Chapter 5: PRE HARVEST FACTORS AFFECTING QUALITY ON POST HARVEST LIFE OF FRUITS AND VEGETABLES – FACTORS RESPONSIBLE FOR DETERIORATION OF HARVESTED FRUITS AND VEGETABLES

Quality of post harvest product

Post harvest quality represents market quality, edible quality, transport quality, table quality, nutritional quality, internal quality and appearance quality. Quality means a combination of characteristics, attributes and properties that gives the values to human and enjoyments. Consumers consider good quality in relation to colour, flavour and nutrition. Quality of the produce is the final manifestation of inter-relation between the commodity and its environment. The genetic characteristics and physiological status of the commodity determine the typical post-harvest behavior and quality of the produce and these two are the major bases for the interaction. Pre-harvest factors viz, environmental factors such as temperature, relative humidity, water potential, light, cultural practices and pest management techniques determined the inherent quality of the produce. However, the ultimate quality is the final manifestation of inter relation between the commodity and its environment.

Several pre-harvest and post-harvest factors affect the quality of horticultural crops. Some of these factors are related to plant, others are related to environment or to cultural practices.

A. Pre-harvest factors

a) Related to plants

- **Crops: Q**uality of the fruit and vegetables are varies from crop to crop e.g. jackfruit, bael, potato, onion, pumpkin, garlic etc. having good quality in relation to shelf life, while apple, mango, cherry, strawberry, tomato, capsicum, okra, brussels sprout, chinese cabbage, carrot, radish attract more to consumers due to their attractive appearance.
- **Cultivars:** The quality of seed or plant material is an important factor that controls the quality of the fruit and vegetable produced. Several parameters of quality are controlled genetically.

• **Cultural practices**: All cultural practices have direct effect on the final quality of the produce.

• **Planting period**: Many plants are very sensitive to environmental conditions, and thus quality will not be optimized when crop is produced under adverse conditions. Producing summer plants during the winter or vice-versa will not be appropriate, unless protection practices are implemented.

• **Planting density**: It affects both the quantity and quality of the produce. High density planting increases competition between plants, reduces light availability, and thus may decrease

quantity. Low density planting lead to large size, better colored fruit or vegetable which may have shorter shelf life. Larger fruits are commonly more sensitive to physiological disorders.

• **Irrigation:** Irregular watering usually reduces fruit size, increases splitting, physiological disorders, reduces water content in the plant or plant part, etc.

• **Fertilization:** Poor management of fertilizers will increase physiological disorders due to deficiencies of some minerals or increase of other leading to toxicity. In both cases, quality will be negatively affected.

• **Pruning:** It reduces the load and increases the growth of fruit and chemical use after harvest.

• **Thinning:** This operation reduces the competition between fruits or plants and thus promotes a good balance between the vegetative and fruit parts and improves quality.

• **Protection:** Pathogens and insects have a very negative effect on quality. Poor management of plant protection programmes can lead to very poor quality and reduced yield.

b) Related to environments

Temperature is the most important environmental factor that affects quality, very low or very high temperature may injure sensitive crops. Adequate high intensity and quality is important for the formation of some colour. Wind and rain may cause negative effects on some crops.

c) Related to chemicals

Many hormones and growth regulators are used in agriculture and they can affect quality in different ways.

B) During harvest factor

• **Season:** Quality of produce are greatly influenced by season e.g. Winter season harvest having more shelf life as compared to other season, while off season fruits and vegetables give more remunerative price. Harvesting during or immediately after rains should not be carried out since it creates most favourable conditions for multiplication of micro-organisms. Citrus fruits become susceptible to damage if harvested during rains as their rind becomes turgid and prone to easy bruising, sun-scald etc.

• **Time:** Fruits and vegetables should always be harvested when temperature is mild. Because, higher temperature leads to faster respiration. Morning harvest of horticultural crop prefer for local market because they are fully fresh and turgid and having dew drop in this time. Evening harvesting is preferred for distant market due to higher accumulation of reserved carbohydrates and less amount of moisture which give the better quality of the produce to consumer. Leafy vegetables harvested in the latter part of the morning or late in the afternoon, the petioles of these vegetables break less easily and their leaves are more resistant to tearing, since they

have lost water through transpiration and therefore are less brittle. Cucumber is harvested in the late morning when it to be transported under less than ideal condition because it is less prone to injury when it contains less water.

