UNIVERSITY OF AGRICULTURAL SCIENCES, BANGALORE
Department of Horticulture, CoA, GKVK, Bengaluru

HRT 321 - Post Harvest Management and Value Addition of Fruits and Vegetables (1+1)

III B. Sc. (Hons.) Agri. and III B. Sc. (Hons.) Agribusiness Management II Semester of 2025-26

EXTENDED SYLLABUS

Theory

- **Importance of post-harvest processing of fruits and vegetables**
  - Definition of post harvest technology/ post harvest management
  - Importance of post-harvest processing of fruits and vegetables: Reduction in post harvest losses, value addition, contribution to the economy, increased availability, export earnings, employment generation, adding taste and variety to foods, providing nutritional security, waste utilization, home scale preservation, reduction in cost of production, reduction in economic losses, supply for defence and astronaut's requirements, infant and speciality foods

- **Extent and possible causes of post-harvest losses**
  - Extent of post-harvest losses
  - Possible causes of post-harvest losses: Unfavourable climate, poor cultural practices, improper storage conditions, inadequate handling during transportation, inadequate facilities available for processing, government policies, education and resources, transportation facilities

- **Pre-harvest factors affecting postharvest quality**
  - Market factors
  - Cultivar and rootstock genotype
  - Environment: Light, temperature, rainfall, humidity, wind
  - Production practices: Water supply (irrigation), soil fertility and use of fertilizers (mineral nutrition, foliar nutrient sprays), cultivation practices (weed control, crop hygiene), agricultural chemicals (pesticides and herbicides, growth regulating chemicals), canopy manipulations (crop load, fruit canopy position, leaf removal, girdling), seasons, planting density, maturity, stage of harvesting, method of harvesting, consumer demand, crop rotation

- **Maturity**
  - Definition of maturity
  - Types of maturity: Physiological maturity, horticultural/ commercial maturity
  - Judging the maturity: Culinary maturity, dessert maturity, shipping maturity, processing maturity
  - Determination of Harvest Maturity Indices
    - Computational methods: Calendar date, DFFB (days from full bloom to harvest), mean heat units/ degree days, T- stage
    - Physical methods: Fruit retention strength, acoustic/sound tests, fruit size and surface morphology, shape, weight, specific gravity, colour (skin, flesh and seed), firmness/solidity, ease of separation, brittleness of the floral part, juice content, bulk density, formation of abscission layer, aroma/ organoleptic quality, vibration tests, electrical characteristics, electromagnetic methods, optical methods, radiation

- Chemical methods: Titrable acidity, TSS/acid ratio, sugars, sugar/ acid ratio, bioelectrical conductance, starch content (iodine test), tannin content, oil content, dry matter percentage, juice content
- Physiological methods: Rate of respiration, rate of ethylene production, transpiration, production of volatiles
- Geometrical methods

- **Ripening and changes occurring during ripening**
  - Definition of ripening
  - Changes that occur during the ripening of fruits
    - Physical Changes: Colour changes, abscission (detachment from parent part), softening, development of wax on the skin
    - Chemical Changes: Cell wall changes, changes in starch/carbohydrate composition, organic acid changes, amino acids and protein changes, production of flavour volatiles and aroma, ascorbic acid, phenolic compounds
    - Physiological Changes: Changes in respiration rate, changes in the rate of ethylene evolution, seed maturation

- **Respiration and factors affecting respiration rate**
  - Definition of respiration
  - Factors affecting respiration rate: Stage of development, moisture content, sugar of fruit, coating on surface of fruits, type of tissue, external factors (temperature, ethylene, availability of O_2, CO_2, growth regulator application, fruit injury)

- **Harvesting and field handling**
  - Harvesting Methods: Hand harvesting, mechanical harvesting (mechanical assistance, harvesting machines)
  - Post harvest field handling operations of fruits and vegetables: Harvesting, precooling, washing/ cleaning, trimming, sorting, curing, waxing/ chemical treatments, grading and sizing, packaging, storage, transportation, wholesaler, restoring, resizing and repacking, transportation, retailer and consumer

