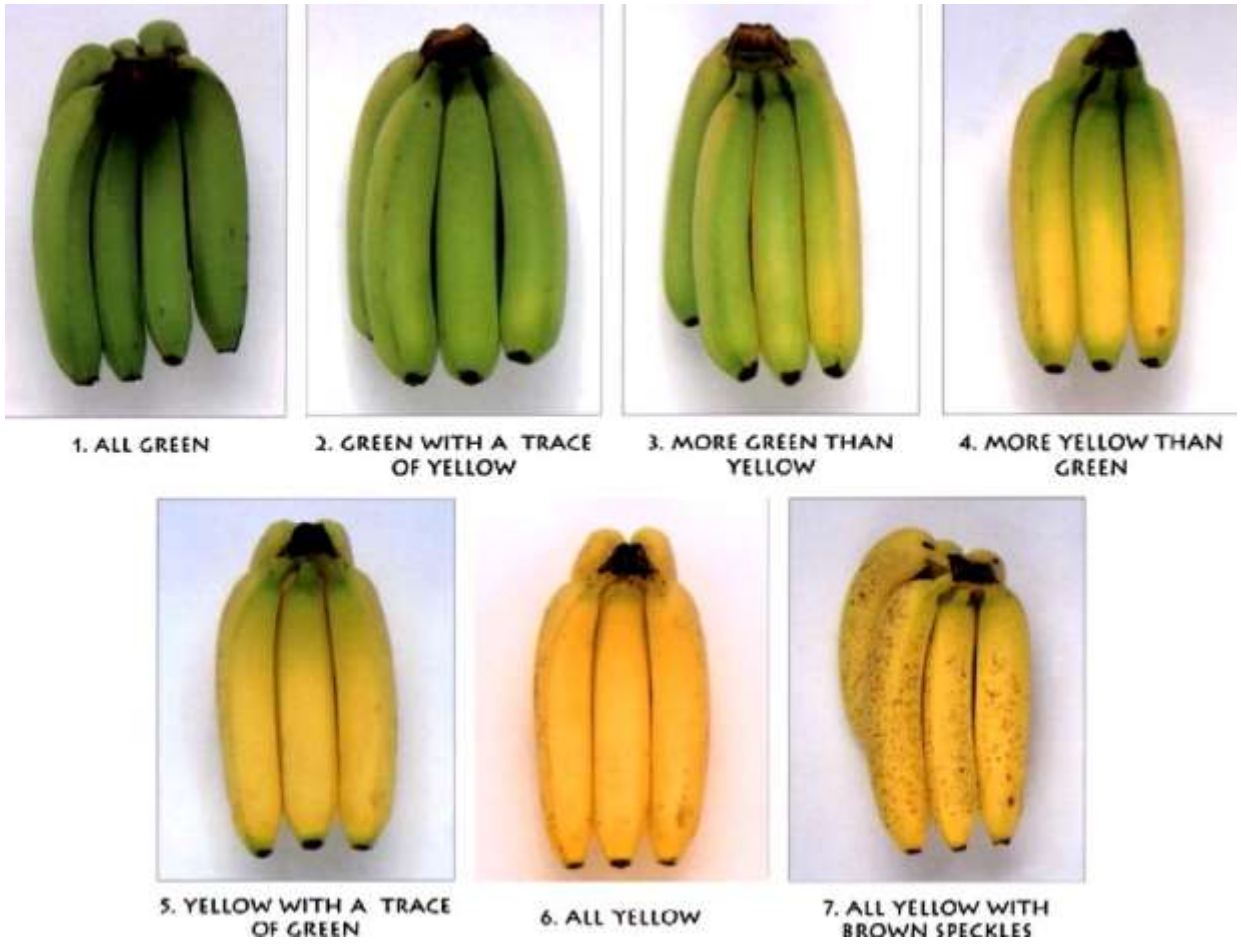
