NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE

Department of Storage, Processing and Standardization
of Plant Products after prof. B.V. Lesik

"CONFIRMED"
Dean of the Agrobiological Faculty
_____Oksana Tonha
"___" _____2023p.

"APPROVED"
at the meeting of the department of Storage,
Processing and Standardization of Plant Products
Protocol №4 dated "25" 04 2023 p.
Head of Department
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"REVIEWED "
Program Coordinator EP "Agronomy"
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PROGRAM OF THE COURSE
"Technology of storage and processing of crop products"

Specialization	201 "Agronomy»
Educational program	Agronomy
Faculty (Institute)	Agronomy
Developers:	Sergiy Gunko, PhD, associate professor (position, academic degree, academic title)

Kyiv – 2023

1. **Description of the course**
"Technology of storage and processing of crop products"

Field of knowledge, specialization, educational program, educational degree		
Educational degree	*Bachelor's*	
Specialization	*201 Agronomy*	
Educational program	*Agronomy*	
Characteristics of the course		
Type	Compulsory	
Total number of hours	150	
Number of ECTS credits	5	
Number of content modules	4	
Course project (work) (if applicable)	–	
Form of assessment	*Exam*	
Indicators of the course for full-time and part-time forms of study		
	Full-time form of study	Part-time form of study
Course (year of study)	4	
Semester	7	
Lecture classes	*45 hr.*	*hr.*
Practical, seminar classes	– *hr.*	*hr.*
Laboratory classes	*60 hr.*	*hr.*
Self-study	*45 hr.*	*hr.*
Individual assignments	– *hr.*	*hr.*
Number of weekly classroom hours for the full-time form of study	*7 hr.*	

2. Purpose, objectives, and competencies of the course

Technology of storage and processing of crop production is a specialized discipline that studies post-harvest processing technologies for grains, legumes, cereals, oilseeds, sugar beets, fiber crops, hops, tobacco, snuff, fruits, vegetables, and short-term and long-term storage techniques. It covers the fundamentals of processing and is the final subject after studying the technology of growing grains, legumes, cereals, technical crops, vegetables, and fruits.

The discipline is based on fundamental disciplines such as chemistry, physiology, and physics and is closely related to disciplines such as agricultural machinery, crop science, vegetable growing, fruit growing, and is a foundation for studying economic and technical disciplines by students of all faculties with a specialization in "Agronomy".

Purpose: formation of specialists with knowledge of the complete process of crop production, which does not end with harvesting but requires continuation - post-harvest processing, storage, and processing technologies. In the case of seasonal production, only high-quality preservation and processing of the products ensure year-round food for humans, feed for livestock, and raw materials for the processing industry.

After studying this academic discipline, the student **should know**:

- Modern scientific and technical achievements in the field of agronomy;
- Fundamental disciplines to the extent necessary for acquiring the relevant skills in agronomy;
- Knowledge of general and specialized professional training to the extent necessary for specialized professional work in the field of agronomy;
- Measures for growing high-quality agricultural products in accordance with current requirements;
- Production processes for growing agricultural products in accordance with current requirements.

To be able to:

- Compare and evaluate modern scientific and technical achievements in the field of agronomy;
- Demonstrate knowledge and understanding of fundamental disciplines to the extent necessary to possess relevant skills in agronomy;
- Analyze and integrate knowledge from general and specialized professional training to the extent necessary for specialized professional work in the field of agronomy;
- Initiate timely and effective solutions to production problems;
- Design and organize measures for the cultivation of high-quality agricultural products;
- Integrate and improve production processes for the cultivation of agricultural products in accordance with current requirements;
- Plan economically viable production of agricultural products.

Acquisition of competencies:

Integrated competency (IC): The ability to solve complex specialized tasks and practical problems in agronomy, which involves the application of theories and methods of the relevant science and is characterized by complexity and compliance with zonal conditions.

General competencies (GC): Knowledge and understanding of the subject area and professional activity; Ability to apply knowledge in practical situations; Skills for performing safe activities; Ability to search for, process, and analyze information from various sources.

