The University of Jordan

Faculty of Agriculture

Department of Horticulture and Crop Science
2016-2017/second semester

Course title: Harvesting, Handling and Storage of Crops (641441)
Pre-requisite:- Crop Physiology (601241)

Instructor Name	Office			E-mail Please email to schedule an appointment
	Number	Phone	Hours	
Dr. Nihad Alsmairat	278	++962-5355000/22510	Sun, Tue , Thu 8-10am	drnihad@ju.edu.jo Home page: http://www2.ju.edu.jo/sites/academic/drnihad/default.aspx Course material: On UJ E. Learning portal @ Moodle LCM .

Lecture hours					
Day/Time	**Sunday**	**Monday**	**Tuesday**	**Wednesday**	**Thursday**
Day	*	-	*		*
Time	**10-11 Mgdade Hall**	-	**10-11 Mgdade Hall**		**10-11 Mgdade Hall**

Course Description

Modern plant production has changed from local production to global production chains. The organization of production chains necessitates knowledge of product quality and current postharvest technologies to maintain high quality produce. This course will give a fundamental understanding of many aspects of postharvest technology and biology, including internal and external factors determining quality and postharvest performance. It will discuss several technological and biological topics focusing on proper handling and reduction of postharvest losses. Important concepts such as maturity, harvesting, packing and packaging, cooling, storage, and transport will be addressed in some details to comprehend the nature of fresh produce for apt understanding of their proper handling. The last series of lectures will be directed toward the application of the technologies above on selected commodities of importance to Jordan and neighboring countries.

Learning Objectives

1. Awareness of students with the factors related to quality deterioration of horticultural commodities pre-, and post-harvest.
2. To develop a knowledge and understanding of commercial procedures of harvesting, preparation, packaging, transportation, and storage methods of fresh fruits, vegetables and cut flowers.
3. Sensitize students to the importance of post-harvest losses and handling procedures of the commodities through a visit to packaging and handling station and to the fruits and vegetables central market.

Intended Learning Outcomes (ILOs):

Successful completion of the course should lead to the following outcomes:

A. Knowledge and Understanding: Student is expected to

A1- Gain student information for an internet sources related to post harvest biology.
A2- Demonstrate basic knowledge on technology, biology, physiology, and pathology, of plant products during the postharvest period
A3-Understand external and internal factors, which are influencing quality
A4- Reflect about the relevance of modern production chain management, i.e. from place of production to the place of consumption.
A5- Apply and analyze methods of postharvest technology and postharvest disease control
A6- Explain the underlying physiological and pathological aspects which can lead to postharvest diseases of plant products during ripening, harvesting, storage and distribution .

B. Intellectual Analytical and Cognitive Skills: Student is expected to

B1- Practical strategy how to cease down the postharvest decay problems and how to maintain good fruit quality .
B2-Know about the biological processes that occur in horticultural commodity before and after harvest that directly impact on product quality .

C. Subject- Specific Skills: Students is expected to

C1- Apply and analyze methods of postharvest technology .
C2- Explain the underlying physiology and biochemistry aspects which can lead to quality during ripening, harvesting, storage and distribution .
C3- Understanding pre-harvest factors that can be managed to optimize their impact on post harvest's quality.
C4-Applicable for solving problems associated with the handling and storage of horticultural crops .

D. Transferable Key Skills: Students is expected to

D1-Gain basic postharvest technologies to maintain the quality of fresh fruits , vegetables and ornamental plants .
D2-Reduce postharvest losses by incorporating postharvest technology in the fresh produce supply chain .
D3-Know the right time to harvest, handle and the importance of temperature management along the supply chain .

ILOs: Learning and Evaluation Methods

ILO/s	Learning Methods	Evaluation Methods
A. Knowledge and Understanding (**A1-A6**)	Lectures and Discussions	Exam, Quiz,
B. Intellectual Analytical and Cognitive Skills (**B1-B2**)	Lectures and Discussions	Exam, Quiz,
C. Subject Specific Skills (**C1-C4**)	Lectures and Discussions	Exam, Quiz,
D.Transferable Key Skills (**D1-D3**)	Project & presentation	Project & presentation evaluation .

Course Contents

No. of lecture (s) /Week	Subject	Sources	ILOs
1 **(lst wk)**	**Useful internet sites .**	**A list of internet sites from The University of California in Davis , 2008** .& **Chapter 1 in Kader , A.A(ed).2002**	**A-1**
3 **(2nd wk)**	**Introduction of post-harvest concepts** . • Importance of fruit and vegetables as food • Structure and composition • Chemical composition and nutritional value of fruits and vegetables • Physiology and biochemistry	**Chapter 1,2 &3 in Wills et al. 2007 .**	**A-2**
3 **(3rd wk)**	**Pre harvest factors affecting quality .** • Cultivar and rootstock genotype • Mineral nutrition • Irrigation • Canopy manipulations • *Crop rotations*	**Chapter 5 in Kader , A.A(ed).2002**	**C-3**
4 **(4th&5th wk)**	**Cooling horticultural commodities .** • Cooling methods • Room cooling • Cooling bays • Forced air cooling • Tunnel-type forced-air cooling • Cold wall • Serpentine cooling • Forced-air evaporative cooling • Container venting • Cooling transport • Hydrocooling • Package- icing • Vacuum cooling • Selecting a cooling method	**Chapter 11 in Kader , A.A(ed).2002**	**A-4 , B-1 , C-1 , C-4, D-1, D-2, D-3 .**
4 **(5th&6th wk)**	**Maturation and maturing indices**. • Definition • Indices of maturity • Developing a maturity index • Features used as maturity indices • Predicting maturity	**Chapter 6 in Kader , A.A(ed).2002**	**B-2,C-1,C-2,C-4, D-3**
2 **(6thwk)**	**Harvesting systems and preparation for fresh market .** • Hand harvesting • Mechanical harvesting • Field packing • Harvesting for packing in a central facility	**Chapter 7&8 in Kader , A.A(ed).2002**	**A-3, A-4, B-1, C-1, C-4, D-1, D-2, D-3.**

