

Post Harvest Technology



DEPARTMENT OF POST HARVEST TECHNOLOGY

Course No.- H/PHT-362 Course title:Post-harvest Management of Horticulture Crops

Credit hours: (2+1) 3 Semester- VI

Theory-Importance of postharvest technology in horticultural crops. Maturity, types of maturity and factors affecting maturity of horticultural crops, maturity indices, harvesting, handling, grading of fruits, vegetables, cut flowers, plantation crops, medicinal and aromatic plants.Pre-harvest factors affecting quality, factors responsible for deterioration of horticultural produce, physiological and bio-chemical changes, hardening and delaying ripening process.Postharvest treatments of horticultural crops.Quality parameters and specification. Structure of fruits, vegetables and cut flowers related to physiological changes after harvest. Methods of storage for local market and export.Pre-harvest treatment and pre-cooling, pre-storage treatments.Different systems of storage, packaging methods and types of packages, recent advances in packaging.Types of containers and cushioning materials, vacuum packaging, cold storage, poly shrink packaging, grape guard packing treatments. Modes of transport.

Practical-Practice in judging the maturity of various horticultural produce, determination of physiological loss in weight and quality.Grading of horticultural produce, post-harvest treatment of horticultural crops, physical and chemical methods. Packaging studies in fruits, vegetables, plantation crops and cut flowers by using different packaging materials, methods of storage, post-harvest disorders in horticultural produce.Identification of storage pests and diseases in spices.Visit to markets, packaging houses and cold storage units.

Lesson/Course Plan - Theory

| Lecture No. | Topics | Weightage (%) |
|--------------------|---------------|----------------------|
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| | | |
|-------|---|---|
| 1 | Importance of Postharvest Technology in horticultural crops. Maturity, types of maturity and factors affecting maturity of horticultural crops, | 8 |
| | Maturity indices, harvesting, handling, grading of | |
| 2-3 | Fruits (Mango, Banana, Papaya, Citrus, Guava, Annona, Aonla, Grape, Sapota, Pomegranate, Pine apple, Litchi, Strawberry) | 8 |
| 4-5 | Vegetables (Tomato, Brinjal, Chilli, Potato, Cabbage, Cauliflower, Onion, Okra, Peas, Watermelon/Muskmelon, Cucumber, Turmeric) | 8 |
| 6 | Cut flowers (Rose, chrysanthemum, Gladiolus, Carnation, Tuberose, Gerbera) | 4 |
| 7-8 | Plantation crops and spices (Coconut, Cashew nut, Arecanut, Tea, Coffee) | 4 |
| 9-10 | Medicinal and aromatic plants(Aswagandha, Safed musali, Aloevera, Lemon grass, Citronella, Khus, Mentha, Osimum) | 4 |
| 11 | Pre-harvest factors affecting quality | 4 |
| 12-14 | Factors responsible for deterioration of fruits, vegetables, cut flowers | 4 |
| 15-16 | Physiological and bio-chemical changes during ripening | 4 |
| 17 | Hastening and delaying ripening process. | 4 |
| 18-20 | Postharvest treatments of horticultural crops –VHT, HWT, irradiation, fungicidal and chemical | 8 |
| 21-23 | Quality parameters and specification in fruits, vegetables and cut Flowers | 4 |
| 24-25 | Structure of fruits, vegetables and cut flowers related to physiological changes after harvest. | 4 |
| 26 | Methods of storage for local market and export. | 4 |
| 27 | Pre-harvest treatment and pre-cooling, pre-storage treatments | 4 |
| 28 | Different systems of storage. | 4 |

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| 29 | Packaging methods and types of packages, recent advances in packaging-vacuum packaging, poly shrink packaging, grape guard | 7 |
| 30 | Types of containers and cushioning materials, packing treatments and cold storage. | 7 |
| 31 | Modes of transport | 3 |
| 32 | Recommendations of Joint Agresco | 3 |
| Total | | 100 |

Practical programme

| Practical No. | Topics |
|----------------------|--|
| 1 | Maturity indices of fruits |
| 2 | Maturity indices of vegetables |
| 3 | Maturity indices of flowers |
| 4 | Maturity indices of Plantation crop |
| 5 | Maturity indices of Spices |
| 6 | Determination of physiological loss in weight and quality |
| 7 | Grading of horticultural produce (manual) |
| 8 | Grading of horticultural produce(Mechanical) |
| 9 | Post-harvest treatment of horticultural crops, physical and chemical methods. |
| 10 | Packaging in fruits, vegetables by using different packaging materials, |
| 11 | Packaging in plantation crops and cut flowers by using different packaging materials |
| 12 | Methods of storage |
| 13 | Post-harvest disorders in horticultural produce |
| 14 | Identification of storage pests and diseases in Horticulture crops |
| 15 | Visit to packaging houses |
| 16 | Visit to cold storage |