Professional (special) competencies (PC): The ability to cultivate, propagate, and manage agricultural crops, and carry out technological operations for primary processing and storage of products; the ability to apply knowledge and understanding of physiological processes of agricultural plants to solve production and technological tasks; the ability to manage complex actions or projects, with responsibility for making decisions in specific production conditions.

Program learning outcomes (PLO): PLO 4. Compare and evaluate modern scientific and technical achievements in the field of agronomy; PLO 6. Demonstrate knowledge and understanding of fundamental disciplines to the extent necessary to possess relevant skills in the field of agronomy; PLO 10. Analyze and integrate knowledge from general and specialized professional training to the extent necessary for specialized professional work in the field of agronomy; PLO 11. Initiate timely and appropriate solutions to production problems in accordance with zonal conditions. PLO 13. Design and organize events for the cultivation of high-quality agricultural products in accordance with current requirements; PLO 14. Integrate and improve production processes for the cultivation of agricultural products in accordance with current requirements; PLO 15. Plan economically viable production of agricultural products.

The curriculum for the bachelor's degree program in Agronomy includes 150 hours of study for the course "Technology of storage and processing of crop production", including 105 hours of classroom lectures. The final exam is the form of assessment. An Educational and Methodological Complex (EMC) has been developed and certified for this course: https://elearn.nubip.edu.ua/course/view.php?id=2742

3. Program and structure of the course for:

– complete full-time (part-time) form of study;

– shortened full-time (part-time) form of study.

3.1. Program of the course.

Module 1. The tasks of the crop production preservation and processing industry.

Lecture 1. The significance of the crop production preservation and processing industry. The characteristics of the crop preservation and processing sectors. The history of the development of the industry, course, and science. Scientific principles of crop preservation.

Lecture 2. Grain mass as an object of post-harvest processing and storage. The chemical composition of the main component of the grain mass. Characteristics of other components of the grain mass.

Lecture 3. Physical and physiological properties of grain mass. Grain mass self-heating. Physical properties of grain mass. Physiological processes that occur in grain masses during storage. Grain mass self-heating.

Module 2. Post-harvest treatment, storage, and processing of grain (seeds).

Lecture 1. Post-harvest treatment of grain mass. Technology for preparing grain mass for long-term storage. Grain cleaning. Characteristics of current technological lines for grain cleaning. Features of grain cleaning technology for individual crops.

Lecture 2. Active ventilation of grain mass. Grain drying, drying regimes, and methods. Basics of active ventilation of grain mass. Types of equipment for active ventilation. Technology and regimes of active ventilation. Technological features of grain drying. Heat drying technology. Features of grain drying for different crops.

Lecture 3. General principles of plant raw material preservation. Storage of grain and seeds in a dry state. Storage of grain mass in a chilled state. Storage of grain mass without air access. Chemical preservation of grain mass. Methods of storing grain mass. The main types of grain storage facilities. Features of storing grain for individual crops.

Lecture 4. Basics of Grain Processing for Flour and Bread Production. Flour Production. Grain - raw material for the flour industry. Yield and types of flour. Preparation of grain for milling. Types of milling. Production of wheat and rye flour. Flour storage. History of bread making industry. Bread-making properties of flour. Bread preparation technology. Bread storage. Quality indicators of bread.

Lecture 5. Basics of Processing of Cereals and Oilseed Crops. Technology of cereal production. Quality indicators of cereal grains. Production of cereals on agricultural-type grain cleaners. Requirements for the quality of cereals. Cereal storage. Nutritional and technical value of oilseed crops. Oil production technology. Quality indicators of oil.

Module 3. Post-harvest processing, storage and processing of fruit and vegetable products.

Lecture 1. Post-harvest processing and storage of vegetable crops: root, cabbage, onion, fruit, and green vegetables. Chemical composition of vegetable products and the importance of individual substances for their storage and processing. General morphological and physiological features of storage objects. General processes that occur in the mass of vegetable products during storage. Characteristics of storage modes. Methods of storing vegetable products. Technological features of simple storages - pits and trenches. Characteristics of complexes for product storage. Characteristics of stationary storages. Characteristics of refrigerated storages. Refrigerated storages with regulated or modified gas environment.

