

1. Mango

Maturity Indices

- (1) Fruits generally require 95 to 115 days to mature after flowering.
- (2) Raising of shoulders and a slight depression near the stalk end indicates the maturity of fruit.
- (3) Colour of fruit changes from dark green to pale green.
- (4) Red blush develops on the fruits shoulders
- (5) One or two or three ripe fruits fall from the plant naturally, indicating maturity of the other fruits on the tree.
- (6) The fruits with specific gravity between 1.00 to 1.02 are said to be mature.

#Harvesting

Harvesting is done using pole harvesters without causing any damage to the fruit. The fruit is twisted sharply sidewise or upward. The pedicel is trimmed short enough to keep it from puncturing other fruits. NUTAN Mango harvester developed by Dr. BSKKV, Dapoli used harvests fruits borne on high branches.

Handling

- Washing with water to remove the latex and dust.
- On a commercial scale or for export purpose, they are sometimes dipped in hot water, containing fungicide for the control of diseases.
- Hot water treatment (HWT) is an effective post-harvest treatment for Mangoes.

Grading

A+ grade >300 g

A grade 250-299 g

B grade 200-249 g

C grade 150-199 g

D grade < 150

2. Banana :-

Maturity Indices

1. The dwarf bananas are ready for harvest within 11 to 14 months after planting. While tall varieties take about 14 to 16 months to harvest.
- (2) Fruits usually mature in 120 to 140 days after flowering.
- (3) The fruit bunch is harvested when the ridges on their surface changes from angular to round
- (4) The dried parts of flowers at the top of fruit drop off easily.
- (5) The top most leaf starts drying as the bunch matures.

(6) Colour of fruits / fingers changes from dark green to pale green

OR

- i. Drying of top leaves.
- ii. Change of fruit colour from dark green to light green.
- iii. Tendency of floral end of the fruit to fall by slightest touch by hand.
- iv. Fruit become plumpy and angles are filled in completely.
- v. When tapped, the fruit give metallic sound.

Harvesting

The trunk is lopped with a sickle or hatchet over halfway through the stem. The bunch will not fall to the ground but hang on, and injury is avoided. The bunch is held and its peduncle is served. About 30 cm of the stalk must be left to make handling easy.

Handling

- After harvest banana bunches are arranged in rows with the cut ends of pedicel upward, called stowing
- After harvest, dehandling should be carried out with a sharp, clean Banana knife, making a smooth cut as close as possible to the stem.
- After dehandling, the fruits are placed with the crown facing downwards onto a layer of leaves to allow for latex drainage

Grading

A. Extra class - Bananas shall be of superior quality. They must be characteristics of the variety and/or commercial type. The fingers must be free of defects, provided these do not affect the general appearance of the produce, quality, the keeping quality and presentation in the package.

B. Class I - Bananas shall be of good quality. They must be characteristics of the variety and/or commercial type. The slight defects of the fingers, however, may be allowed, provided these do not affect the general appearance and quality of the produce in the package.

C. Class II - This includes bananas which do not qualify for inclusion in the higher classes, but satisfy the minimum requirements. Defects in shape and colour provided the product remains the normal characteristics of bananas, skin defects due to scrapping, scabs, rubbing, blemishes or other causes not The defects must not affect the flesh of the fruit.

3. Papaya

Maturity indices

1. Fruits require 125 to 140 days from flowering to maturity.
2. Colour of fruit changes from dark green to pale green or yellowish / pink streak at apex
3. The latex of the fruits becomes watery.
4. T.S.S. at harvest should be minimum 11 to 12%

Harvesting

1. Fruits are harvested by twisting the fruit with hand.
2. Ladders are often used to harvest tall trees
3. Mechanical injury to the fruits should be avoided.

Handling

1. After harvesting the fruit should be placed in single layer and covered with straw till ripening.
2. For distant markets it should be packed in baskets by placing straw below and newspaper along with gunny bag above to avoid bruising of fruits.
3. Papaya is a climacteric fruit hence, it can be artificially ripened by dipping fruits in 500 ppm ethephon.
4. At ripening fruits attain golden yellow colour of skin.

Grading

Size grading of Papaya	Size grade weight (grams)
XL	> 850
L	650-850
M	450-640
S	250-450

4. Citrus

Sweet Orange and Mandarin

Maturity Indices

1. Fruit mature in about 210 to 240 days.
2. Colour changes from green to pale green or pale yellow or orange.
3. Outer rind looks shiny and one can see oil glands on the fruit.
4. Mandarin 0.4% acidity and 12 to 14 % T.S.S., orange 0.3% acidity and 12% T.S.S.

