



### Maturity Indices: Important Key to Minimize Post Harvest Loss of Fruits

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India occurs post harvest fruits and vegetables losses >25% annually. The major loss is observed in the state of West Bengal, Gujarat, Bihar and Uttar Pradesh, where the fruit cultivation is commercialized. This loss is mainly due to improper harvesting, handlings, poor storage facilities in rural areas and improper transportation facilities etc. Hence, it is a great challenge to us to minimize the losses.

#### Introduction

India has diverse agro climatic region in different parts, which are useful to growing a vast range of fruits, vegetables and flowers and also other horticultural produces. India ranks 2<sup>nd</sup> in world production of fruits after china. In India total area under horticultural crops is 23.6 MHa with production of 268.8 MT. Out of total horticultural production fruits contributes 6.9 MHa area with production of 81.2 MT in year 2012-13. (NHB Database 2013, NHB, Gurgaon, Haryana).

#### Maturity indices

Maturity is the stage of any commodity at which attainment of proper size takes places by the tissues and it leads to the ripening. These are the indices which determine the harvesting stage of horticultural produce to ensure the acceptable to the consumer and marketability. There are two type of maturity shown by any commodity-

- 1. Horticultural maturity**-it is the development stage of the fruits still attached on the mother plant or it posses prerequisite to the for the utilization i.e. ready for harvesting.
- 2. Physiological maturity**-It is the maturity when fruits attain its maximum growth even after if detached to the plants.

#### Methods of determining the maturity

There are many methods to assessing and determining the maturity of any particular commodity. These are different according to fruits and vegetables. These are as under –

- 1. External appearance or visual means** – It includes all visual characters like colour, shape, fullness and size of the fruits and vegetables. It is the most convenient method to assessing the maturity.
- 2. Physical methods**- Fruit retention strength, Fruit firmness, Specific gravity, weight etc.
- 3. Chemical methods**-It includes all chemical aspect of the fruits such as titrable acidity, total soluble solids, Juice content, TSS/Acid ratio, starch-iodine test, oil content, tannin content, sugar/acid ratio etc.
- 4. Physiological methods**- Respiration rate and ethylene evolution rate.
- 5. Computational methods**- Calendar date, Days from full blooming (DFFB), heat units, T-stage for apple etc. (Note: Only physical and visual means applicable to the farmers on field to judge the maturity of particular commodity).

**Maturity indices for some important fruits-** Different maturity indices of major fruit crops are briefly described here-

### 1. Apple-

- Days from full bloom to harvest (DFFB) considered best. It's for delicious group 135±4 and optimum maturity 140-150 days after full bloom.
- Starch pattern index- For Fuji, gala and golden delicious it is 3, for McIntosh it is 5 and for red delicious it is 2.5. If the starch index is more than 5.5 it starts showing over maturity.
- Colour of skin, ease to separation and firmness also used to asses' maturity but these are not so effective methods. Firmness should be 13-14lb/sq. inch for local market Short distance it should be 14.5 -15.5lb/sq. inch.
- Total soluble solid ranges from 11-13% for most of varieties.
- T stage-angle b/w pedicle and receptacle varies in relation to growth.

### 2. Banana-

Banana is a climacteric fruit so it harvested on full maturity but green stage. Important maturity indices are-

- Fullness of fingers is standard index. Disappearance of angularity takes place after full development, the angular ridges become roundish.
- Pulp to peel ratio for dwarf Cavendish is 1.35 to 1.40.
- For local market at 90% maturity and for long distance 75-80% such fruits will ripen within 3-4 weeks
- Colour development from green to yellowness
- pH of fruit is 5.2-5.6
- When mature banana cut into two halves some threads like structure are formed.

### 3. Citrus-

- TSS/acid ratio for mandarin 13:1, for kinnow 12:1-14:1,
- Peel colour development from green to yellow (But not in all fruits), Size etc.
- Acidity- for mandarin 0.4-0.6%, sweet orange 0.3%, lime 6%
- TSS- mandarin 12-14°, sweet orange 12°
- Calendar date -Kinnow harvested in Punjab from last week of Jan. to mid Feb. Mandarin in Darjeeling (MH) mid Nov. to late Dec.

### 4. Mango-

Generally mango harvested at mature stage but ripening done artificially by ethylene.

- Naturally falling of the fruits called "Tapka stage" is most prevalent in rural areas.
- Colour development green to light yellow but not applicable in all varieties such as dashehri remains green at all.
- Fullness of cheeks or shoulder development.
- Specific gravity ranges from 1.01-1.02. it is most reliable methods.
- Calendar date- Dashehari and Langra harvested in 2<sup>nd</sup> week of June, Amrapalli and Mallika harvested in later 3<sup>rd</sup> week of July, Fazli late august, Bombay green 1<sup>st</sup> half of June, Chausa in last week of July.

