



Universitat de Lleida

DEGREE CURRICULUM
**INDUSTRIES OF FRESH
HORTICULTURAL PRODUCTS**

Coordination: GRAELL SARLE, JORGE MARIANO

Academic year 2022-23

Subject's general information

Subject name	INDUSTRIES OF FRESH HORTICULTURAL PRODUCTS				
Code	102258				
Semester	1st Q(SEMESTER) CONTINUED EVALUATION				
Typology	Degree	Course	Character	Modality	
	Bachelor's Degree in Food Science and Technology	3	OPTIONAL	Attendance-based	
Course number of credits (ECTS)	6				
Type of activity, credits, and groups	Activity type	PRACAMP	PRALAB	PRAULA	TEORIA
	Number of credits	0.2	0.6	1.4	3.8
	Number of groups	1	1	1	1
Coordination	GRAELL SARLE, JORGE MARIANO				
Department	FOOD TECHNOLOGY, ENGINEERING AND SCIENCE				
Teaching load distribution between lectures and independent student work	60 hours + 90 hours				
Important information on data processing	Consult this link for more information.				
Language	Catalan or Spanish (according to the teacher's preference, consulting the students)				

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
GRAELL SARLE, JORGE MARIANO	jordi.graell@udl.cat	6	

Subject's extra information

It is a subject that has the character of optional, so that the students can choose it in the last courses of the degree, and thus to deepen in the study of the processes of conditioning and conservation in fresh to which they are submitted the fruits and the vegetables harvested, which are carried out in fresh product industry.

Learning objectives

The student, upon passing the subject, must be able to:

- Specify the maturity and quality requirements to be met by horticultural raw materials to be used in fresh products handling and cold storage and transport processes.
- Select and plan the necessary steps to carry out a specific post-harvest management process of a particular fresh fruit and vegetable product.
- Describe the action of the different technical parameters of an operation or treatment on the modifications of the characteristics of the horticultural products along potharvest period.
- Select the equipment needed to be applied in each of the stages of a post-harvest processing process of a horticultural product.
- To choose the optimal conditions for the storage and refrigerated transport for a certain horticultural product.
- Recognize, according to symptoms, the types of alterations that can develop in fruits and vegetables throughout their post-harvest life, especially to be submitted to conservation in cold storage, and to estimate the possible causes.
- Evaluate the necessary capacity of the equipment to be used in the conditioning and in the cold storage of fruit and vegetable products.
- Specify the quality characteristics that, according to the corresponding regulations, have to present the different types and commercial categories of fruits and vegetables.
- To interpret the analytical values referring to the composition and the characteristics of the horticultural products throughout its process of handling and cold storage, to proceed to the regulation of the same.
- Graphically outline the sections or areas that are part of a horticultural industry, to make a preliminary design of the layout in the plant.

Competences

Basic skills:

CB1: That students have demonstrated to possess and understand knowledge from the base of general secondary education at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of that area .

CB2: That students know how to apply their knowledge to their work or vocation in a professional way and possess the competencies that are usually demonstrated through

elaboration and defense of arguments and problem solving within their area of study

CB3: That students have the ability to gather and interpret relevant data to make judgments that include a reflection on relevant issues of a social, scientific or ethical nature.

CB4: That students can transmit information, ideas, problems and solutions to both a specialized and non-specialized audience

CB5: That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

General competences

CG1: Analyze specific situations, define problems, make decisions and implement action plans in search of solutions.

CG2: Interpret studies, reports, data and analyze them numerically.

CG3: Select and manage the written and computerized information sources available related to the professional activity.

CG4. Work alone and in a multidisciplinary team.

CG5: Understand and express yourself with the appropriate terminology.

CG6. Discuss and argue in various forums.

CG7. Recycle in new technological advances through continuous learning.

CG8. Value comprehensive training, personal motivation and mobility.

CG9: Analyze and assess the social and ethical implications of professional activity.

CG10: Have a critical and innovative spirit.

CG11: Analyze and assess the environmental implications in their professional activity.

Transversal competences

CT1: Correctly present information in oral and written form (UdL strategic competence)

CT3: Use existing IT and communication tools as support for the development of their professional activity (UdL strategic competence))

CT4. Respect the fundamental rights of equality between men and women, the promotion of Human Rights and the values of a culture of peace and democratic values

Reinforcement of specific competences of modules 3 and 4

Module 3 Competences: Food Science

CE1. Select and apply the physical and mathematical foundations necessary for the development of other disciplines and the activities of the profession.

CE2. Identify and apply the chemical foundations necessary for the development of other disciplines and the activities of the profession.

CE3. Identify and apply the fundamentals of Biology and Human Physiology necessary for the development of other disciplines and the activities of the profession.

CE4. Select and apply the basic concepts of the statistical method, being able to statistically analyze the results of studies and interpret them critically.

Module 4 Competences: Food Technology

CE20. Evaluate the characteristics of the main plant varieties and their aptitude for the different transformation processes.