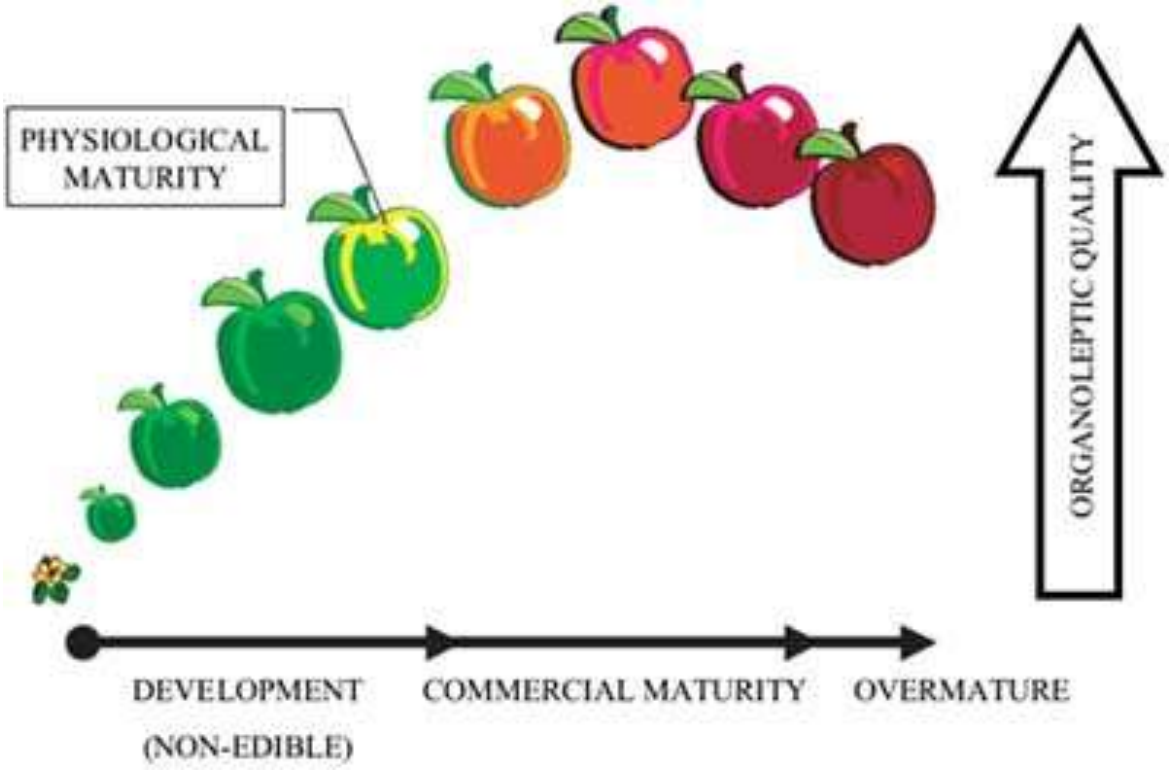
Maturation and Maturity Indices