Harvesting

In India the fruit picker collect the fruits manually by climbing on a ladder when the tree is tall, with a collecting bag on his shoulders. In U.S.A. mechanical harvesting is done particularly for processing industry.

Handling

1. Harvested fruits should not be kept out in the hot sun.
2. Fruit can be cleaned manually by hand rubbing.
3. Individual fruit dumped in a tank of sanitized water.
4. Fruit can also be cleaned mechanically by passing the citrus fruit over a series of roller brushes wetted from wash water with spray nozzles.

Grading

i. Grading of Mandarin

Grade designations	Minimum diameters (cm)	State of condition
Extra	8.1	The mandarins shall have reached a stage of maturity which will permit the subsequent ripening in the ordinary course of transport and market.
Special	7.5	Fruits should be reasonably uniform in colour No fruit shall be entirely green.

Good	6.8	Each fruit shall have the shape normal to the variety and free from malformation.
A	6.2	Fruits shall be free from defects due to diseases or insects or mechanical injuries or sunburn affecting the fruit internally.

ii. Various grades given by Agmark in citrus fruits.

1. Mosambi	
Grade	Minimum diameter (cm)
Extra special	7.50
Special	6.75
Good	6.25

2. Mandarin	
Grade	Minimum diameter (cm)
Extra special	8.00
Special	7.50
Good	6.75
A	6.25
B	5.25

5. Guava

Maturity Indices

- i. Guava fruit generally takes about 17-20 weeks from fruit set to maturity.
- ii. Change in colour of fruits from dark green to pale green is the indication of maturity.
- iii. TSS acid ratio of 35: 8
- iv. A slight depression develops near the stalk end.
- v. Ridges on the fruits disappears and it becomes round.

Harvesting

The fruits are harvested selectively by hand along with the stalk and leaves.

Handling

The harvested fruits should be assembled in baskets or plastic crates, since keeping them on ground may lead to latent infections from soil microbes causing spoilage of fruits during storage and ripening. The containers should be kept under shade to avoid sun heat which may cause rise of respiration resulting into shorter shelf life of fruits.

Grading

On the basis of weight and size, Directorate of Marketing and Inspection (DMI) suggested the following grades for guava

Grades	Weight (gm)	Diameter (cm)
A	> 350	> 95
B	251 - 350	86 - 95
C	201 - 250	76 - 85
D	151 - 200	66 - 75
E	101 - 150	54 - 65
F	61 - 100	43 - 53

6. Custard apple

Maturity Indices

- (1) Requires 100 to 120 days for full maturity
- (2) Scales on fruits become prominent, plumpy and well space.
- (3) Fruit become comparatively soft.
- 4) Skin between scales / segments turns creamy white.

Harvesting

Harvesting may extend from September to November depending on the period of flowering. Fruits are harvested manually.

Handling and processing

Harvested fruits are placed in Bamboo baskets lined with soft material like straw.

Custard apple (*Annona squamosa*) is one of the most perishable fruit crop and has a limiting shelf-life of 1 to 2 days. Hence there is greater need to preserve the custard apple fruits and to process into suitable products viz., icecream, milkshake, custard powder etc.

7. Aonla

Maturity Indices

Commercially used parameters like days from flowering to maturity, heat units, colour of fruit surface and TSS: acid ratio can be used for determining the maturity index of aonla cultivar in a particular region. The colour of fruit changes during ripening. The fruits are normally light green at first but on maturity and ripening, the colour becomes dull, greenish yellow or rarely brick red. Change in seed colour from creamy white to brown is an indication of fruit maturity.

Harvesting

Aonla fruits are ready to harvest during November-December. Maximum ascorbic acid content is observed in mature fruits, while immature fruits are acrid and low in ascorbic acid content and minerals.

Fully developed fruits are harvested. Delayed harvesting results in heavy dropping of fruits particularly in Francis and Banarasi.

Harvesting should be done in early or in late hours of the day. The method of harvesting is hand picking of individual fruits. Individual fruits are plucked by climbing on the tree with the help of pegged bamboo or ladder.

