings and seeds; and determine plant density, biological yield, and its structure.	30
Laboratory work 30.	Know the characteristics of cucurbit crops and identify pumpkins, watermelons, and melons by morphological traits of seeds, seedlings, and fruits.	10
Independent work 8-10.	Know the morphological and anatomical traits of root crops, tuber crops, and cucurbit crops.	10
Module test 3.	Possess, at an operational level, methods of observation, description, identification, classification, as well as cultivation of objects and maintenance of agrocenosis stability while preserving natural diversity. Analyse and integrate knowledge from general and specialized professional training to the extent necessary for specialized professional work in agronomy. Initiate prompt and appropriate solutions to production problems in accordance with zonal conditions. Design and organize measures for growing high-quality agricultural products in accordance with current requirements. Integrate and improve production processes for growing agricultural products in accordance with current requirements. Plan economically profitable agricultural production.	30
Total for Module 3.		100
MODULE 4 - INDUSTRIAL CROPS AND PRODUCTION OF STRATEGIC CROP-BASED RAW MATERIALS		
Practical work 31-33.	Know the morphological and anatomical structure of first- and second-year beet plants, assess biological yield and the structure of root crops, and analyse juice quality and factory sugar yield.	40
Independent work 11-12.	Characterize the biological and economic-technological features of sugar crops, particularly sugar beet; determine the morphological and anatomical traits of plants; assess raw material quality by dry matter and starch content; and apply methods for productivity control and cultivation technology.	30
Module test 4.	Assess the biological and economic-technological features of sugar crops, determine the morphological traits of sugar beet, and control raw material quality.	30
Total for Module 4.	Possess, at an operational level, methods of observation, description, identification, classification, as well as cultivation of objects and maintenance of agrocenosis stability while preserving natural diversity. Analyse and integrate knowledge from general and specialized professional training to the extent necessary for specialized professional work in agronomy. Initiate prompt and appropriate solutions to production problems in accordance with zonal conditions. Design and organize measures for growing high-quality agricultural products in accordance with current requirements. Integrate and improve production processes for growing agricultural products in accordance with current requirements. Plan economically profitable agricultural production.	100
MODULE 5 - OILSEED AND ESSENTIAL-OIL CROPS		
Laboratory work 34.	Be able to determine the general features of oilseed crops and identify them by morphological traits of fruits, seeds, seedlings, stems, and leaves.	10
Laboratory work 35.	Conduct botanical and morphological characterization of sunflower; determine its structure, groups, achene armour layer, and hull content; and develop the agronomic section of a technological chart for cultivating the crop.	10
Laboratory work 36-38.	Know the morphological characteristics of the main oilseed crops and identify them by vegetative and generative organs, as well as distinguish species-specific features for subsequent application in production practice.	20
Laboratory work 39-40.	Conduct botanical and morphological characterization of essential-oil crops; recognize them by morphological traits of plant organs; determine zones of essential oil accumulation; and establish species-specific features important for agricultural production and raw material processing.	20
Independent work 13-14.	Be able to identify oilseed and essential-oil crops by morphological traits, carry out their botanical and morphological characterization, determine economic and biological features, cultivation zones, and main directions of use in the food, technical, and pharmaceutical industries.	10
Module test 5.	Possess, at an operational level, methods of observation, description, identification, classification, as well as cultivation of objects and maintenance of agrocenosis stability while preserving natural diversity. Analyse and integrate knowledge from general and specialized professional training to the extent necessary for specialized professional work in agronomy. Initiate prompt and appropriate solutions to production problems in accordance with zonal conditions. Design and organize measures for growing high-quality agricultural products in accordance with current requirements. Integrate and improve production processes for growing agricultural products in accordance with current requirements. Plan economically profitable agricultural production.	30
Total for Module 5.		100
MODULE 6 - FIBRE, AROMATIC, MEDICINAL, AND PHYTOENERGY CROPS		
Laboratory work 41-42.	Conduct botanical and morphological characterization of the main fibre crops - fibre flax, hemp, cotton, and kenaf; identify them by morphological traits of vegetative and generative organs; and distinguish economically important biological features related to fibre quality.	20
Laboratory work 43.	Carry out botanical and morphological characterization of tobacco, makhorka, and hop; determine species affiliation by traits of vegetative and generative organs; and analyse structural features relevant to cultivation and technological use.	10
Laboratory work 44.	Conduct botanical and morphological characterization of medicinal crops; identify them by morphological traits of vegetative and generative organs; determine plant parts used as raw material; and evaluate their importance for medical and pharmaceutical use.	10

Laboratory work 45.	Carry out botanical and morphological characterization of phytoenergy crops; identify them by morphological traits; analyse structural features of organs that determine energy value; and justify the feasibility of their use in bioenergy.	10
Independent work 15-18.	Conduct botanical and morphological characterization of fibre, aromatic, medicinal, and phytoenergy crops; identify them by morphological traits; determine economic and biological features and directions of use in various sectors of the economy.	20
Module test 6.	Possess, at an operational level, methods of observation, description, identification, classification, as well as cultivation of objects and maintenance of agrocenosis stability while preserving natural diversity. Analyse and integrate knowledge from general and specialized professional training to the extent necessary for specialized professional work in agronomy. Initiate prompt and appropriate solutions to production problems in accordance with zonal conditions. Design and organize measures for growing high-quality agricultural products in accordance with current requirements. Integrate and improve production processes for growing agricultural products in accordance with current requirements. Plan economically profitable agricultural production.	30
Total for Module 6.		100
Learning activities	$(M1 + M2)/6 * 0.7 \leq 70$	$(M1 + M2)/6 * 0.7 \leq 70$
Total for module 2		100
Class work	$(M1 + M2)/2 * 0.7 \leq 70$	
Exam/credit		30
Total for year	(Class work + exam) ≤ 100	
Course project (work) (if included in the curriculum)		100