Lecture 2. Post-harvest processing and storage of potato tubers. Effect of cultivation factors on the quality and storage of tubers. Harvesting and post-harvest processing of potato tubers. Characteristics of potatoes as a storage object. Differentiated storage regime for tubers. Methods of storing tubers. Storage of potatoes in bags, pits, cellars, refrigerated storages, and refrigerated storages with regulated or modified gas environment. Quality indicators of stored potatoes.

Lecture 3. Features of post-harvest processing and storage of fruit and berry products. Chemical composition of fruit and berry products and the significance of individual substances for their storage and processing. General morphological and physiological characteristics of storage objects. General processes that occur in the mass of fruit and berry products during storage. Characteristics of storage regimes. Methods for storing fruit and berry products. Characteristics of complexes for storing products. Characteristics of stationary storage facilities. Characteristics of refrigerated storage facilities. Refrigerated storage facilities with regulated or modified gas environments.

Lecture 4. Basics of processing fruit and vegetable products. Classification of methods of preservation. Basic technical requirements for preservation. Preparation of raw materials for preservation. Microbiological methods of preservation. Physical methods of preservation. Preservation with sugar. Chemical preservation.

Module 4. Post-harvest processing, storage and processing of technical crops raw materials and feed production.

Lecture 1. Basics of post-harvest processing, storage, and processing of technical raw materials: sugar beets, flax, tobacco, hops, cannabis, and essential oils. Chemical composition of sugar beets. Processes that occur in sugar beets during storage. Methods for storing sugar beets. Sugar production technology. Progressive technologies for primary processing and storage of flax fiber. Technologies for harvesting and primary processing of flax stems. Methods of storing husks. Basics of husk fiber processing technology. Technology for harvesting and post-harvest processing of hops. Harvesting hops. Active ventilation of hop cones. Drying hop cones. Conditioning cones. Sulfiting hops. Dense pressing and storage of hops. Preservation of unsalted hop cones. Basics of tobacco and cigar production technology, including harvesting and primary processing. Tobacco harvesting and post-harvest processing. Storage and sorting of tobacco. Fermentation of tobacco. Harvesting, post-harvest processing, and storage features of cigar tobacco.

Lecture 2. Basics of technology for the production and storage of mixed feeds and plant-based feeds. The impact of cultivation and production factors on the quality and preservation of raw materials. Mixed feeds. Production and storage of artificially dehydrated feeds. Grass meal. Grass silage. Harvesting of monofeeds. Basics of technology for the preservation of juicy grass feeds.