• **Method of harvesting**: Selection of suitable method for harvesting of the produce is necessary otherwise bruises or injuries during harvesting may later manifest as black or brown patches making them unattractive. Latex coming out of stem in mango should not be allowed to fall on fruits as it creates a black spot. Injury to peel may become an entry point for microorganisms, causing rotting. Some harvesting gadgets have been developed, e.g. mango harvester in Lucknow (CISH).

• **Stage of harvesting**: Fruits and vegetables must be harvested at right stage of maturity. A very common cause of poor product quality at harvest and rapid deterioration thereafter is harvesting immature vegetables. Vegetables harvested immature or over mature usually do not keep long. Fruit vegetables harvested too early lose water fast and are more susceptible to mechanical damage and microbial attack. An over mature vegetable is more susceptible to decay, has passed its best eating quality, and deteriorates fast.

• **Consumer demand**: Harvesting time and harvest maturity can be altered by the requirement of the consumer's demand which may affect the quality of the produce at some extent.

c) Post-harvest factors:

• **Curing:** Curing is done immediately after harvesting. It strengthens the skin. The process is induced at relatively higher temperature and humidity, involving suberization of outer tissues followed by the development of wound periderm which acts as an effective barrier against infection and water loss. It is favoured by high temperature and high humidity. Potato, sweet potato, colocasia, onion and garlic are cured prior to storage or marketing. Potato tubers are held at 18°C for 2 days and then at 7°—10°C for 10—12 days at 90% relative humidity. Curing also reduces the moisture content especially in onion and garlic. Drying of superficial leaves of onion bulbs protects them from microbial infection in storage.

• **Degreening**: It is the process of decomposing green pigment (Chlorophyll) in fruits usually applying ethylene or similar metabolic inducers to fruit. It is applicable to banana, citrus and tomato. Degreening is carried out in special treating rooms with controlled temperature and humidity in which low concentration of ethylene (20 ppm) is applied.

• **Pre-cooling:** High temperatures are detrimental to keeping quality of fruits and vegetables, especially when harvesting is done during hot days. Pre-cooling is a means of removing the field heat. It slows down the rate of respiration, minimizes susceptibility to attack of micro-

organisms, and reduces water loss. Peas and okra which deteriorate fast need prompt pre-cooling.

- **Washing and drying**: Most of the fruits and vegetables are washed after harvesting to improve their appearance, to prevent wilting and to remove primary inoculum load of microorganism. Hence, a fungicide/bactericide should be used in washing water. Washing, improves shelf life of bananas by delaying their ripening. After washing, excess of water should be removed which would otherwise encourage microbial spoilage.

• **Sorting and grading**: Fruits and vegetables require sorting and grading for uniform packing at field level. Sorting is done on the basis of size and colour while grading practice is performed as per the defect or on the basis of marketable and unmarketable produce.

• **Disinfection:** Papaya, mango, melon and other fruits are susceptible to fruit fly attack. Disinfection is done either by vapour heat treatment (VHT) at 43°C with saturated air with water vapour for 6-8 hr by Ethylene dibromide fumigation.

• **Waxing:** Fruits and vegetables have a natural layer on their outer surface which is partly removed by washing. An extra discontinuous layer of wax applied artificially with sufficient thickness and consistency to prevent anaerobic condition within the fruits provides necessary protection against decay organism. Waxing also improves the appearance and glossiness, making them more acceptable.

• **Packing:** It means more than carrying multiples of an object. Packing not only protects the horticultural produce but also makes a favourable impression on the buyers and May able to fetch higher income.

• **Delivery:** Moving the harvest produce from the farm to the customer in good condition is important. All efforts upto delivery can be invalid if the fresh fruits and vegetables reach the destination in poor condition. Care should be taken to protect the produce and it becomes necessary when mixing load of fruits and vegetables to prevent violating the compatibility factors.