### 5. Guava-

- Days from fruit set to harvest –Most of varieties take 106 to 121 days to harvest.
- TSS/acid ratio 35.8 for Allahabad safeda and 34.25 L-49 etc.
- TSS range varies from 8.2 to 10.5 in most of cultivars.
- Specific gravity should be <1.0.
- Acidity is 0.22-0.39
- Peel colour White to light pink in pink flesh varieties.

**6. Grape-**

There are many maturity indices those are helpful for harvesting of the grape at optimum stage. These are as under-

- Development of the abscission layer
- TSS range Anab-e-shahi 14-16%, Thompson seedless-18-22%, Bangalore Blue-12-14%
- Colour development of berries also but not so effective method.
- TSS –acid ratio is a good indication of the maturity i.e.
- Degree days of heat units also good. For BB -3562 degree days, Gulabi 3508 degree days and for Thompson seedless 1600-2000 degree days required.

**7. Papaya-**

- Surface colour change from green to yellow. Appearance of yellow streaks on the surface is a visual index.
- Jellyness of seed and seed colour changing also indication of maturity.
- TSS about 11.5% depending upon the varieties.
- Latex colour and reduction also a criteria of maturity.

**8. Pineapple-**

- The flattening of eye on the surface is most important criteria.
- Surface colour change from green to brown, light yellow or golden colour.
- TSS nearly 12-14%.Acidity 0.5-0.6%
- Development of good aroma.
- Specific gravity of pineapple is 0.98-1.02

**9. Pomegranate-**

- It is also doesn't ripen after harvesting so harvesting done at fully ripened.
- Metallic sound when tapping is a indication of maturity.
- When seed colour become pink and peel colour also turn pinkish.
- Total sugar content is 12-16%
- Inward curving or closing of the calyx at distal end during it mature.
- It takes 120-135days from fruit set to harvest.

**10. Sapota-**

It is very difficult to judge the maturity of sapota. But some indices are by which we can judge the maturity:

- Skin colour change from light brown to dark brown (Potato like colour).
- Through the scratching it is found that the colour of flesh turns light brown to dark brown.
- The brown scale like structure on the surface is disappeared during ripening.
- Latex is completely reduced.
- TSS range 13-26% and acidity 0.2-0.3%
- Scurf formation when touch it with finger it ease out separately.

**11. Strawberry-**

- Berry colour 2/3 or 3/4 part show red or pink colour.
- Development of proper size and shape a/c to variety.
- Development of flavor and characteristic aroma
- TSS should not less than 7% and acidity nearby 0.8% preferred.

**12. Kiwifruit**

- TSS should be minimum 6.2-6.5 %
- Scurf formation which are ease to separate out.
- Flesh firmness 14lb.

**13. Aonla-**

- Colour change is most important aspects which change from light green to dull greenish yellow with red tinge and seed colour creamy white to blackish.
- Vitamin C content 600mg/100g fruits but ascorbic acid content also varies a/c to cultivars.
- From flowering to harvesting fruits takes about 8 months.
- Titrable acidity content ranges from 1.9% to 2.24% (Yadav S.S and Yadav P.N., 2010)

**14. Date palm-**

- Sugar content should be 50% by fresh wt basis and nearly 75% by dry weight basis.
- In India date is mostly harvested at Doka stages also k/a *khalal* stage. In this stage moisture content is 50-80% less astringent fruits and bright yellow and red in colour but perishing ability is high.
- Doka fruits are suitable for *Chuhara* making. (a processed product of date).
- In other countries it harvested at Dang stage which are suitable for fresh eating. Dang stage also k/a *Rutab* stage, moisture is 30-45% soften fiber also perishable.
- Fully ripened stage is pind or *Tamer* stage, moisture content below 25% and high storage life, fruits dark brown in colour. This is highly suitable for dried dates making.

**15. litchi-**

Hence litchi is a non climacteric fruit so it is necessary to harvest at proper ripening for better quality and as well marketing also.

- Surface colour should be deep red during harvesting or orange colour disappeared.
- Flattening of the segments also good indicates of litchi maturing.
- Soluble solid concentration/titrable acidity ratio is a good and reliable indicator for litchi harvesting.

**Conclusion**

It is concluded that post harvest loss can be minimized by harvesting of fruits at right stage and right time. Farmers should be considered these maturity indices for quality management and to extend the shelf life of a produce.

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