3.2. Structure of subject

Names of content modules and topics	Number of hours												
	Full-time form							Part-time form					
	weeks	total	including					total	including				
			l	p	lab	ind	self		l	p	lab	ind	self
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Content Module 1. The tasks of the crop production preservation and processing industry.													
Topic 1. The significance of the storage and processing of agricultural products.	1	10	2	–	4	–	4	34	1	–	–	–	10
Topic 2. Grain mass as an object of post-harvest processing and storage.	2	10	2	–	4	–	4			–	–	–	10
Topic 3. Physical and physiological properties of grain masses. Self-heating of grain masses.	3	11	3	–	4	–	4		1	–	–	–	10
Total for content module 1	31		7	–	12	–	12	34	2	–	–	–	30
Content Module 2. Post-harvest treatment, storage, and processing of grain (seeds)													
Topic 1. Post-harvest processing of grain crops.	4	8	2	–	4	–	2	28	2	–	–	–	8
Topic 2. Active ventilation of grain crops. Grain drying, regimes and methods of drying.	5	10	4	–	4	–	2			–	–	–	8
Topic 3. General principles of preserving plant raw materials.	6	8	2	–	4	–	2	28	4	–	–	–	8
Topic 4. Basics of grain processing for flour and bread baking.	7	12	4	–	4	–	4			–	–	–	10
Topic 5. Basics of processing of cereal and oilseed crops.	8	12	4	–	4	–	4			–	–	–	10
Total for content module 2	50		16	–	20	–	14	56	6		–	–	–
Content Module 3. Post-harvest processing, storage and processing of fruit and vegetable products.													
Topic 1. Post-harvest treatment and storage of vegetable crops.	9	14	4	–	6	–	4	20	2	2			8
Topic 2. Post-harvest treatment and storage of potato tubers.	10	8	2	–	4	–	2						8
Topic 3. Specifics of post-harvest treatment and storage of fruit and berry products.	11	14	4	–	6	–	4	20	2	2			8
Topic 4. Basics of processing fruit and vegetable products.	12	13	4	–	6	–	3						8
Total for content module 1	49		14	–	22	–	13	40	4	4			32
Content Module 4. Post-harvest processing, storage and processing of technical crops raw materials and feed production.													
Topic 1. Basics of post-harvest processing, storage, and processing of technical raw materials.	13	12	4	–	4	–	4	10	1	–	–	–	8
Topic 2. Basics of technology for the production and storage of mixed feeds and plant-based feed.	14	8	4	–	2	–	2	10	1	–	–	–	8
Total for content module 2	20		8	–	6	–	6	20	2	–	–	–	16
Total hours	150		45	–	60	–	45	150	14	–	–	–	128
Course project (work) on_____ (if included in the curriculum)	–		–	–	–	–	–	–	–	-	-	–	-
Total hours	150		45	–	60	–	45	150	14	–	–	–	128

4. Laboratory class topics

№	Topic title	Number of hours
1	Selection of spot samples, preparation of composite and daily samples	2
2	Organoleptic (sensory) evaluation of grain	2
3	Determination of grain infestation by granary pests and damage by the corn bug	2
4	Determination of grain test weight	2
5	Determination of grain moisture content	2
6	Determination of impurities in grain (seeds)	2
7	Identification of types and subtypes of cereal crops	2
8	Determination of quantity and quality of crude gluten in wheat grain	2
9	Determination of autolytic activity of grain and flour by Hagberg Falling Number	2
10	Technological calculations for grain and seed cleaning	2
11	Technological calculations for grain and seed drying	2
12	Active ventilation of grain masses.	2
13	Storage of grain (seeds)	2
14	Quantitative and qualitative accounting of grain	4
15	Calculations for grain based on its quality	2
16	Evaluation of the quality of cereals	4
17	Determination of flour quality	2
18	Evaluation of flour quality by laboratory test baking	6
19	Determination of potato quality	2
20	Storage of potatoes and vegetables in temporary (field) storage facilities	2
21	Organization of fruit and vegetable storage	4
22	Production of sauerkraut	4
23	Evaluation of the quality of sugar beets for technical purposes	2
24	Evaluation of flax fiber quality	2
	Total	60

5. Independent work topics

№	Topic title	Number of hours
1	Working with standards, studying quality indicators normalization.	4
2	Microorganisms and pests of grain reserves. Their role in grain and seed storage. Preparation for laboratory classes in the workshop.	4
3	Respiration of grain masses. Preparation for laboratory classes in the workshop.	4
4	Familiarization with normalization of grain impurities. Preparation for laboratory classes in the workshop.	4
5	Technological properties of special post-harvest processing lines. Preparation for laboratory classes in the workshop.	4
6	Characteristics of storage facilities for storage of grain of different crops.	6
7	Features of drying legume and technical crops. Preparation for laboratory classes in the workshop.	4
8	Dependence of flour quality on the influence of entomo - and phytopathological factors on grain. Preparation for laboratory classes in the workshop.	4
9	Main quality indicators of oil and oilseed crops. Preparation for laboratory classes in the workshop.	4
10	Impact of cultivation factors on the quality and storability of tubers. Features of storage of carrot, beet, and other root crops. Preparation for laboratory classes in the workshop.	6
11	New and environmentally friendly schemes for processing fruit and vegetable products. Preparation for laboratory classes in the workshop.	5
12	Features of storage of different types of fruit and berry products. Preparation for laboratory classes in the workshop.	4
13	Fundamentals of post-harvest processing, storage, and processing of raw materials for rare technical crops. Preparation for laboratory classes in the workshop.	4
14	Fundamentals of post-harvest processing and storage of feed. Preparation for the exam.	4
	Total	45