Suggested reading:

Reference Books:

- Battacharjee, S. K. and De, L. C. 2005. Post Harvest Technology of Flowers and Ornamentals Plants. Ponteer Publisher, Jaipur, India.
- Chadha, K. L. and Kalloo, G.1993. Advances in Horticulture. Vol. 4 to 10. MPH, New Delhi.
- Fellows, P. J. 1998. Food Processing Technology – principles and Practices. Ellis Horwood.
- Hulme, A.C. 1970. Food Science & Technology - A Series of Monograph. The Biochemistry of Fruits and their Products. Vol.-1. Academic Press London & New York.
- Jacob John, P. 2008. A Handbook on Post Harvest management of Fruits and vegetables. Daya Publishing House, Delhi-1081-7035-532-X.
- Kitinoja, L. and Kader, A. A. 2003. Small-Scale Postharvest Handling practice: A Manual for Horticulture crops (4th edt.). US Davis, PHT Research and information Center.
- Kitinoja, L. and Kader, A. A. 2003. Small-Scale Postharvest Handling practice: A Manual for Horticulture crops (4 edt). US Davis, PHT Research and information Center.
- Mitra, S. K. 1997. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits. CAB International.
- Neetu Sharma and Mashkoo Alam, M. 1998. Post Harvest Diseases of Horticultural Perishables. International Book Distributing Co., Lucknow.
- Pruthi, J. S. 2001. Minor Spices and Condiments – Crop Managements and Post Harvest Technology. ICAR, New Delhi.
- Saraswathy, S. *et. al.* 2008. Post harvest Management of Horticultural Crops. Agribios (India).81-7754-322-9.
- Shanmugavelu, K. G., Kumar, N. and Peter K.V. 2002. Production Technology of Spices and Plantation Crops. Agrobios (India).
- Stanley, J. K. 1998. Post Harvest Physiology of Perishable Plant Products. CBS, New Delhi.

Thomposon, A. K. 1996. Post harvest Technology of Fruits and Vegetables. Blackwell Science.

Verma, L. R. and Joshi, V. K. 2000. Post Harvest Technology of Fruits and Vegetables. Vol. I & II. Indus Publishing Co., New Delhi

Wiils, McGlasson and Graham, J. 2007. Post Harvest- An Introduction to the Physiology and Handling of Fruits, Vegetables and ornamentals. Cab International

e-reading: <http://ecourses.iasri.res.in/>
www.postharvest.ucdavis.edu
http://www.fao.org/infoods/index_en.stm
<http://www.postharvest.com.au>

Course No.- H/PHT-363

Course title:- Processing of Horticultural Crops

Credit hours: (1+2) 3

Semester- VI

Theory- Importance and scope of fruit and vegetable preservation industry in India, food pipeline, losses in post-harvest operations, unit operation in food processing. Principles and guidelines for the location of processing units. Principles and methods of preservation by heat pasteurization, canning, bottling. Methods of preparation of juices, squashes, syrups, cordials and fermented beverages viz., wine, cider and neera. Jam, jelly and marmalade. Preservation by sugar and chemicals, candies, crystallized fruits, preserves chemical preservatives, preservation with salt and vinegar, pickling, chutneys and sauces, tomato and mushrooms, freezing preservation. Processing of plantation crops, products, spoilage in processed foods, quality control of processed products, Govt. policy on import and export of processed fruits. Food laws.

Practical - Equipment used in food processing units. Physico-chemical analysis of fruits and vegetables. Canning of fruits and vegetables, preparation of squash, RTS, cordial, syrup, jam, jelly, marmalade, candies, preserves, chutneys, sauces, pickles (hot and sweet). Dehydration of fruits and vegetables–tomato product dehydration, refrigeration and freezing, cut out analysis of processed foods. Processing of plantation crops. Types of containers for processing of fruits and vegetables. Visit to processing units.

Lesson/Course Plan

| Lecture No. | Topics | Weightage (%) |
|--------------------|--|----------------------|
| 1 | Importance and scope of fruit and vegetable preservation industry in India | 10 |
| 2 | Food pipe line, losses in post-harvest operations | 4 |
| 3 | Unit operations in food processing, guidelines for the location of processing unit | 8 |
| 4 | Principles of food preservation, methods of preservation- refrigeration, freezing preservation, pasteurization, sterilization | 4 |
| 5 | Methods of preservation-sun drying, dehydration (freeze drying, foam mat drying, spray drying, low temperature evaporation or concentration) | 4 |
| 6 | Methods of preservation-by salt, vinegar, sugar, chemical preservatives | 4 |
| 7 | Preparation of juices, squashes, syrups | 10 |
| 8 | Cordial, fermented beverages (wine, cider and neera) | 8 |
| 9 | Jam , jelly, marmalade | 8 |
| 10 | Preserve, candy, crystallized fruits | 4 |
| 11 | Pickle, chutney, tomato ketchup | 8 |
| 12 | Mushroom processing | 4 |
| 13 | Processing of plantation crops (cashew, coconut, Arecanut, tea, coffee, cocoa, rubber) | 8 |
| 14 | Spoilage in processed food products, quality control of processed products including HACCP and GMP | 8 |
| 15 | Govt. policy on import and export of processed products Food laws (FSS Act) | 4 |
| 16 | Recommendations of Joint Agresco | 4 |
| Total | | 100 |