Handling

Harvested fruits are mostly kept in Bamboo baskets or crates in shade. Fruits should not be kept in sun to avoid shrivelling of fruits.

Grading of Aonla

Aonla fruits are graded into 3 grades i.e. large sized, small sized and blemished fruits. Large sized, sound fruits are mostly utilized for preserve and candy; small sized for chavanprash and trifala and blemished fruits for powder and shampoo making.

8. Grapes

Maturity Indices

- (1) A fruit mature in 120 to 135 days, after flowering.
- (2) Depending upon the variety colour changes from green to yellow or golden yellow or black or pink.
- (3) Being non-climacteric, fully ripe fruits are harvested.
- (4) Easy separation of berries indicates harvesting stage.
- (5) Development of characteristic flavour and aroma.
- (6) Anab-e-shahi : 15 to 16% T.S.S. Thompson seedless 18 to 20% T.S.S.

Harvesting

Grapes are harvested when they are fully riped. When the lower most berry of a bunch becomes soft and sweet, this bunch is harvested. While harvesting the clusters should be removed from the vine by cutting with a sharp knife near its attachment to the cane. Handle the cluster by the stem.

The bunches are generally harvested in the evening.

Handling

Harvested bunches are placed gently in clean perforated plastic crates and left in the shade of the vines for subsequent transfer to pack-house. The crates should be lined with clean bubble sheets for cushioning and kept over newspapers spread on the ground to avoid contamination with vineyard dust. The bunches are kept in such a way that their stalks should not injure berries from other bunches.

The bunches are pre cooled at low temperature before packing.

Grading of Grapes

The grapes have three standards viz.; Extra Class, Class I and class II as per AGMARK.

Grade	Grade Requirements
Extra class	Grapes must be of superior quality. The bunches must be typical of variety in shape, development and coloring and have no defects. Berries must be firm, firmly attached to the stalk, evenly spaced along the stalk and have their bloom virtually intact.
Class I	Grapes must be of good quality. The bunches must be typical of variety in shape, development and coloring. Berries must be firm, firmly attached to the stalk and, as far as possible, have their bloom intact. They may, however, be less evenly spaced along the stalk than in the extra class.
Class II	The bunches may show defects in shape, development and coloring provided these do not impair the essential characteristics of the variety. The berries must be sufficiently firm and sufficiently attached. They may be less evenly spaced along the stalk than Class I grade.

Size is determined by the weight of bunches (in gms). The following minimum (in gms) requirements per bunch are laid down for large and small berries grapes.

Grade	Large berries (gm)	Small berries (gm)
Extra class	200	150.
Class I	150	100
Class II	100	75

9. Sapota

Maturity Indices

- (1) Fruits generally matures in about 240 to 270 days after flowering.
- (2) Fruits at full maturity develop a dull orange or potato colour.
- (3) A mature fruit when scratched slightly with nail shows a yellow streak instead of green streak.
- (4) Brown scaly material disappears from the fruit surface as the fruits approach full maturity.
- (5) The milky latex content is reduced.
- (6) The dried spine like style at the top of the fruit falls or drops off easily when touched.

Harvesting

The fully matured fruits are harvested with the stalk intact, individually by giving a twist and collected without brushing. Atul sapota harvester developed by Konan Krishi Vidyapeeth, Dapoli should be used to avoid post harvest losses.

Handling

- . Fruit must be carefully handled in order to prevent bruising and wounding.
- . Detached fruits must not be allowed to fall to the ground.
- Harvested fruit must not be exposed to direct sunlight, but should be kept under shade.
- Harvested fruit must be collected in clean and dry plastic crates.
- Defective fruits, i.e., those that are diseased, mechanically damaged and not marketable must be separated out.
- Fruits must be cleaned by wiping or brushing. They must not be immersed in water as the corky fruit peel can retain moisture.
- Fruits must be transported during the cooler part of the day, in well ventilated plastic crates under clean and dry conditions.
- Wetting of fruit during transportation must be avoided.
- Fruit must be transported as quickly as possible to the final destination, to prevent spoilage.
- Fruit destined for export must be packed in cardboard cartons lined with shredded paper to protect against injury.

Grading

Grading is mainly based on size and shape of the fruits. The fruits are graded into three categories depending on their size viz. large, medium and small.