8.2. Scale for assessing student's knowledge

Student's rating, points	National grading (exam/credits)
90-100	excellent
74-89	good
60-73	satisfactory
0-59	unsatisfactory

8.3. Assessment policy

Deadlines and exam retaking rules	works that are submitted late without valid reasons will be assessed with a lower grade. Module tests may be retaken with the permission of the lecturer if there are valid reasons (e.g. a sick leave).
Academic integrity rules	cheating during tests and exams is prohibited (including using mobile devices). Term papers and essays must have correct references to the literature used
Attendance rules	Attendance is compulsory. For good reasons (e.g. illness, international internship), training can take place individually (online by the faculty dean's consent)

9. Teaching and learning aids

1. Electronic educational resource for the academic discipline "Plant Science" on the NULES of Ukraine eLearn educational portal. URL: <https://elearn.nubip.edu.ua/enrol/index.php?id=4563>
2. Kharchenko, O. V., Prasol, V. I., Kravchenko, S. M., & Mokriienko, V. A. (2023). Agro-economic and ecological foundations of forecasting and programming the yield level of agricultural crops: Educational manual (O. V. Kharchenko, Ed.). Sumy: Universytetska Knyha. 240 p.
3. Kalenska, S. M., Dmytryshak, M. Ya., & Mokriienko, V. A. (2020). Cereal and grain legume crops: Educational manual. Vinnytsia: TVORY LLC. 366 p.

4. Kalenska, S. M., Novytska, N. V., Sonko, R. V., & Karpenko, L. D. (2024). Seed science: Educational manual. Kyiv: Komprynt Printing Centre LLC. 469 p.
5. Kalenska, S. M., Rakhmetov, D. B., Novytska, N. V., Yunyk, A. V., Mokriienko, V. A., Harbar, L. A., Antal, T. V., Honchar, L. M., Pylypenko, V. S., & Karpenko, L. D. (2022). Energy and raw-material plant resources: Educational manual. Kyiv: Komprynt Printing Centre LLC. 322 p.
6. Kalenska, S. M., Dmytryshak, M. Ya., Mokriienko, V. A., et al. (2023). Plant Science with fundamentals of forage production and agrometeorology. Part 1: Textbook. Kyiv: Printeko. 610 p.
7. Kalenska, S. M., Mokriienko, V. A., & Antal, T. V. (2024). Plant Science: Educational manual. Kyiv: Printeko. 562 p.
8. Kalenska, S. M., Yunyk, A. V., Honchar, L. M., et al. (2024). Plant Science: Methodological recommendations for completing a course paper in Plant Science for higher education students in field of knowledge 20 "Agricultural Sciences and Food", specialty 201 "Agronomy", first (bachelor's) educational level. Kyiv: Publishing Centre of NULES of Ukraine. 66 p.

10. Recommended sources of information

(the use of outdated information sources and those of the aggressor country is not recommended)

1. Kalenska, S. M., Honchar, L. M., Mokriienko, V. A., Novytska, N. V., Harbar, L. A., Zavorodnia, S. V., & Sonko, R. V. (2023). Express methods for determining the potential yield of agricultural crops: Scientific and production recommendations. 43 p.
2. Kalenska, S. M., Rakhmetov, D. B., Honchar, L. M., Yunyk, A. V., Mazurenko, B. O., Harbar, L. A., Stoliarchuk, T. A., & Hordyna, N. (2021). Technologies for growing minor oilseed crops. 33 p.
3. Kalenska, S. M., Honchar, L. M., Yunyk, A. V., Harbar, L. A., Mokriienko, V. A., Mazurenko, B. O., & Pylypenko, V. S. (2022). Technologies for growing castor bean, soybean, sunflower, sea kale, chufa, winter and spring rapeseed. Technological charts (scientific and practical recommendations). Kyiv. 31 p.
4. Palamarchuk, V. D., Doronin, V. A., Kolisnyk, O. M., & Aliksieiev, O. O. (2022). Fundamentals of seed science (theory, methodology, practice): Monograph. Vinnytsia: Druk LLC Printing House. 392 p.
5. Petrenko, O. S. (2021). Digital technologies in crop production: Theory and practice. Kharkiv: Osnova. 280 p.
6. Petrychenko, V. F., & Lykhochvor, V. V. (2020). Plant Science. New technologies for growing field crops: Textbook (5th ed., revised and expanded). Lviv: Ukrainian Technologies. 806 p. URL: https://www.fri.vin.ua/download_materials/PLANT_GROWING.pdf
7. Food and Agriculture Organization of the United Nations. URL: <https://www.fao.org/home/en>.