6. Samples of control questions, tests for assessing the level of knowledge acquisition by students.

TASK 1.
Calculate the capacity of the granary for storing 5000 tons of barley and 2000 tons of food wheat. Permissible loading height of fodder barley - 4 m, wheat - 3 m; nature 650 and 760 g/l, respectively. The working width of the warehouse is 20 m, the length is 50 m. Determine the length of the warehouse necessary for loading wheat and barley grain.
TASK 2.
Determine how many bins can be made in a warehouse that has a useful length of 40 m, a total width of 10 m, an aisle width of 2 m, and a distance from the walls of 0.5. The length of the bins is 3 and 6 m. Determine the volume of oat and rye grains in one bin, if its nature is 480 and 700 g/l, respectively, and the loading height is 2 m.
TASK 3.
Calculate the productivity of the OVS-25 grain cleaning machine when working with wheat grain with purity of 86% and moisture content of 20%, if the planned productivity is 25 t/h.
TASK 4.
To evaluate the quality of the grain cleaning machine, if the grain material to be cleaned had the following composition: grain of the main crop Zm - 83.5%, large impurities A1 - 12.9%, seeds of other cultivated plants B2 - 1.8%, weed seeds B3 – 0.9%, mineral admixture – 0.9%.

1. Chemical composition of grain of bread cereals, influence of chemical composition on quality.
2. Classification of grain and seeds by chemical composition. Dependence of grain storage and processing on chemical composition.
3. Technological properties of frostbite, sprouted grain and grain damaged by the shell bug.
4. Ways of improving the quality of grain masses.
5. Characteristics of grain mass as a storage object.
6. Classification of grain mass properties. Physical properties and their importance in the practice of grain storage.
7. Flowability, self-sorting and sorption properties of grain mass, their practical significance in grain storage.
8. Post-harvest ripening of grain and its importance during storage and processing. Conditions affecting the post-harvest ripening process.
9. Respiration of grain during storage, factors affecting its intensity.
10. Effect of gas exchange products on stored grain. Losses of grain dry matter as a result of respiration.
11. Germination and aging of grain during storage and measures to prevent these phenomena.
12. Species composition and characteristics of grain mass microflora.
13. Characteristics of modes and methods of storage of grain masses used in Ukraine
14. Conditions favoring the development of microorganisms in grain mass. Damage caused by microorganisms.
15. Damage caused to the grain mass by collared pests. Ways of contamination of grain and granaries by these pests.
16. Protection of grain mass from pests of grain stocks.
17. The phenomenon and essence of the process of self-heating of grain masses, as well as the conditions contributing to its occurrence. Types of warming up.
18. The influence of self-heating on the quality of seed and food grains. Types and phases of its development. Measures to combat self-heating of grain.
19. Get acquainted with the methods of determining the contamination of grain by pests of grain stocks.