- Fresh perishables should be harvested at the time of correct maturity.
- Affects the storage life and quality, the way the perishables are handled, transported and marketed.



Definition of maturity

- The stage at which a commodity has reached a sufficient stage of development that ~~after~~ harvesting and postharvest handling (including ripening) its quality will be at least the minimum acceptable to the ultimate consumer.

Types of maturity

1. Physiological maturity

✓The stage in the development of fruits and vegetables when maximum growth and maturation has occurred.

✓Usually associated with the full ripening of fruits.

✓Followed by senescence.

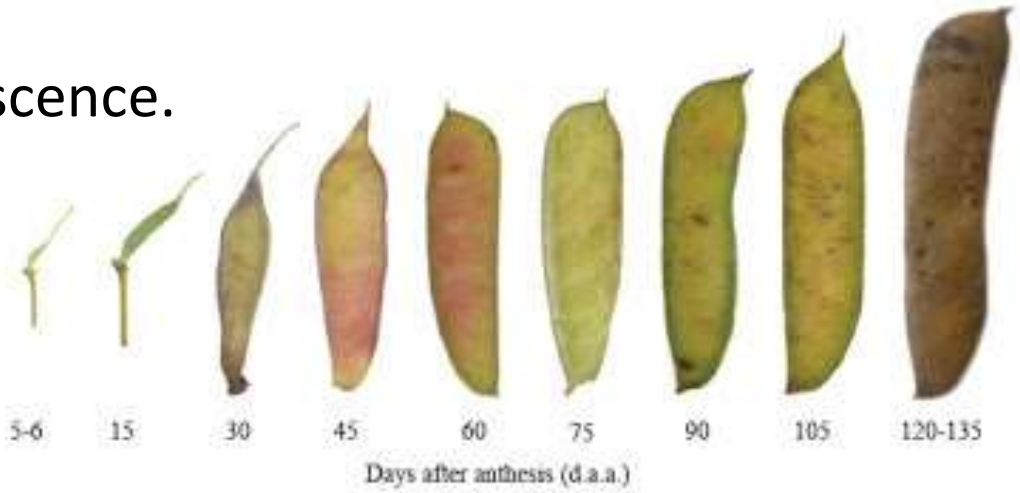


Figure 1. Color of *P. pyramidalis* fruits from the beginning of their formation (5 to 6 d.a.a.) until the end of the final maturation phase (between 120 d.a.a. and 135 d.a.a.).

Types of maturity

2. Horticultural/ Commercial maturity

✓Any stage of development when the commodity has reached a level of development sufficient for its intended use.

Types of maturity

3. Harvest maturity

- ✓Defined in terms of physiological maturity and horticultural maturity.
- ✓The stage which will allow fruits or vegetables at its peak condition when it reaches to the consumers and develop acceptable flavour or appearance and having adequate shelf-life.

Indices of maturity

- A measurement that can be used to determine whether is mature.
- Trade regulations contain conditions to minimum (sometimes maximum) maturity acceptable for a given commodity based on subjective and objective indices.
- Prevents the sale of immature and over-mature product and consequent loss of consumer confidence.

- Objective maturity indices enable growers to know whether their commodity can be harvested.
- Objective maturity indices allow growers to use labour and resources efficiently.

