

CHAPTER 8

FRUIT HARVESTING, GRADING AND STORAGE

INTRODUCTION

*A grower must not only produce healthy plants with a balanced fruit load, but also handle and store that harvested fruit properly in order to maximize harvest and profit.

*This chapter presents techniques for tomatoes as well as peppers and cucumbers.

FRUIT MAINTENANCE FOR OPTIMUM HARVEST

Tomato

*The initial selection of a tomato variety may depend on what your “market” wants.

It also can be significant as some varieties produce less than optimum fruit under certain conditions. Consult the seed company for details.

Ex.: Some tomato varieties are more likely to produce boat shaped fruit.

Ex.: Some tomato varieties are sensitive to heat:

producing weak stick trusses, requiring added support,

producing fruit with blossom end rot, reducing marketable yield.

Ex.: Some tomato varieties perform better with higher or lower EC.

*Remove damaged or imperfect tomato fruit including scarred, boats, blossom end rot, cat faced, etc., so the plant will not waste nutrients on unmarketable fruit.

If flowers close but do not develop into fruit, or if the fruit remains small and/or dull in appearance, remove from the truss.

HOWEVER, keep the plant “in balance” (see Chapter 3).

*To prevent rotting, fruit should not rest on the floor.

-The overhead support cables should be high enough for the variety.

-Rule of thumb: the smaller the fruit the taller the producing part of the plant and the higher the wire will need to be to keep the fruit from dragging on the floor.

-Stem supports can be used to keep the horizontal stems off the ground.

*Beef steak tomatoes: Large fruited; harvested individually when ripe.

-Typically 150-300 grams per fruit.

-Depending on light levels and variety, keep 3-5 fruit per cluster.

Rule of thumb: Maintain an average of 9-15 fruit per every 3 clusters

-If too many fruit are left on a cluster, the average fruit size within the cluster may be reduced and the number and size of fruit on clusters above may be reduced.

-If 0-2 flowers appear on upper clusters, 5-6 fruit may be left on a lower cluster.

-Important: cluster clip all beef type tomato clusters (they will crimp or rip off).

- *TOV's (tomatoes on the vine): Medium to small fruit; harvested by the truss when ripe.
 - Include what are typically called "TOV", "Plum" (Roma), "cocktail" or "cherry".
 - Larger = 100-140g/fruit Medium = 50-100g/fruit Small = 20-50g/fruit
 - Cluster size depends on fruit size. If large fruit, then fewer fruit/cluster (truss):
 - Large = 4-6 fruit/truss Medium = 6-8 fruit/truss Small = 8-15 fruit/truss
 - "Symmetrical" clusters are preferred – called a "herring bone" because of it's resemblance to a fish backbone. If a cluster bi- or trifurcates, choose the best single "hand" (group of tomatoes on the same stem), remove the rest.
 - Allow the best consecutive fruit on a cluster to mature. If the king fruit is small or misshapen, remove it. Otherwise take fruit off the end of the cluster. Small/damaged fruit within the cluster may force division into 2 clusters.
 - Use truss supports or cluster clips to prevent larger TOV clusters from crimping. Smaller TOV types may not need cluster clipping.

- *Mini-Plum, Grape, maybe Cherry: Small fruit; harvest by truss or singles when ripe.
 - Small fruit typically 6-25 or 30 grams per fruit.
 - Cluster size will vary from 15 to 100 fruit per cluster depending on fruit size.
 - For larger cherry or mini-plum (strawberry) types, prune cluster to 12-15 fruit.
 - For smaller grape types, tip prune. Starting from the top flowering cluster, count down 3-4 clusters and remove the buds and open flowers only on the tips.
 - Bi- or tri-furcated (2 & 3 hand) clusters do occur. Prune off smaller fruit.
 - Truss supports or cluster clips are usually not necessary, but watch for crimping of the cluster stem. If this occurs, add supports.