20. To study how the indicator of contamination of grain by collared pests is regulated by the existing grain standards.
21. Get acquainted with the method of determining the contamination of grain of the main crops by collared pests (infection of grain by collared weevil and mite in an obvious form, contamination of grain by pests in a hidden form (wheat - weevil, legumes - Bruchus). Study the signs of wheat grain damage by a harmful beetle
22. To study the concept of the nature of the grain and the factors affecting the nature. Get acquainted with the method of determining nature.
23. Familiarize yourself with the methods of calculating discounts that are used for wheat grain that is dry-warped and severely damaged by the shell bug with a sharply reduced quality.
24. Familiarize yourself with the methods of determining humidity.
25. To study what is meant by the terms critical and equilibrium grain moisture. To study the division of grain according to the state of moisture.
26. Get acquainted with the method of determining the moisture content of corn in the cob.
27. Familiarize yourself with the methods provided by the state standards for determining grain contamination of various crops.
28. Familiarize yourself with the grain standard for wheat, rye, peas, corn, millet, and rice and their division into types and subtypes.
29. To study the procedure for determining the vitreousness of wheat grain using a diaphanoscope.
30. To study the concept of wheat gluten and its quality.
31. Learn the method of determining the quantity and quality of gluten.
32. Familiarize yourself with the terms soft and hard, "strong" and "valuable" wheat.
33. To study the normalization of the number of fall by standards for wheat and rye grain.
34. Theoretical foundations of grain storage in a dry state.
35. General characteristics of the principles and methods of drying grain masses.
36. Drying of seed and food grains of the most important agricultural crops. Drying mode and control.
37. Modes of drying grain and seeds. The choice of drying mode depends on the culture, quality and purpose.
38. Characteristics of the main types of grain dryers used in agriculture.
39. Theoretical foundations of grain drying.
40. Technological process and methods of drying seed material on mine dryers.
41. Technological process and methods of drying seed material on drum dryers.
42. Active ventilation of grain masses. Basics of application and types of installations.
43. Conditions and modes of active ventilation of grain masses for the purpose of cooling.
44. Conditions and regimes of active ventilation of grain masses for the purpose of drying and drying.
45. To study the procedure of giving and receiving grain.
46. Using DSTU, learn to determine the class of grain.
47. Determine the cost of 1 ton of grain depending on the results of the analysis.
48. To study the method of determining the intensity of grain respiration.
49. Learn the concept of active ventilation and the functions of active ventilation.
50. To study the principle of the method of active ventilation and devices for its implementation.
51. To study the procedure for calculating the size of the working area for grain ventilation with a floor-portable installation.
52. To study the procedure for determining the expediency of grain mass ventilation using tablets and nomograms.
53. Get acquainted with the method of determining the duration of cooling and drying of grain mass.
54. Processing of grain into groats. Schemes are technological.

National University of Life and Environmental Sciences of Ukraine

ED Bachelor's Specialization *201 Agronomy*	Department of Storage, Processing and Standardization of Plant Products	**Examination test № _ Subject "Technology of storage and processing of crop products"**	**APPROVED** Head of department of Storage, Processing and Standardization of Plant Products (sign) **Hrigoriy Podpriatov** _____20__p.

Exam questions

1. *Characteristics of the branches of storage and processing of plant products.*

2. *Methods of cooling grain masses with atmospheric air.*

Test tasks

1. **Bread-receiving companies for long term storage of grain are called:**	
2. During the storing of plant production we distinguish the following types of losses:	
1	In the weight
2	In the quality
3	Destruction by rodents
4	Destruction by birds
5	Self-heating
3. . Mechanical types of losses occur due to:	
1	Destruction by birds
2	Spraying, strewing, injuring
3	Self-heating
4	Destruction by rodents
5	Destruction by ticks, destruction by birds
4. The composition of components of grain mass does not include:	
1	Wet
2	Impurities
3	**Grain of basic crop**
4	Microorganisms
5	Insects and ticks
5. According to the principles of storage (canning) of plant production by Ya. Nikitinskyy, storage and transporting of whole, living organisms, to the processing time is called:	
6. Grain mass is kept well with the humidity:	
1	Critical
2	Above the critical
3	Average
4	High
5	Low

7. Divide according to the chemical composition the following cultures into groups:	
А. Rich in protein	1. Rye
	2. Soybean
Б. Rich in starch	3. Buckwheat
	4. Oat
	5. Beans

8. Chemical composition of grain mass affect its hygroscopicity:	
1	Yes
2	No
9. Which is term of ripening of oats in optimal conditions:	
10. Which chemical substances are used for chemical canning of wet grain intended for forage purposes:	
1	Sulphuric acid
2	Propionic acid
3	Benzoic acid
4	Ant acid
5	Sorbic acid