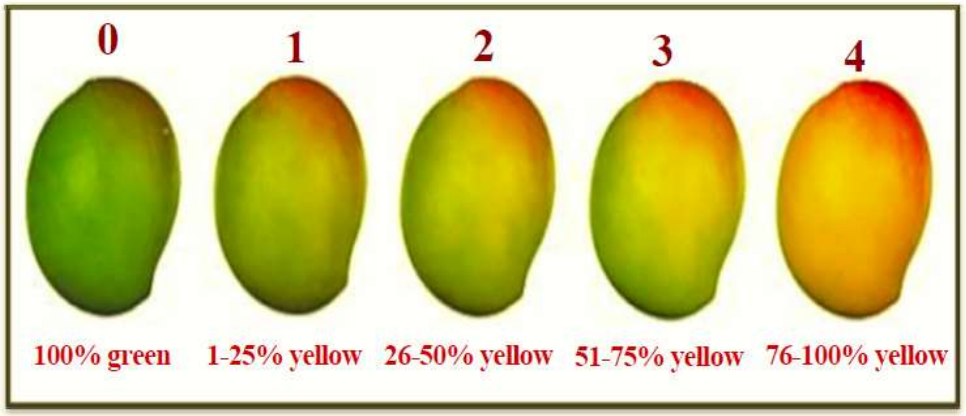
Characteristics of a maturity index

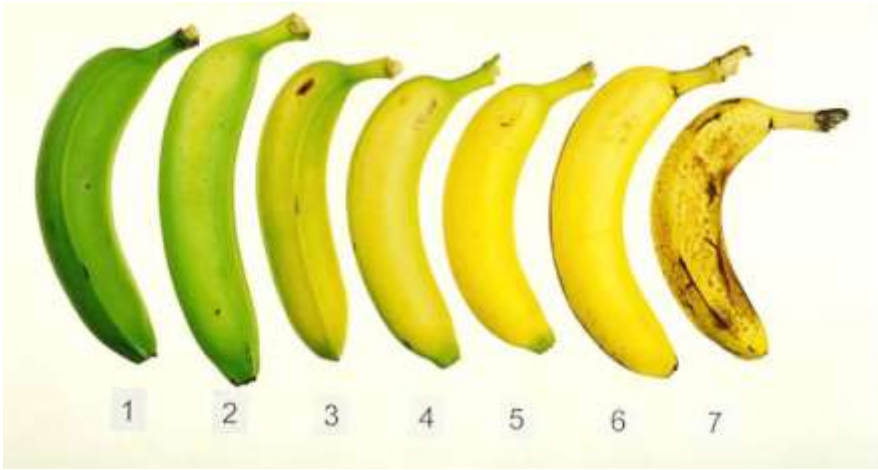
- Must be simple.
- Readily performed in the field.
- Require relatively inexpensive equipment.
- Should be objective (measurement) rather than subjective (evaluation).
- Consistently relate to the quality and postharvest life of commodity for all growers, districts and years.
- Should be non-destructive.

Assessment of crop maturity

1. Skin colour

✓Colour changes associated with maturation of many fruit types.





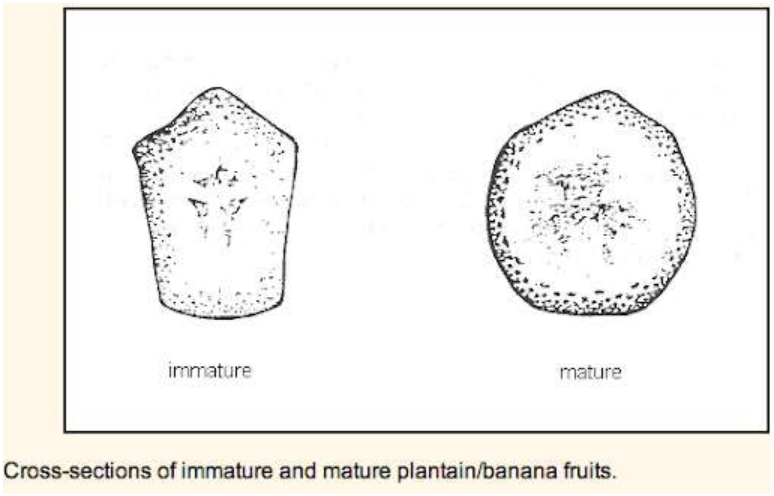
- ✓Some fruits show no perceptible colour changes during maturation.
- ✓Partly dependent on the position of the fruit on the tree or the weather conditions during production.
- ✓Colorimeter provides objective measurement of colour.

✓Colour comparison methods using colour swatches are used.

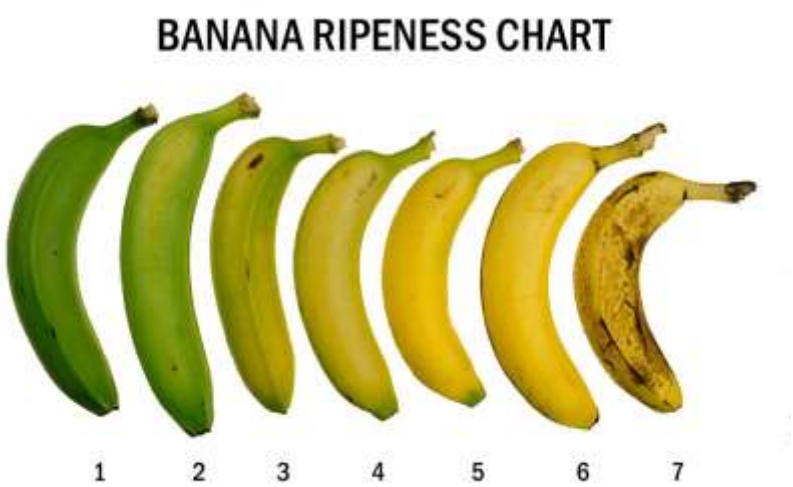
Assessment of crop maturity

2. Shape

✓In banana, the individual fruit become more rounded in cross section.



Cross-sections of immature and mature plantain/banana fruits.