- **Storage**
  - ZECC: Principle and operation
  - Cold/ Refrigerated storage
    - Refrigerated storage: Concept, principle of refrigeration
    - Chilling: Concept, chilling injury
    - Freezing: Concept, freezing injury
    - Jacketed storages
    - Solar driven cold stores
  - Controlled Atmosphere Storage (CA Storage)
    - Physiological basis, essential features, benefits and harmful Effects
  - Modified Atmosphere storage (MA storage)
    - Biochemical and physiological basis of MA storage, methods of creating modified atmosphere conditions (commodity generated or passive MA and active MA)
  - Low Pressure Storage / Hypobaric Storage
    - Concept and mechanism

- **Value addition concept**
  - Definition, meaning and examples

- **Principles and methods of preservation**
  - Principles of preservation
    - Prevention or delay of microbial decomposition of the food
    - Prevention or delay of self decomposition of the food
    - Prevention of damage by insects, animals, mechanical causes etc.

  - **Methods of preservation**
    - Asepsis/ by keeping out micro-organisms/ absence of infection
    - Preservation by high temperature/ by killing the microorganisms: Pasteurization (heating below 100°C), boiling (heating at 100°C), sterilization (heating 100°C and above), difference between pasteurization and sterilization
    - Preservation by low temperature: Cellar storage, refrigeration or chilling, freezing
    - Preservation by chemicals: Sulphur dioxide, Benzoic acid
    - Preservation by drying
    - Preservation by filtration/ removal of micro-organisms
    - Preservation by carbonation/ by creating anaerobic conditions
    - Preservation by sugar
    - Preservation by fermentation: Acetic acid, lactic acid and alcoholic fermentation
    - Preservation by salt
    - Preservation by acids
    - Preservation by oil and spices
    - Preservation by antibiotics
    - Preservation by irradiation

  - **Minimal processing**
    - Definition, meaning and examples

- **Intermediate moisture foods - Jam, Jelly, Marmalade – Concepts and Standards**
  - Definition and meaning of intermediate moisture foods
    - Jam: Concept and standards, problems in jam production (crystallization, sticky or gummy jam, premature setting, surface graining and shrinkage, microbial spoilage)
    - Jelly: Concept and standards, important considerations in jelly making (pectin, acid, sugar, judging of end point), problems in jelly making (failure to set, cloudy or foggy jellies, formation of crystals, syneresis or weeping of jelly)
    - Marmalade: Concept and standards, jelly marmalade and jam marmalade, browning problem of marmalade

- **Fermented and non-fermented beverages**
  - Fermented beverages: Wine, champagne, port, sherry, tokay, muscat, perry, orange wine, berry wine, nira, fenni, cider
  - Non-fermented/ Unfermented beverages: Juice (natural/ pure juice, sweetened juice), Ready-to-serve (RTS), nectar, cordial, squash, crush, syrup, fruit juice concentrate, fruit juice powder, barley water, carbonated beverages

- **Drying/ Dehydration of fruits and vegetables – Concept and method**
  - Concept of drying and dehydration
  - Difference between drying and dehydration
  - Drying/ Dehydration techniques/ methods: Fruit and vegetable natural drying, sun and solar drying, shade drying, osmotic dehydration, dehydration using driers (air convection driers, drum or roller driers, vacuum driers), important differences between conventional and freeze drying

- **Canning - Concepts and Standards**
  - Principle of canning
  - Steps in canning: Selection of fruits and vegetables, grading, washing, peeling (hand, steam, mechanical, lye, flame), cutting, blanching, cooling, filling (syruping, brining), exhausting, sealing, processing, cooling, storage
  - Specific requirements for canning of fruits like banana, grapes, mango and papaya
  - Specific requirements for canning of vegetables like carrot, beans, cauliflower, peas and green leafy vegetables

- **Packaging of products**
  - Importance of packaging
  - Packing containers for fresh fruits and vegetables: Corrugated fibreboard, sacks, wooden containers, plastics, baskets, pre-packaging, paper and paperboard containers, modified atmospheric packaging, wrapping
  - Packing containers for processed fruits and vegetables: Tin containers, aluminium cans, collapsible tubes, glass containers, plastic containers, laminate, coextruded films, retortable pouch, bulk packaging, aseptic packaging
  - Packing of dried or dehydrated products

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