# DESCRIPTION OF THE DOCTORAL STUDY SUBJECT OF AGRONOMY SCIENCES FIELD

Administrator of doctoral study program:Vytautas Magnus University Agricultural Academy andLithuanian research centre for Agriculture and forestryThe coordinator of study subject - Agriculture and food sciences instituteCourse code:AGR8015Name in English:Storage and processing of plant raw materials

Number of ECTS credits: 7, 187 h, of which for contact work 46 h., for shelf-study 141 h

Type of contact work	Hours	Self-study	Hours
Lectures	42	Control works	-
Practical	-	Practical works	-
Consultations	2	Individual assignment	20
Examination	2	Preparation of report	21
		Preparation for examination	100

# Course workload structure and hours:

# Subject belongs to:

Study Cycle	Study program	Subject type
Third	Agronomy	Optional

*The aim of the course*: to provide the latest knowledge on the storage and processing of plant raw material, to develop the skills in integrating interdisciplinary knowledge based on the results of the most advanced fundamental and applied research, to offer, analyse, systemize and critically evaluate new and complex ideas in the search of original scientific decisions that are of public interest and strategic significance in the field of storage and processing of plant raw material.

# Prerequisites for entering the course:

# Links between the study programme outcomes, course outcomes, study methods and criteria and methods for learning achievement evaluation

Type of study	Course outcomes	Study methods	Criteria and methods for
programme			learning achievement
outcomes			evaluation
	Will have the latest	Lecture, given in a	Knowledge of the qualitative
Knowledge, its application	systematic research	problematic,	criteria for storing and
	knowledge in solving the	visualized teaching	processing plant raw
	problems of improving the	method, case study,	material, ability to participate
	storage and processing of	discussion	in the discussion and to
	plant raw material		answer the questions
			Ability to assess the

			influence of biotic and abiotic factors on the quality of stored and processed plant production; to rationally solve the problematic situation; interview, managed and assessed by the lecturer and/or practitioner
			Ability to plan and execute applied research or projects related to solving the problems of storing and processing the plant raw material (interview, managed and assessed by the lecturer and/or practitioner)
Skills for	Will propose, analyse, systematize and critically evaluate new and complex ideas in the search of original scientific solutions for storing and processing plant raw material	Individual assignment, case study, brainstorming	Knowledge of qualitative criteria for storing and processing the plant raw material, presentation of the report, ability to participate in the discussion and answer the questions
research implementation	Will plan and carry out scientific large-scale research or projects related to the relevance of solving the problems of processing and storing the crop production	Report	Ability to plan and execute applied research or projects related to solving the problems of storing and processing the plant raw material
Special skills	Will create original tools for scientific research	Report	Knowledge about the qualitative criteria for storing and processing the plant raw material, timely problems (presentation of the report)

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*Content of the course: Lectures:* 

## 1. Management of the system for the analysis of risk factors - 9 hours.

1.1. The latest research achievements, perspectives and problems in Lithuania, the EU and the world on the issues of storage and processing of plant raw material (1 hour).

1.2. Risk assessment – scientific approach to the safety of plant raw material and food. Application of an important control point system for the analysis of risk factors. The benefits of the quality and safety management systems of plant food raw material in agribusiness (2 hours).

1.3. Advantages and disadvantages of the Hazard Analysis Critical Control Point (HACCP) system for the analysis of risk factors. Stages of the development of a plan for HACCP system for the analysis of risk factors. Risk factors: microbiological, chemical, physical factors. Typical control points (SVT) for quality management in the production of plant and other products (4 hours).

1.4. Food safety management systems: BARC, HALAL, ISO 22000 standards (2 hours).

## 2. Processing of crop production – 18 hours.

2.1. The suitability of plant raw material for processing. Storage of raw material prior to processing. Requirements for quality of raw material. Technological processes. Physical and biochemical changes occurring during the processing (2 hours).

2.2. Microbiological bioconversion. The use of enzymes when processing fruits, berries and vegetables (2 hours).

2.3. Methods for processing fruits and vegetables. Abiotic preservation. Preservation of the dry matter content inside the product. Biochemical preservation. Drying: general characteristic of the process; Heat and mass exchange; Equilibrium humidity; Osmotic, thermal, microwave and lyophilic drying methods. Quick freezing: the effect of freezing speed and temperature on product quality; Physical-chemical processes that occur during the freezing; Defrostation (8 hours).

2.4. Changes in the chemical composition of fruits, berries and vegetables during their processing (2 hours).

2.5. Food additives. Food colouring. Pigments. Natural food colours: sources, classification, chemical composition, stability. Anthocyanins, carotenoids. (2 hours).