7. Teaching methods

Methods of organization and implementation of educational and cognitive activities of students, which are used in the study of the discipline: "Technology of storage and processing of plant products":

1. in the aspect of transmission and perception of educational information:
- verbal (lecture);
- visual (illustration, demonstration);
- practical (laboratory works);
2. in terms of logic and thinking:
- explanatory and illustrative (presentation);
- reproductive (short control tests);
3. in terms of training management:
- educational work under the guidance of a teacher;
- independent work under the guidance of a teacher;
4. in terms of team activity:
- methods of stimulation (additional points for essays, participation in Olympiads, conferences);
5. in terms of independent activity:
- educational module: structural and logical schemes;
selective tests.

8. Forms of assessment

Forms of control of students, which are used when studying the discipline: "Technology of storage and processing of plant products": current, borderline and final control.

Current control of knowledge is an organic part of the entire pedagogical process and serves as a means of detecting the degree of perception (assimilation) of educational material. Management of the educational process is possible only on the basis of current control data. The tasks of current control are reduced to:

1) to reveal the volume, depth and quality of perception (assimilation) of the studied material;

2) identify gaps in knowledge and outline ways to eliminate them;

3) to reveal the degree of responsibility of students and their attitude to work, establishing the reasons that prevent their work;

4) identify the level of mastery of independent work skills and outline the ways and means of their development;

5) stimulate students' interest in the subject and their activity in learning.

The main task of current supervision is to help students organize their work, learn independently, responsibly and systematically study all subjects.

Boundary (thematic, modular, block) control of knowledge is an indicator of the quality of studying individual sections, topics and related cognitive, methodical, psychological and organizational qualities of students.

Border control can be carried out verbally and in writing, in the form of a control work, individually or in a group.

The final control of students is carried out in order to assess their knowledge and skills in the discipline. The main goal is to establish the actual content of students' knowledge in terms of volume, quality and depth and the ability to apply it in practical activities.

The main forms of monitoring students' knowledge are monitoring during lectures, laboratory classes, extracurricular time, consultations and tests.

We monitor lectures either selectively (oral survey of students) or using tests (based on previously taught material).

Current monitoring of lectures is designed to accustom students to systematic study of the passed material and preparation for the upcoming lecture, to establish the degree of assimilation of the theory, to identify the sections that are most difficult for students to understand, followed by their explanation.

Current monitoring of laboratory classes is carried out in order to find out the readiness of students for classes in the following forms:

1. Selective oral survey before the start of classes.
2. Frontal standardized survey on cards, tests within 5-10 minutes.
3. Frontal check of homework.
4. Calling individual students to the blackboard for independent problem solving, written answers to individual questions given in the laboratory session.
5. Evaluation of the student's activity in the process of classes, submitted proposals, original solutions, additions to previous answers, etc.
6. Written test (up to 45 minutes).

Control in extra-auditory time.

1. Checking the course of homework and control work. The quality and accuracy of execution, the accuracy and originality of solutions, the review of special literature, the presence of research elements, the completion of the task in the specified amount according to the specified terms are evaluated.
2. Review of lecture notes and recommended literature.
3. Review and assessment of essays on the part of the lecture course, which is worked out independently.
4. Individual interview with the student at consultations.

Consultations. The purpose of consultations is to help students understand complex issues, to solve those that students cannot solve on their own. At the same time, consultations provide an opportunity to monitor students' knowledge, to form a correct picture of the course and results of educational work.

Exam. When studying the discipline, an exam is used with the presentation of grades on a five-point scale.

Laboratory work is accepted upon completion of each task. At the same time, the student submits records and calculations.

Standardized control of knowledge (exam).