10. Pomegranate

Maturity Indices

- (1) Fruits are ready for harvesting in about 150 to 170 days.
- (2) Colour changes from green to yellow or yellowish brown.
- (3) Fruit becomes soft.
- (4) Ridges develop on the fruits and fruits become flat.
- (5) Floral part dry out.
- (6) Pressing fruit with finger give cracking or metallic sound.

Harvesting

Pomegranate fruits are harvested manually or harvested with the help of secateurs.

Handling

The fruit should be cushioned in wooden crates or in baskets lined with paper or straw. The fruits should be transported in cool temperature.

Grading

Pomegranate fruits should be graded on the basis of their weight, size and external rind colour. The grades are:-

Grading based on size and colour.

Super sized: Fruits having good, attractive bright red colour weighing 500-750 g

King sized: Free from spots, having an attractive red colour and weighing 500-750 g

Queen sized: Fruits between 400 and 500 g having bright red colour and free from spots.

Prince sized: Fully ripe fruits weighing between 300 and 400 g with red colour.

Besides pomegranate are also graded into 2 grades 12 A and 12 B.

12 A :- Fruits having 1-2 spots and weighing between 250-300 g.

12 B :- Fruits weighing <250 g.

11.PINEAPPLE:

Maturity Indices

- (1) Require 105 to 130 days for maturity
- . (2) Colour of lower portion of fruit turns green to yellow.
- (3) Eyes on the fruit become smooth or flat and they budge on the sides.
- (4) Eye bracts become loose and turn brown in colour.
- (5) Mature pineapple should have 12% T.S.S., 0.5 to 0.6% acidity, and Specific gravity 0.98 to 1.02.

Harvesting

Harvesting should be done with a sharp knife severing the fruit stalk with a clean cut and retaining 5-7 cm. of the stalk.

Handling

Harvested pineapples are placed into a basket carried on the back of the harvester.

Grading by AGMARK standard

i. Extra class - Pineapples must be of superior quality. They must be characteristic of variety and/or commercial type. They must be free of defects. Very slight superficial defects may be there, provided these do not affect general appearance of the produce, the quality, the keeping quality and presentation in the package. The crown, if present, shall be simple and straight with no sprouts and shall be between 50 and 150% of the length of the fruit with trimmed or untrimmed* crowns.

ii. Class I - Pineapples must be of good quality. They must be characteristics of the variety and/or commercial type. The following slight defects however, may be allowed, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.

- slight defects in shape

- slight defects in colouring; including sunspots;

- slight skin defects (i.e. scratches, scars, scraps and blemishes) not exceeding 4% of the total surface area.

iii. Class II - Pineapples which do not qualify for inclusion in the higher grades but satisfy the minimum requirements. The following defects may be allowed, provided the pineapples retain their essential characteristics as regards the general appearance, quality, the keeping quality and presentation

- defects in shape,

- defects in colouring; including sunspots;

- skin defects (scratches, scars, bruises and blemishes) not exceeding 8% of the total surface area.

Weight Grading for export purpose (with crown)

A- grade: 2750 g, B- grade: 2300 g, C- grade: 1900 g

12. Litchi

Maturity Indices

1. Fruits turns deep red when fully ripe.

2. Tubercles becomes somewhat flattened and epicarp becomes smooth.

3. Specific gravity 1.00 and TSS 0.24% considered as optimum stage of maturity.

Harvesting

The fruits are harvested manually after reaching proper maturity stage. The fruits are harvested in bunches along with a portion of the branch and a few leaves.

Handling

After harvesting, the fruits should be kept in cool, dry and properly ventilated rooms to facilitate the ripening process under high atmospheric temperature. If exposed to sun even for a few hours the quality deteriorates markedly.

Litchi is non-climacteric fruit that possesses poor shelf life and therefore needs specific treatment before packing and transportation for long distance market.

Grading

A- grade : 33 mm (diameter) and B- grade : 20 mm (diameter)

13. Strawberry

Maturity Indices

1. 1/2 -3/4th of skin develops colour.
2. Berry turns whitish and maximal of water afterwards colour and flavour develops.
3. Delaying in picking usually increases the proportion of over ripe and rotted berries

Harvesting

Strawberries are generally harvested when half to three fourths of skin develops colour. Depending on the weather conditions, picking is usually done on every second or third day usually in the morning hours.

Handling

Strawberries are harvested in small trays or baskets. They should be kept in a shady place to avoid damage due to excessive heat in the open field.

Grading

Fruits are graded on the basis of their weight, size and colour.