2.6. Preservatives. Antioxidants. Stabilizers. Their significance and utilization in the processing of fruits, berries and vegetables (1 hour).

2.7. Storage of the canned fruits, berries and vegetables. Processes, happening during the storage in the canned products. Causes of deterioration and the methods for preventing it (1 hour).

#### 3. Storage of crop production – 15 hours.

3.1. Specificity of storing the plant raw material (0.5 hours);

3.2. The effect of abiotic and biotic factors on the storing the plant raw material (1 hour);

3.3. Scientific principles of storage, the essence of biogenesis and the methods for its implementation (1.5 hours)

3.4. Theory and practice of storing the grain. Use of the principle of xero-anabiosis in the grain storage. Analysis of grain biological processes. Processes for moisture migration. Microbiological processes of grain mass in their warehouses. Mycological pollutants. Grain pests. Progressive methods and techniques for drying. Application and the methods of the principle of thermo-anabiosis for storing the grain. Anoxic anabiosis principle and the airless (hermetic) method for grain storage. Advantages and issues of wet grain storage. Principles and methods for chemical preservation of grain. Types of grain storage losses and the reasons for their formation (4 hours).

3.5. Theory of potato, vegetable and fruit storage. The influence of biological factors and agroproducts for the preservation of stored production. Processes occurring in plant raw material after the harvest. Control of storage conditions (4 hours); 3.6. Biological aspects of storage. The processes of breathing, maturation, microbiological processes and their effect on the preservation. Calm period. Germination of stored raw material and the possibilities for managing this process with chemical and natural means. (2 hours);

3.7. Physical characteristics of juicy raw material. Physical processes of the raw material held in containers/crates. Their influence on the preservation of raw material. Changes in chemical composition of stored raw material, products in a modified atmosphere. The characteristic of stationary modern warehouses – naturally and artificially refrigerated warehouses and warehouses with gas composition controlled by controlling the atmosphere (2 hours).

# Preparation of the individual assignment:

Topic: The influence of storage and processing on the quality of plant raw material -20 hours.

# **Preparation of the report – 21**

Topic: Projects related to solving the storage and processing of plant raw material by using the EU funding/potential for absorption.

# Methods and structure of the cumulative assessment of students' achievements

Students' achievements are assessed in a 10-grade scale in the system of cumulative assessment. Assessment is carried out in accordance with the criteria for the assessment of the subject's study results.

## Structure of the cumulative grade:

Assessment type	Weighted score	Assessment deadline
Report	0,2	
Individual assignment	0,3	
Examination	0,5	According individual plan

## **Required reading:**

- 1. Adeyeye Samuel A.O., Yildiz Fatih. Fungal mycotoxins in foods: A review. Cogent Food & Agriculture .2016, (2):doi.org/10.1080/23311932.2016.1213127.
- Advances in fruit processing technologies / edited by Sueli Rodrigues and Fabiano Andre Narciso Fernandes. Boca Raton, London, New York: CRC Press, 2012, 458 p.
- 3. Blackburn Clive, <u>J McClur</u> Peter. Foodborne Pathogens, Second Edition: Hazards, Risk Analysis and Control (Woodhead Publishing Series in Food Science, Technology and Nutrition) 2nd Edition, 2009, 1193P.
- 4. Danilčenko, H. Maisto žaliavų kokybės ir saugos valdymas [elektroninis išteklius] : mokomoji knyga/ Akademija, 2012. 158 p.
- 5. Danilčenko H., Jarienė E., Rizikos veiksniai produkcijos gamyboje. Mokomoji knyga. Akademija, 2009. 57p.
- 6. Danilčenko, H.; Jarienė, E.; Paulauskienė, A.. Augalinių maisto produktų kokybė ir apsauga : vadovėlis. Akademija, 2008. 247 p.
- Danilčenko, H.; Kulaitienė, J.; Tarasevičienė, Ž.; Zaleckas, E.. Instrumentinė ir juslinė maisto produktų analizė [elektroninis išteklius] : mokomoji knyga /Akademija, Kauno r. :, 2011. 101 p.