9. Distribution of grades received by students.

Evaluation of student knowledge is carried out on a 100-point scale and is converted to national grades according to Table 1 "Regulations and Examinations and Credits at NULES of Ukraine" (order of implementation dated 26.04.2023, protocol №10)

Student rating, points	**National grade based on exam results**	
	Exams	**Credits**
90-100	**Excellent**	**Passed**
74-89	**Good**	
60-73	**Satisfactory**	
0-59	**Unsatisfactory**	**Not passed**

In order to determine the rating of a student (listener) in the discipline $\mathbf{R_{dis}}$ (up to 100 points), the rating from the exam $\mathbf{R_{ex}}$(up to 30 points) is added to the rating of a student's academic work $\mathbf{R_{aw}}$ (up to 70 points): $\mathbf{R_{dis} = R_{aw} + R_{ex}}$ **.**

10. Educational and methodological support.

1. More than 200 tables, drawings, diagrams are used for lectures and laboratory classes.

2. The laboratories are equipped with: 1) stands with natural samples;

2) schemes of post-harvest processing, storage, grain, potato, fruit and vegetable and technical technologies - 20 stands in total;

3) Drawings from individual production processes.

3. Equipment for processing: semi-industrial type mill, small MUL type mills, equipment for obtaining juice, samples of container types, bakery oven, refrigerating chambers, storage for storing juicy products.

4. Out-of-town classes are organized for each stream: within the city of Kyiv - a mill, an elevator, a fruit and vegetable base, and outside of Kyiv: a grain-receiving enterprise, a sugar factory, a compound feed plant, etc.

5. Natural samples of grain of different crops and of different quality (organoleptic indicators, moisture, waste admixture, technological properties).

6. Devices for determining quality:

a) grains - POOK-1, POZ (to determine contamination) TransHygro, VZPK, WILE, Elektronika, Farmpro, Aqua-15 (to determine humidity) sets of sieves of all numbers (to determine elements of garbage, grain impurities), diaphanoscopes (to determine vitreous), dough mixer, IDK-1 (for determining the quantity and quality of raw gluten), one-liter flask (for determining the nature), a set of thermometers, probes, BIS-1 device (for grain quality control);

b) potatoes (drying cabinets, steam scales, polarimeters, etc.);

c) flax: SMT-200 M (industrial sample for evaluating the quality of flax fiber, devices for determining the quality of straw (DL-1, DKV-60, LM-1, squares, moisture meters, device for determining suitability;

d) sugar beets (refractometers, polarimeters);

e) hops (a device for determining the alpha-acid content).

7. Permanent natural samples:

a) grain damaged by pests and diseases;

b) harmful elements and other types of impurities;

8. Albums of warehouses, types of linen, projects of warehouses.

9. Natural samples of juicy fresh produce stored in a warehouse or refrigerator.

10. Natural samples of canned products: vegetable and fruit and berry.

11. Recommended sources of information

Basic

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3. Подпрятов Г.І. Післязбиральна доробка та зберігання продукції рослинництва: лабораторний практикум (навчальний посібник). / Г.І. Подпрятов, Л.Ф. Скалецька, А.В. Бобер. – К.: Центр інформаційних технологій, 2009. – 296 с.

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7. Скалецька Л.Ф. Переробка продукції рослинництва: лабораторний практикум (навчальний посібник). / Л.Ф. Скалецька, А.В. Бобер, В.І. Рожко, Л.М. Хомічак. – К.: Центр інформаційних технологій, 2013. – 360 с.
8. Подпрятов Г.І., Бобер А.В., Ящук Н.О. Технохімічний контроль продукції рослинництва. Навчальний посібник. 2-е вид., допов. і перероб. – К.: ЦП «Компринт», 2020. – 791 с.
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Additional

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3. Подрятов Г.І. Технологія виробництва борошна, крупи та олії: навч. посіб. / Г.І. Подрятов, Скалецька Л.Ф. – К.: Видавництво НАУ, 2000 – 202 с.
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6. Подпрятов Г.І. Стандартизація та контроль якості продукції рослинництва: практикум / [Подпрятов Г.І., Скалецька Л.Ф., Войцехівський В.І., Мацейко Л.М.]. – Луцьк: Терен, 2012. – 448 с.
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Information resources

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