Practical programme

| Practical No. | Topics |
|----------------------|--|
| 1 | Equipments used in food processing units |

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| 2 | Physico-chemical analysis of fruits and vegetables-TSS and Acidity |
| 3 | Physico-chemical analysis of fruits and vegetables- Vitamin C/Ascorbic acid and Carotene |
| 4 | Physico-chemical analysis of fruits and vegetables- Reducing and Total sugars |
| 5 | Canning of fruits- mango, pineapple, guava etc |
| 6 | Canning of vegetables- peas, tomato etc. |
| 7 | Preparation of RTS |
| 8 | Preparation of squash |
| 9 | Preparation of syrup |
| 10 | Preparation of cordial |
| 11 | Preparation of jam |
| 12 | Preparation of jelly |
| 13 | Preparation of marmalade |
| 14 | Preparation of preserves |
| 15 | Preparation of candies |
| 16 | Preparation of chutneys |
| 17 | Preparation of tomato ketchup |
| 18 | Preparation of hot pickles |
| 19 | Preparation of sweet pickles |
| 20 | Dehydration of fruits |
| 21 | Dehydration of vegetables |
| 22 | Refrigeration and freezing |
| 23 | Dehydrofreezing of fruits and vegetables |
| 24 | Cut out analysis of processed food- TSS and Acidity |
| 25 | Cut out analysis of processed food- Vitamin C/Ascorbic acid and carotene |
| 26 | Cut out analysis of processed food- Reducing and Total sugars |
| 27 | Processing of plantation crops- Nut crops |
| 28 | Processing of plantation crops- Beverage crops |
| 29 | Processing of plantation crops- Rubber, Oil Palm |
| 30 | Spoilage of processed products |
| 31 | Types of containers used for processing of fruits and vegetables |
| 32 | Visit to processing units |

Suggested reading:

Reference Books:

Bhatti, S. 1995. Vame, Fruit and vegetable processing. CBS Publishers, Distributors, NewDelhi. Chadha, K. L. 2003. Hand book of horticulture, ICAR, New Delhi.

Chadha, K. L. and Kalloo, G.1993. Advances in Horticulture. Vol. 4 to 10. MPH, New Delhi
DauthyandMircea,E.1995. Fruitandvegetablesprocessing.InternationalBookDistributionCo, Lucknow.

Dauthy, M. E. 1995. Fruits and Vegetables Processing- FAO Bulletin 119. International Book Distributing Co., Lucknow.

FAO - Training Manual No.17/2. 2007. Prevention of post-harvest food losses: Fruits, Vegetables and Root crops. Daya Publishing House, Delhi.

Fellows, P. J. 1998. Food Processing Technology – principles and Practices. Ellis Horwood.

- Girdharilal, Siddappa, G. S. and Tandon, G. L. 1998. Preservation of fruits and vegetables. ICAR, New Delhi.
- Kays and Stanely, J. 1998. Post-harvest physiology of perishable plant products. CBS Publishers, Distributors, New Delhi
- Manoranjan, K and Sangita, S. 1996. Food Preservation & Processing. Kalyani Publishers, India.
- Neetu Sharma and Mashkoo Alam, M. 1998. Post-Harvest Disease of Horticultural Perishable. International Book Distributing Co., Lucknow
- Ranganna, S. 1986. Handbook of analysis and quality control for fruit and vegetable product, II edition, Tata McGraw-Hill publishing company limited, New Delhi.
- Salunkhe, D.K., Bolin, H. R. and Reddy, N. R. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. 2nd Edition. Vol. II. CRC Press, 0849356245
- Siddappaa, G. S., Girdhari Lal and Tandon, G.L. 1998. Preservation of Fruits and Vegetables. ICAR, New Delhi
- Srivastava, R. P. & Sanjeev Kumar. 2002. Fruits and vegetable Preservation – Principles and Practice. International Book Distributing Co., Lucknow.
- Srivastava, R. P. and Sanjeev K. 1998. Fruit and vegetable preservation principles practice. International Book Distributing Co., Lucknow.
- Verma, L. R. and Joshi, V. K. 2000. Post-Harvest Technology of Fruits and Vegetables. Vol. I & II. Indus Publishing Co., New Delhi.
- Vijay, K. 2001. Text Book of Food Sciences and Technology. ICAR, New Delhi.