	• Transport to packinghouse • Temperature protection • Preparation for packing		
2 **(7th wk)**	**Ethylene in post-harvest technology .** • Properties • Measurements • Postharvest uses • Treatment system • Undesirable effects • Overcoming undesirable effects • Inhibiting the effect of ethylene	**Chapter 16 in Kader , A.A(ed).2002**	**A-3,B-2,C-1,C-2, C-4, D-1, D-2**
4 **(8th wk)**	**Quality and safety factors .** • Components of quality • Factors influencing quality • Methods for evaluating quality • Quality control and assurance	**Chapter 22 in Kader , A.A(ed).2002 &** **- Chapter 10 in Wills et al. 2007 .**	**A-3, B-1, B-2, C-2, D-1**
3 **(9th wk)**	**Modifies atmosphere during transport and storage .** • Effects of controlled atmosphere • CA & MA requirements and recommendations • Benefits & Hazards • Super atmospheric oxygen atmospheres • Atmospheric modification • MAP	**Chapter 14 in Kader , A.A(ed).2002**	**A-3, B-1, C-1, C-4, D-1, D-2.**
9th wk	**Midterm Exam will be .**	**26/3/2017**	
1 **(10th wk)**	**Packages for horticultural crops .** • Product requirements • Adaptability to handling requirements • Prevention of mechanical damage • Packing	**Chapter 10 in Kader , A.A(ed).2002** **- Chapter 12 in Wills et al. 2007 .**	**A-3, A-4, B-1, C-1, C-4, D-1, D-2**
4 **(11th wk)**	**Physiological disorders**	**- Chapter 8 in Wills et al. 2007 .** **- Each student will prepare a presentation for a physiological disorder of specific crop.**	**C-3**
3 **(12 wk)**	**Post harvest losses** • Biological factors involved in deterioration • Environmental factors • Growth and development • Postharvest technology procedure • Postharvest integrated pest	**Chapter 4 in Kader , A.A(ed).2002** **Chapter 2,4,5,8,9 in Wills et al. 2007 .**	**A-4, A-5, A-6, B-1, D-2**

	management		
1 **(13 wk)**	**Transportation** • High way trucks • Marine containers • Rail cars • Air	**Chapter 20 in Kader , A.A(ed).2002**	**A-4, C-4, D-1, D-2, D-3**
8 **(14-16 wk)**	**Post-harvest handling system for Ornamental , Fresh herbs , Pome fruits , Stone fruits , Small fruits, Subtropical and Tropical fruits**	**Fact sheet from internet site in University of California - Davis & Chapter 25-36 in Kader (ed).2002**	**A-1 - A-6** **B-1 - B-2** **C-1 - C-4** **D-1 - D-3**

Learning Methodology

The course will be structured in lectures, discussions, theoretical and practical exercises and excursions. The course comprises overviews, from general understanding to expert knowledge on key topics, and learning is based on lectures as well as independent learning through exercises, excursions and a final project work Evaluation

Evaluation	Point %	Date
Field Trip	5%	18/2/2017
Midterm Exam	15%	26/03/2017
Quizzes	20%	Every Sunday at the end of the lecture.
Presentation	10%	23,25,27, ,30/2017
Final Exam	50%	Will be announcing from registration. (11/05-20/5/2017)

Main Reference/s:

Kader, A.A(Ed). 2002. Post-harvest Technology of Horticultural Crops. Third edition ,publication 3311. University of California, Division of Agriculture and Natural Resources, Oakland CA.

Wills, R.B.H., W.B. McGlasson, D. Graham, and D.C. Joyce. 2007. Postharvest - An introduction to the physiology and handling of fruit, vegetables and ornamentals. Fifth edition. CAB International, Wallingford, UK 227 pp. ISBN 978 1 84593 227 5 http://www.cabi.org.

References:

Ontario Tender Fruit Producers Marketing Board	http://www.ontariotenderfruit.com/
Ontario Ministry of Agriculture, Food and Rural Affairs	http://www.gov.on.ca/OMAFRA
UC Postharvest Technology	http://postharvest.ucdavis.edu
Food and Agriculture Organization of the United Nations	http://www.fao.org/ag
University of Florida/IFAS Post Harvest Programs and Information	http://postharvest.ifas.ufl.edu
WSU Tree Fruit Research & Extension Center Postharvest Information Network	http://postharvest.tfrec.wsu.edu
The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks	http://www.ba.ars.usda.gov/hb66

Notes:

- Concerns or complaints should be expressed in the first instance to the module lecturer; if no resolution is forthcoming, then the issue should be brought to the attention of the module coordinator (for multiple sections) who will take the concerns to the module representative meeting. Thereafter, problems are dealt with by the Department Chair and if still unresolved the Dean and then ultimately the Vice President. For final complaints, there will be a committee to review grading the final exam.
- For more details on University regulations please visit:
  http://www.ju.edu.jo/rules/index.htm

*** The trip will be on Saturday, 26/3/2017 at 8 Am to **Fresh Fruits Company**.
***Name of the presentation topic for each student will be announce on my web page (http://eacademic.ju.edu.jo/drnihad/default.aspx). The topics may be about **Post-harvest handling system for fruit trees or vegetables or ornamental plants**.