CE21. Discuss the rationale and apply basic operations to food manufacturing processes.

CE22. Recognize food processing equipment and know how to use it.

CE23. Outline, based on flow diagrams, the processes of food preparation and preservation.

CE24. Identify and evaluate raw materials, ingredients, additives and technological aids for use in the agri-food industry.

CE25. Explain the role of ingredients and food additives.

CE26. Apply basic knowledge about raw materials, ingredients and additives to food formulation.

CE27. Interpret the physical and chemical changes that occur during the different food-making processes.

CE28. Modify the processes of making a food based on some objectives.

CE29. Select equipment and organize food preparation and packaging lines.

CE30. Develop new processes and products.

CE33. Estimate equipment capabilities for production lines and auxiliary systems needs.

Subject contents

Theory

HORTICULTURAL FRESH PRODUCTS (FRUIT AND VEGETABLES)

Unit 1.- Introduction.

Economic data of the sector hortofrutícola.- Concept of horticultural industry.- Main fresh products treated in the horticultural industries.- Process diagrams.- Necessity of the conditioning and the cold preservation of fruits and vegetables in fresh.- Fundamentals of the treatment of fresh horticultural products.- Evolution of recent techniques and innovations in the horticultural industries.

Unit 2.- Horticultural industry. Technical characteristics.

Horticultural industries: function.- Types of horticultural plants.- Diagrams of process: main operations.- Sections of a horticultural industry.- Basic installations in a horticultural industry.- Aspects of the design of horticultural plants.-

Legislative aspects on design and operation of horticultural plants.

Unit 3.- Operations prior to the arrival of the products to the industry.

Preparation of cold rooms and other sections.- Revision of technical installations.- Disinfection and cleaning of cold stores.- Preparation of containers and other maintenance elements.- Pre-harvest planning and follow-up in the field.- Harvest. Last date of harvest. - Transport of the products to the industry.- Reception of the products to the industry.- Traceability. Unit 5.- Cooling of products.

Unit 4.- Precooling: purpose and beneficial effects.-

Semi-cooling of a product: factors.- Systems and equipment of pre-cooling.- System of pre-cooling by air.- System of pre-cooling by water.- System of pre-cooling by vacuum.- System of Pre-cooling by ice. - Criteria for the selection of a system. - Conditions of application of the pre-cooling to different horticultural products

Unit 5.- Cold rooms: technical characteristics

Design of the cold room: dimensions and constructive aspects. - Installation of insulation: purpose, insulation materials and anti-vapor materials. - Insulation mounting systems: traditional and integral. - Refrigeration system by mechanical compression: elements and operating principles. - Refrigerants: types, characteristics and application. - Characteristics of refrigeration equipment: compressors, condensers and cooling towers, evaporators. - Main automatism of control and regulation of the refrigeration system.

Unit 6.- Storage in normal refrigeration.

Objectives of refrigeration storage.- Parameters of cold storage.- The storage temperature: optimum values, control and regulation.- Cooling regimes.- Relative humidity: values, control and regulation.- Air movement: recirculation and renovation.- Charge operation of the cold room: product storage.- Product monitoring in the chamber.- Discharge operation of cold chamber.

Unit 7.- Controlled atmosphere storage.

Concept of controlled atmosphere: differences with modified atmospheres.- Fundamentals of controlled atmosphere.- Benefits and limitations of storage in controlled atmosphere.- Types of controlled atmospheres.- Recommended conditions: balance of parameters.- New techniques of controlled atmosphere: very Low levels of oxygen, low level of ethylene, dynamic controlled atmosphere.- Management of the product and the chambers in a controlled atmosphere.- Safety standards. Characteristics and elements of controlled atmosphere chambers. - Hermeticity to gases in the chambers: hermeticity test. - Pressure equilibrium: compensatory lungs and valves. - Generation and maintenance of controlled atmospheres: phases and systems. - O₂ reducing equipment : Burners, air separators (PSA and membranes), sweeping with nitrogen.- CO₂ reducing equipment: active carbon adsorber.- Equipment for gas analysis in chambers.- Automatic and regulation of controlled atmosphere.

Unit 8 - Treatments prior to the conservation and / or expedition of the products.

Purpose of the treatments: examples of application to various products.- Methods used for treatments- Chemical treatments: types of active substances.- Equipment for chemical treatments. Conditions of use - Problematics of chemical treatments - Thermic treatments .- Gaseous treatment .- Treatments with radiation.

Unit 9.- Special techniques: accelerated maturation, degreening.

Accelerated maturation: concept and purpose.- Parameters in accelerated maturation chambers.- Accelerated maturation chamber installations.- Conditions for application to different products.- Degreening: concept and purpose.- Parameters in degreening chambers- Installations in degreening chambers - Conditions of application to different products.

Unit 10.- Conditioning and preparation operations for the fruit and vegetable market.