- 8. Fresh-cut fruits and vegetables: science, technology, and market. Ed. Lamikanra O. CRC Press. 2002. 452 p.
- 9. Fruit and Vegetable Processing. FAO. 2009. 93 p. Handbook of vegetable preservation and processing / edited by Y. H. Hui ... [et al.] Food science and technology; v. 130 New York: Marcel Dekker, 2004. 608 p.
- Handbook of Vegetables and Vegetable Processing. Ed. Sinha N.K. Wiley-Blackwell. 2011. 788 p.
- 11. Handbook of postharvest technology: cereals, fruits, vegetables, tea, and spices / edited by Amalendu Chakraverty [et al.]. New York, NY Basel: Marcel Dekker, 2003. 884 p
- 12. Jarienė, E., Augalinių žaliavų cheminė sauga [elektroninis išteklius] : mokomoji knyga /. Akademija, 2012. 137 p.
- 13. Jarienė, Elvyra; Danilčenko, Honorata. Funkcionalusis maistas: produktų kūrimo sistemos [elektroninis išteklius] : praktinių darbų aprašas. Akademija, 2012. 39 p.
- 14. Jarienė E., Danilčenko H., Vaitkevičienė N. 2015 Augalinių žaliavų cheminė sauga. Laboratorinių ir praktinių darbų aprašas Akademija, 26 p.
- 15. Jeswal, P., Kumar, D. Mycobiota and natural incidence of aflatoxins, ochratoxin A, and citrinin in Indian spices confirmed by LC-MS/MS. *International Journal of Microbiology*, 2015: doi:10.1155/2015/242486
- Mannaa Mohamed, Kim Ki Deok.Microbe-Mediated Control of Mycotoxigenic Grain Fungi in Stored Rice with Focus on Aflatoxin Biodegradation and Biosynthesis Inhibition. <u>Mycobiology</u>. 2016 Jun; 44(2): 67–78. doi: <u>10.5941/MYCO.2016.44.2.67</u>
- 17. Moretti A, Susca A, Mulé G, Logrieco AF, Proctor RH. Molecular biodiversity of mycotoxigenic fungi that threaten food safety. Int J Food Microbiol. 2013 Oct 1;167(1):57-66. doi: 10.1016/j.ijfoodmicro.
- 18. Postharvest physiology and pathology of vegetables / edited by Jerry A. Bartz and Jeffrey K. Brecht. New York: Marcel Dekker, 2003. 733 p.
- 19. Satinder Ahuja, Neil D. Jespersen. Modern instrumental analysis. Elsevier, 2006. p. 864.
- 20. Singh N. P. Fruit and Vegetable Preservation. Oxford. 2007. 360 p.
- 21. Thompson, A. K. Fruit and vegetables: harvesting, handling and storage.3rd edition. Oxford: Wiley-Blackwell, 2015, 1035 p.

## **Recommended reading:**

- 1. Carole A. Wallace. Intermediate HACCP. 2005. 231p.
- 2. Carmen Socaciu. Food Colorants: Chemical and Functional Properties, 2008. 633 p.
- 3. Chemistry and technology of soft drinks and fruit juices / edited by Philip R. Ashurst Oxford: Blackwell Publishing, 2005. 392 p.
- 4. Enzymes in Fruit and Vegetable Processing. Chemistry and Engineering Applications. Ed. Bayindirli A. CRC Press. 2010. 373 p.
- 5. Fruit and vegetable phytochemicals: chemistry, nutritional value and stability. Ed. De la Rosa L.A., Alvarez-Parrilla E., Gonz'alez-Aguilar G.A. Wiley-Blackwell. 2010.382 p.
- 6. Handbook of Food Analysis Instruments Edited by Semih Otles. CRC Press, 2008, p. 544.
- Handbook of organic food safety and quality. Edited bei Cooper J., Niggli U. and Leifert C. Woodhead pub. Ltd, 2007. 353p.
- 8. Horticulture. Edited by Maldonado A.I.L. InTech. 2012. 182 p.
- 9. Sprenger R. A. The Foundation HACCP Handbook. 2nd Edition, Blackwell pub. 2007.
- 10. Zarządzanie jakością i bezpieczeństwem żywności. Pod.red. Trziszki T. Wydawn. Uniw. Przyrodn. we Wrocławiu. Wrocław. 2009. 354 s.

Subject teachers:

Role of teacher	Academic title, scientific degree, name, surname
Coordinating teacher	Prof. (HP) dr. Elvyra Jarienė
Other teachers	prof. dr. Honorata Danilčenko, prof. dr. Pranas Viškelis

Author of the course description: prof. dr.. Elvyra Jarienė Other authors: prof. dr. Honorata Danilčenko, prof. dr. Pranas Viškelis

*Rewiever:* Agricultural and food science institute of VMU Agricultural Academy – asocc .prof. dr. Ž. Tarasevičienė

*Approval at the Institute:* 2019 06 20 protocol Nr *Approval at the meeting of the PhD programme committee:* 201... ... ... protocol Nr......

Course description valid until