Syllabus

Course Description

Course Title	Quality of horticultural products
Course Code	44723
Course Title Additional	
Scientific-Disciplinary Sector	AGRI-03/A
Language	English
Degree Course	Master in Food Sciences for Innovation and Authenticity
Other Degree Courses (Loaned)	
Lecturers	dr. Maria Dolores Asensio Abella, MariaDolores.AsensioAbella@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/45187
Teaching Assistant	
Semester	First semester
Course Year/s	-
CP	3
Teaching Hours	18
Lab Hours	12
Individual Study Hours	45
Planned Office Hours	9
Contents Summary	1. Definition of fruit and vegetable quality. Pre-harvest factors affecting the quality of horticultural products. 2. Physiology of fruit development and ripening. 3. Methods to assess the fruit ripening stage, time of harvest and final quality (destructive and non-destructive techniques). 4. Factors affecting quality for the processing of horticultural products. 5. Storage techniques: general aspects. Post-harvest of fruits (pome fruits, stone fruits, small fruits) and vegetables (leafy and stem vegetables, tubers).

Course Topics	This course covers the principles defining the quality of fruits and vegetables, from pre-harvest factors to post-harvest handling, storage, and processing. Part 1: Defining and building quality before harvest This section defines produce quality and explores its origins in the field. Multifaceted definition of quality: Sensory: Appearance (color, size, shape, defects), texture (firmness, crispness), flavor (sugars, acids, volatiles). The ratio of Soluble Solids Content to Titratable Acidity (SSC/TA) is a key metric. Nutritional: Vitamins, minerals, and health-promoting phytochemicals (antioxidants, flavonoids). Key pre-harvest factors: Quality is determined before harvest. Genetic: Cultivar selection dictates the potential for all quality traits. Environmental: Light, temperature (heat units), and water availability directly shape development. Cultural practices: Mineral nutrition (especially Nitrogen, N, and Calcium, Ca2+), irrigation strategy, crop load management (thinning), and pest control are critical. Part 2: The biology of fruit development and ripening. An analysis of the physiological and biochemical changes during maturation. The ripening process: A genetically programmed series of events. Biochemical changes: Softening via pectin degradation by enzymes (Polygalacturonase, PG), starch-to-sugar conversion, chlorophyll breakdown, and synthesis of new pigments (carotenoids, anthocyanins) and aroma compounds. Hormonal control: Ethylene (C2H4) is the primary hormone that triggers and coordinates ripening in many species. Climacteric vs. non-climacteric fruits: A critical physiological distinction. Climacteric: Exhibit a sharp peak in respiration and ethylene production during ripening (e.g., apples, bananas, tomatoes). Can be harvested mature and ripened post-harvest. Non-climacteric: Ripen gradually without an ethylene peak (e.g., citrus, grapes, strawberries). Must be harvested ripe for best quality. Part 3: Measuring quality and predicting harvest. Focuses on the techniques used to assess maturity and quality. Destructive assessment: Methods requiring sample destruction. Firmness: Measured with a penetrometer. Soluble Solids Content (SSC): Sugar estimate in °Brix via refractometer. Titratable Acidity (TA): Measures acid content. Starch-Iodine Test: Visualizes starch conversion in pome fruits. Non-destructive Assessment (NDT):

	Technologies for grading and sorting. Colorimetry: Objective color measurement (L*a*b* values). Near-Infrared (NIR) Spectroscopy: Predicts internal attributes like SSC and firmness. Acoustic methods: Correlate sound/vibration response to texture. Part 4: Post-harvest handling for processing. Explores the specific quality needs for processed products. Critical attributes for processors: High solids content: Maximizes yield for pastes and purees. Appropriate pH and acidity: Essential for safety (canning) and flavor. Firmness and integrity: Must withstand mechanical and thermal stress. Color stability: Color must survive processing treatments. Control of enzymatic browning: Preventing discoloration from Polyphenol Oxidase (PPO). Part 5: Principles and technology of post-harvest storage Covers the science of preserving fresh quality after harvest. General principles: Temperature management: The cold chain is paramount. Low temps slow respiration (Q10 effect). Avoid chilling injury in susceptible crops. Humidity control (RH): Prevents water loss (wilting) but avoids condensation. Atmosphere modification: Controlling oxygen (O2), carbon dioxide (CO2), and ethylene (C2H4) is key. Storage Technologies: Refrigerated storage: Standard cold rooms. Controlled Atmosphere (CA): Long-term storage with precisely managed gas levels. Modified Atmosphere Packaging (MAP): Uses permeable films to create a beneficial atmosphere. Ethylene Inhibitors: Products like 1-MCP block ethylene perception. Disorders and diseases: Physiological: Scald and bitter pit, internal breakdown, Pathological: grey mold and blue mold.
Keywords	horticultural quality, post-harvest physiology, ripening, storage technology, quality assessment
Recommended Prerequisites	Introduction to plant sciences and botany, plant physiology, general chemistry
Propaedeutic Courses	None
Teaching Format	Frontal lectures, exercises and labs
Mandatory Attendance	No
Specific Educational Objectives and Learning	This course belongs to the group of "Free choice courses" and is offered within the scientific sector AGR/03 (Arboriculture and

Outcomes	Fruitculture). The course provides general knowledge on the main factors (intrinsic and extrinsic) affecting the final quality of fruits and vegetables. The main physiological aspects of fruit ripening are considered also with the aim to provide basic knowledge on the use of ripening indexes for the detection of the most appropriate time of harvest. Aspects relating the quality of the horticultural products to their suitability for processing are also addressed. The course includes information on the main post-harvest techniques used for fruits and vegetables conservation.
Specific Educational Objectives and Learning Outcomes (additional info.)	Upon successful completion of this course, students will be able to: -Analyze the impact of specific pre-harvest factors on the final sensory, nutritional, and storage attributes of a given fruit or vegetable. -Differentiate between climacteric and non-climacteric ripening behaviors and design appropriate harvest and post-harvest handling strategies for each -Evaluate and select the most suitable storage technology (e.g., Refrigeration, CA, MAP) for a specific commodity to minimize quality loss and extend shelf life -Diagnose common physiological disorders and pathological diseases based on visual symptoms and knowledge of their underlying causes -Interpret data from destructive and non-destructive quality assessment tools to make informed decisions about harvest timing, product grading, and marketability -Formulate a basic quality control protocol for a packinghouse operation, identifying critical control points for quality preservation
Assessment	Oral exam with questions aimed to verify student's knowledge and comprehension of the course topics
Evaluation Criteria	The final mark will reflect the quality of the student's answers to the questions and the quality of the final seminar given by the student. Particularly important will be the capacity showed by the student to fully manage the acquired knowledge, also by showing the ability to make connections between different thematic areas. The ability to develop a personal critical view on specific scientific problems will be also positively considered
Required Readings	Lecture notes (pdf of the slides) and didactic materials (papers)

	loaded on the Teams course channel
Supplementary Readings	"Post-harvest technology of horticultural crops" (2002) edited by A. Kader, ANR – University of California, publication 3311
Further Information	
Sustainable Development Goals (SDGs)	Good health and well-being, Life on land, Responsible consumption and production, Quality education