Purpose of the conditioning - Schemes of typical lines of conditioning of horticultural products. - Feeding equipment of the lines. - Equipment for the cleaning and washing of the products. - Equipment for the drying. - Equipment for the application of waxes and other coatings. - Equipment for the selection of products. - Equipment for the classification of products: mechanical, electronic. - Operation of packaging and palletizing. - Operation of weighing and labeling. Expedition of products: expedition chambers and loading docks.- Conditions for the transport of vegetable products in fresh.- Transport systems.- Land transport: road and rail.- Maritime transport.- Air transport.-

Mixed loads: compatibility between products.- Distribution of horticultural products.- Exhibition of products at the points of sale.- Recommendations and care of the fruit in the home.

Unit 11.- The quality in fruits and vegetables in fresh.

Concept of quality.- Commercial quality, organoleptic and dietetic in fruits and vegetables.- Normatives.- Attributes of quality.- Evaluation of the quality of fruits and vegetables: physical, chemical and sensorial determinations.- Quality management systems.- Environmental management systems.

Unit 12.- Post-harvest disorders of horticultural products.

Types and importance of post-harvest losses of horticultural products.- Losses caused by mechanical damages: types of damages.- Losses due to microbial alterations. Causes and types.- Losses due to physiological alterations. Causes and types.- Losses due to dehydration in fruits and vegetables.

Practical activities

Elaboration of work:

Bibliographic work on postharvest management technology of a specific product.

Exercises:

1. Interpretation of technical information on equipment from catalogs.
2. Interpretation of information in scientific and technical articles.
3. Calculations exercises about design of cold rooms..
4. Calculation exercises of equipment and installations.

Lab practices:

1. Identification of alterations in fruits and vegetables.
2. Analysis of quality parameters and maturity in fruits and vegetables.
3. Sensory analysis of fruits.

Visit to an industry:

Visualization of process, equipment and facilities in an industry.

Methodology

Some face-to-face activities may happen to be carried out on-line due to the specific requirements.

Activity	Description	Face-to face Activity	Not face-to-face Activity		Evaluation	Total time /ECTS	
		Objectives	Hours	Student work			Hours
Master class in theory	Master class	Explanation of the main concepts	38	Study	56	5	99

Problems	Participatory class in the classroom	Problem solving	6	Learn to solve problems and cases	10		16
Laboratory	Laboratory Practices	Execution of the practice in Laboratory	6	Make reports	6		12
Visit	Visit to companies	Attend the visit	2	Make reports	2		4
Work	Work on Postharvest of Product	Delivery and Oral defense of work	8		10	1	19
Totals			60		84	6	150 / 6 ECTS

Development plan

Theoretical activities:

In the classroom are used different teaching methods: magistral classroom, cas study, flipped teaching.

Practical activities

Elaboration of work:

Bibliographic work on postharvest management technology of a specific product.

Exercises:

1. Interpretation of technical information on equipment from catalogs.
2. Interpretation of information in scientific and technical articles.
3. Calculations exercises about design of cold rooms..
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Lab practices:

1. Identification of alterations in fruits and vegetables.
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Visit to an industry:

Visualization of process, equipment and facilities in an industry.

Evaluation

Some face-to-face activities may happen to be carried out on-line due to the specific requirements.

Activity	Process	Number	% qualification
Master lesson	2 written tests	2	70 (35+35)
Exercises, laboratory and visit	Delivery of exercises, laboratory and visit reports		10
Work	Preliminary expositions of parts Exposition of final work		20
Total			100

In order to pass the subject, it is necessary:

- to make and deliver the reports of laboratory practices, visit to industries, exercises and work.
- to obtain a grade greater than or equal to 5, considering all activities with your measurable weight .

(no previous materials of course grades are saved)

Bibliography

Basic bibliography

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- Casp, A. (coord.), 2014. Tecnología de los alimentos de origen vegetal. Vol 1 (Capítulo: Vegetales frescos, J. Graell). Ed Síntesis, Madrid.
- Namesny, A.. 1993. Postrecolección de hortalizas. Vol. 1,2,3. Ediciones de Horticultura, Reus.
- Wills, R.H.H., McGlasson, B., Graham, D., Joyce, D. 1998. Introducción a la fisiología y manipulación poscosecha de frutas, hortalizas, plantas ornamentales. 2 ed, Acribia, Zaragoza, 240 pp.

Complementary bibliography

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- Valero, D., Serrano, M. 2010. Postharvest biology and technology for preserving fruit quality. CRC, Boca Raton.
- Viñas, I., Recasens, I., Usall, J., Graell, J. (coord.). (2013). Poscosecha de pera, manzana y melocotón. Ed. Mundi-Prensa.
- Yahia, E.M. (ed.), 2009. Modified and Controlled Atmospheres for the Storage, Transportation, and Packaging of Horticultural Commodities. CRC Press, Boca Raton.
- Wiley, R.C. (ed.). 1994. Minimally processed refrigerated fruits and vegetables. Chapman & Hall, 1994. 373 pp. (En español: Wiley, R.C., 1997. Frutas y hortalizas mínimamente procesadas y refrigeradas. Ed. Acribia).