✓In mangoes, shoulders become level with the point on attachment.

Assessment of crop maturity

3. Size

- ✓In fruits, size is related to the market requirement and the fruit may not be physiologically mature.
- ✓Partially mature cobs of *Zea mays* are sold as sweetcorn, more immature ones are sold as baby-corn.
- ✓Certain crops develop fibres in relation to size as they mature.

- ✓Calliper grade of banana as a quality criterion during marketing.
- ✓Hand held templates and grading machines are also used.

Assessment of crop maturity

4. Aroma

- ✓Fruits synthesize volatile chemicals as they ripens.
- ✓May only be detectable to human senses when a fruit is completely ripe.
- ✓Equipment fitted with aroma sensors has been developed to measure fruit ripeness.

Assessment of crop maturity

5. Chronological

- ✓Days from planting or days from flowering is used to determine maturity.
- ✓It is difficult to use this with certain fruits.
- ✓Ambul banana reaches physiological maturity 8-9 weeks after the flowers open.
- ✓In apples, time of petal fall is recorded.
- ✓Harvest maturity for rambutan is judged on the time after full flowering.

Assessment of crop maturity

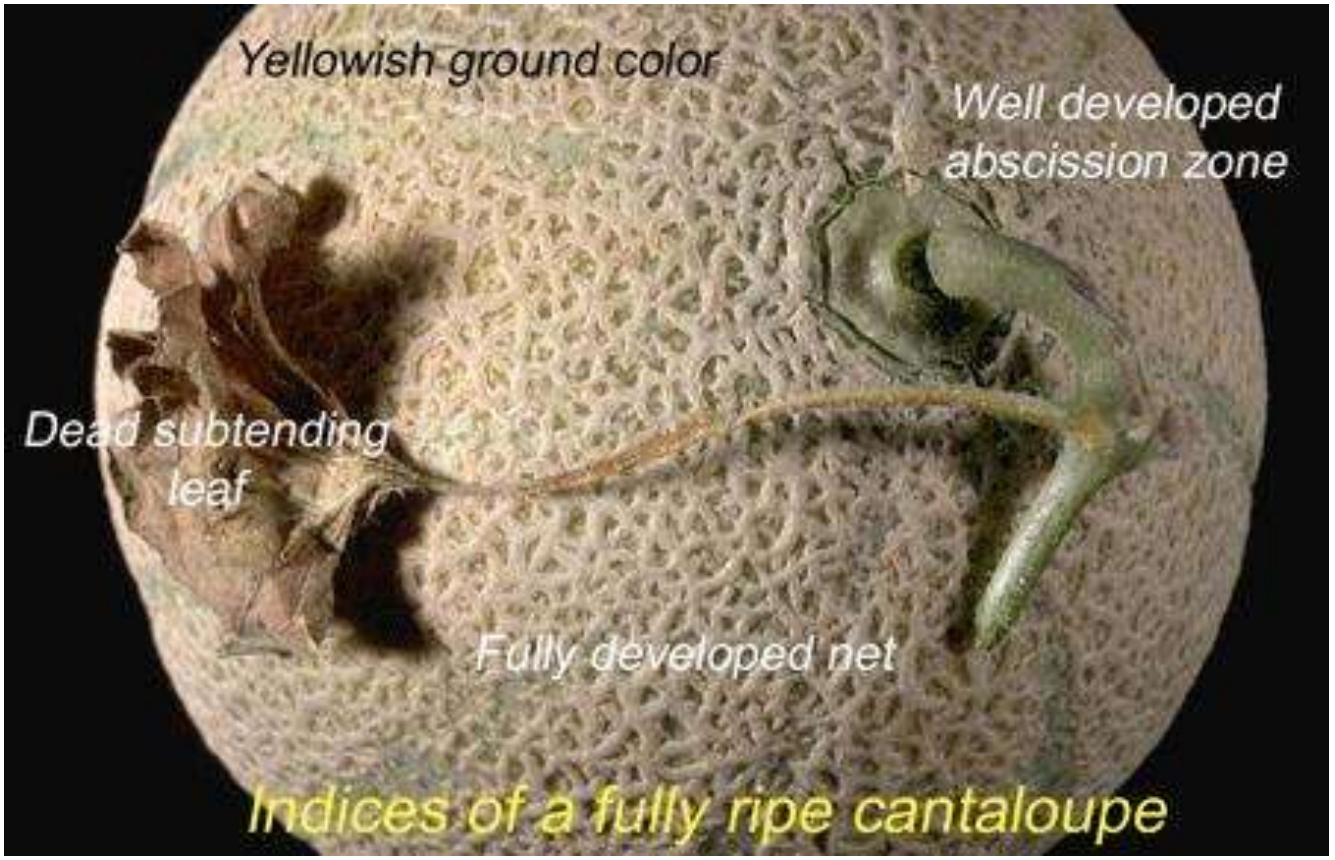
6. Leaf changes

✓Use in both fruits and vegetables.

✓If potatoes are to be stored, the optimum harvesting time is after the leaves and stems have died down.

✓Bulb onions should be harvested when the leaves bend and fall over.

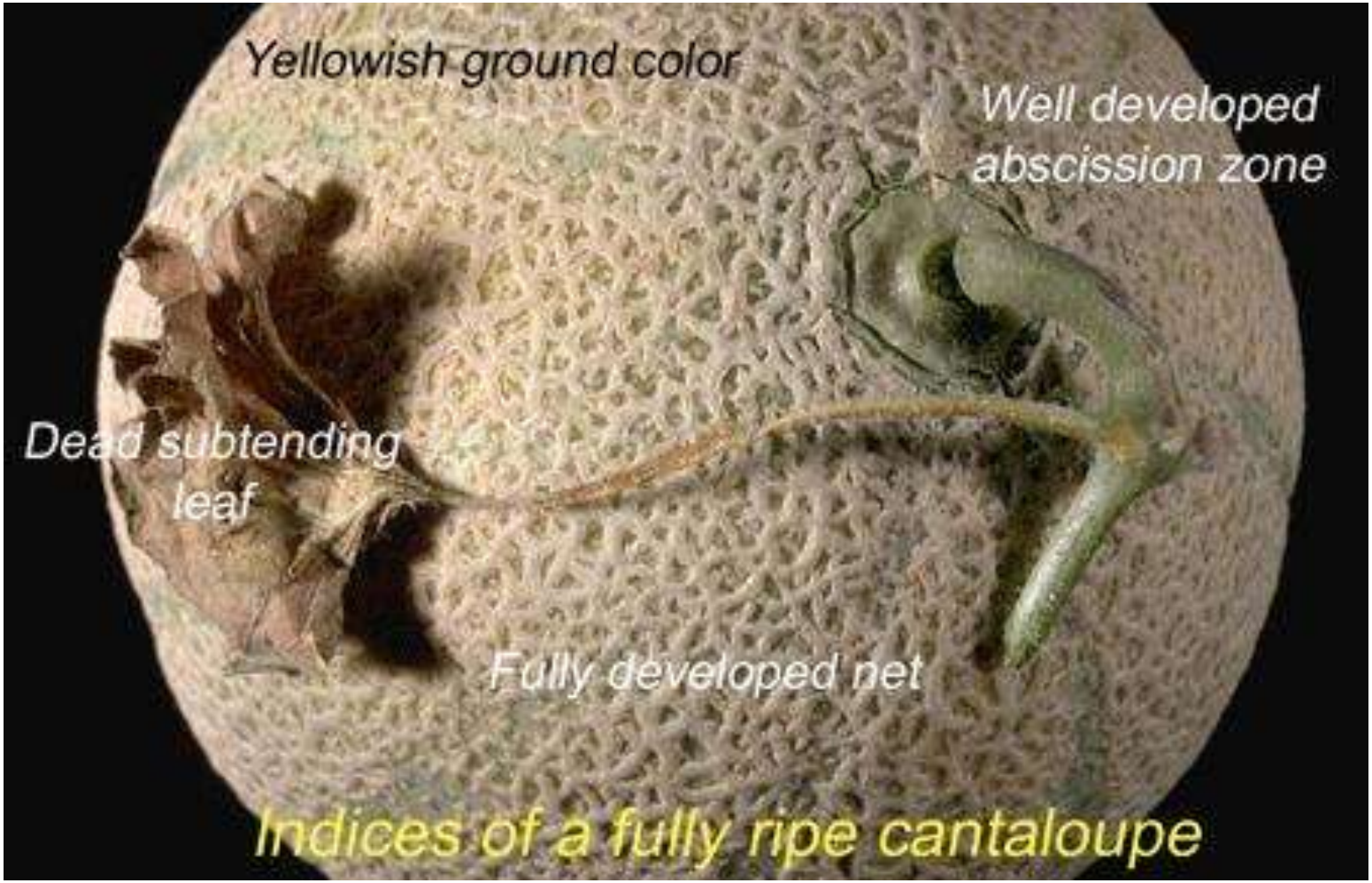
✓Melons are harvested when the leaf dies in whose axis a fruit is borne.