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www.fssai.org

http://www.fao.org/infoods/index_en.stm

<http://www.postharvest.com.au>

Course No. - H/PHT-231

Course title- Fundamentals of Food technology

Credit hours-(1+1) 2

Semester – III

Theory- Food and its function, physico-chemical properties of foods, food preparation techniques, Nutrition: relation of nutrition of good health. Characteristics of well and malnourished population. Energy: definition, determination of energy requirements, food energy, total energy needs of the body. Mineral nutrition: macro and micro-minerals (Ca, Fe and P), function, utilization, requirements, sources, effects of deficiency. Vitamins: functions, sources, effects of deficiency, requirements of water soluble and fat-soluble vitamins. Balanced diet: recommended dietary allowances for various age groups, assessment of nutritional status of the population.

Practical- Methods of measuring food ingredients, effect of cooking on volume and weight, determination of percentage of edible portion. Browning reactions of fruits and vegetables. Microscopic examination of starches, estimation of energy, value proteins and fats of foods. Planning diet for various age groups.

Lesson/ Course plan

| Lecture No | Topic | Weightage (%) |
|--------------|--|---------------|
| 1-2 | Food - Definition, Basic food groups. Nutritive value of food Functions and physico-chemical properties of foods. | 15 |
| 3-4 | Food preparation techniques – Effect of cooking on various nutrients. Different cooking methods – explain in detail the methods, their advantages and limitations. | 20 |
| 5-6 | Nutrition - Definition, relation of nutrition to health. Over and under Nutrition. Characteristics of well and malnourished population. | 10 |
| 7-8 | Energy - Definition, determination of gross energy, value of foods, total energy requirements of the body. | 10 |
| 10 – 12 | Mineral nutrition: macro and micro-minerals (Ca, Fe and P), function, utilization, requirements, sources, effects of deficiency. | 15 |
| 13-14 | Vitamins-Definition, classification, co-enzyme derivatives of water soluble vitamins, sources, metabolic functions and deficiency disorders of vitamins. Requirements of water soluble and fat-soluble vitamins. | 10 |
| 15 | Balanced diet -Definition, Recommended nutrient and dietary allowances for various age groups of both sexes. | 10 |
| 16 | Nutritional status - Definition, Methods of assessment of nutritional status of the population, their advantages and limitations. | 10 |
| Total | | 100 |

Practical programme:

| Practical No. | Topic |
|---------------|--|
| 1 | Methods of measuring food ingredients |
| 2 | Methods of measuring food ingredients |
| 3-4 | Determination of percentage of edible portion. |
| 5-6 | Effect of cooking on volume and weight |
| 7 | Browning reactions of fruits |

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| 8 | Browning reactions of vegetables |
| 9-10 | Microscopic examination of starches. |
| 11-12 | Estimation of energy value of foods. |
| 13 | Estimation of protein and fat content of foods. |
| 14 | Planning diet for various age groups (Age group I- Children) |
| 15 | Planning diet for various age groups (Age group II- Youth) |
| 16 | Planning diet for various age groups (Age group III- Old peoples) |

Suggested Reading:

Reference Books:

Anita, T. 1996. Food and Nutrition. Oxford 0198327668.

Devendra, K. B. and Priyanka, T. 2006. An Introduction to Food Science and technology and Quality Management. Kalyani Publishers 81-272-2521-5.

Dr. Swaminathan, M. 1985. Essential of Food and Nutrition Vol. II. BAPPCO, Bangalore. Dr. Swaminathan, M.1985. Food and Nutrition Vol. I & II. BAPPCO, Bangalore.

George, I. S. and Dennis, D. L. 1994. Chemistry for the Health Science. MacMillan.

Gopalan, G., Ramasastry, B.V. and Balasubramanian, S. C. 1989. Nutritive value of the Indian Foods. National Institute of Nutrition, ICMR, Hyderabad.

Manay, S.N, Shadaksharaswamy, M.1998. Food-facts & Principles .New Age International

Manoranjan, K. and Sangita, S. 1996. Food Preservation and Processing. Kalyani Publishers 978-81-272-4262-6.

Monoranjan, K. and Sangita, S. 2008. Food Preservation and Processing. Kalyani Publishers Passmore, R. and Eastwood, M. A. 1986. Human Nutrition & Dietetics. ELBSPublishers, New

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Shankunthala, M. 1972. Foods-Facts, Principles & Procedure. The Eastern Press, Bengaluru. Srilakshmi, B. 1995. Food Science. New Age International Publishers, New Delhi.

Srilakshmi. 2005. Dietetics. New age International 978-81-224-1611-4.

Srilakshmi. 2010. Food Science. New age International 978-81-224-2724-0.

Swaminathan, M. 1988. Hand book of Food Science & Experimental Foods. Bappco publishers, Bangalore.

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