Assessment of crop maturity

7. Abscission

- ✓An abscission zone develops on the stalk attaching fruit to the plant during the latter stages of maturation in many fruits.
- ✓The development of the abscission zone in cantaloupes is used to determine their maturity.


Yellowish ground color
Well developed abscission zone
Dead subtending leaf
Fully developed net
Indices of a fully ripe cantaloupe

Assessment of crop maturity

8. Firmness

- ✓Fruits change in texture during maturation and ripening and become softer.
- ✓Excessive moisture loss also cause textural changes.
- ✓Detected by touch.
- ✓A firmness tester can be used to.
- ✓The solidity of cabbage and lettuce is checked by slightly pressing the vegetable.
- ✓Over-mature vegetables are tough and fibrous.

Assessment of crop maturity

9. Chemical changes

- ✓Juice content, and oil level increase as fruits mature on the tree.
- ✓The soluble solids (^{0}Brix) indicates the sugar content.
- ✓Distribution of starch in the flesh of the commodity is measured using starch/ iodine reaction.
- ✓Sugar to acid ratio is used as the legal maturity index for citrus.

GRANNY SMITH APPLE STARCH SCALE

Developed by the University of California, Davis, Department of Pomology in cooperation with the California Granny Smith Apple Association.

0 =

¼ of the area within the coreline white, remainder blue, all of the cortex blue.

1 =

⅓ area within coreline white, cortex blue.

2 =

All area within coreline white, cortex blue.

3 =

All area within coreline white, ¼ of the cortex area white, remainder blue.

4 =

All area within coreline white, ½ area of cortex white, remainder blue.

5 =

All area within coreline white, ¾ of cortex area white.

6 =

All surface white.

The reaction of the iodine solution on any starch present in the apple turns the cut surface blue. The greater the starch content the greater the area of blue color.

In the starch-iodine index numbering system 0 represents immature, and 6 fully ripe fruit. The following descriptions represent the upper limit of each index point.

When the average of a thirty fruit sample is 2.5 or higher, it meets the minimum maturity requirements. The samples should represent the variation of sizes in the orchard.

The chart should be used as follows:

1. Use the descriptive terms to determine the numerical value of each sample apple.
2. Compare the sample to the pictures to make sure you are interpreting the chart correctly.
3. Samples difficult to categorize will be assigned the higher value.
4. Each apple is assigned a whole number, not a decimal (1.0, 2.0, 3.0, not 1.2, 2.4, 2.7).
5. The 2.5 standard is a mathematical average of the samples (the sum of all scores divided by thirty).

CROSS SECTION OF AN APPLE

SKIN _____

CORTEX _____

CORELINE _____

CORE _____

VASCULAR BUNDLES _____

Assessment of crop maturity

10. Physiological changes

- ✓Changes in the patterns of respiration and ethylene production.
- ✓Respiration rate is determined by uptake of O_2 or output of gases from the fruit like CO_2, ethylene and other volatiles.
- ✓High variability in ethylene content between fruits.
- ✓Poor correlation between internal ethylene and other maturity indices.