Pepper

- *Remove the crown fruit flower (develops at the first branch point – see Chapter 2). The plant, because of relatively small leaf & root surface, is usually not large enough to support a fruit at this level as well as set good fruit higher up.
- *At each branch point 1-2 flowers may develop. Usually leave 1 flower / branch level. However, during winter (times of lowered light) or if the plant has 3-4 heads, the plant may be able to maintain only 1 fruit every 2 or 3 branch levels (skip 1 or 2).
- *Remove damaged fruit (blossom end rot, oddly shaped fruit including "pancakes" (low pollination/fertilization with few seeds), sunscald, etc., but keep plant in balance).

Cucumber

- *The standard practice has been to remove all flowers/fruit up to 80-100 cm above the base of the plant to allow the stem and root systems to develop sufficiently to support subsequent fruit development. If low fruit sets, high fruit usually aborts.
- *With high light levels, usually leave 1 (or 2-3 if mini cucumbers) flower per node. In low light the plant may only be able to support a fruit every other node.
- *Remove damaged or crooked (bent) fruit that will not be "marketable" but will drain nutrients away from marketable fruit on the plant. Keep plant balanced.

HARVESTING

Tomato

*Tomato fruit should be harvested every 3-4 days or 2-3 times / week. Harvesting a little every few days is less of a “shock” to the plant than harvesting a lot once a week.

NOTE: Due to class time constraints, we will only harvest once a week.

*Typical commercial tomato harvests can range from 30 (lower tech gh) to as much as 75 Kg/m² or higher (in high tech greenhouses such as EuroFresh, Village Farms, etc.)

*Tomato color designations: (USDA Grade Standards for fresh tomatoes):

1. Green = tomato is completely green
2. Breaker = tomato is tannish-yellow with not more than 10% pink or red
3. Turning = tomato is tannish-yellow with more than 10% but less than 30% pink or red
4. Pink = 30-60% of the tomato is pink or red
5. Light red = 60-90% of the tomato is pink or red
6. Red = more than 90% of the tomato is red

*Beef steak tomatoes:

*Fruit should be harvested individually when there is color showing, i.e., not green.

- Some growers harvest when only a little pinkish color is apparent.
- Other growers wait until the pinkish color is even all the way around the fruit.
- If the fruit will be sold locally, and soon after harvest, it can be picked red.
- Some varieties ripen with an orange tinge. Check with the seed supplier.

*Removed each fruit at the abscission zone so the green stem and green sepals are left on the fruit. This gives the fruit a “home grown” appearance which commands a higher price at the market. It has also become a “trademark” of greenhouse, hydroponic, vine-ripened fruit.

*Some varieties contain the REN gene (incorporated through traditional breeding not genetic engineering). This gene imparts long shelf life and is common for field though no longer used for greenhouse varieties. The fruit may take up to 2 weeks to fully ripen (and therefore has a longer shelf life).

*TOV’s (tomatoes on the vine or cluster tomatoes):

- Remove the entire cluster as a unit when ~80% of the fruit show color.
- Choose a variety that ripens evenly (all/most fruit ripen at the same time).
- Choose a variety where the fruit stay affixed to the cluster (don’t fall off easily).

*Mini-Plum, Grape & sometimes Cherry types:

- Certain mini-plum types should be harvested as a cluster (12-15 fruit/truss).
- Grapes: remove each fruit individually when ripe (pink if they will be shipped).
- Some varieties should be harvested with the sepals left on while for others the sepals should be removed (i.e., grape types that are packaged in “clam shell” type containers will poke each other if the sepals are left on).

Pepper

*Pepper fruit can be harvested once a week but twice a week is common.

*A typical commercial harvest is about 20 Kg/m² (less than tomatoes; they are hollow!).
Due to class time constraints, we will harvest only once a week.

*Greenhouse hydroponic growers usually grow the colored bell pepper varieties.
-Most colored peppers will “size” (grow to final size) while they are still green then turn color (yellow, orange, red, etc. depending on the variety).
-In a commercial setting they are harvested either as mature green or fully turned but can also be removed when the fruit is about half way turned in color.
-Since colored peppers usually take 2-4 weeks to turn color, and during this time the grower must feed and care for the plants, these are usually more expensive than green peppers.

*As with beef steak tomatoes, pepper fruit should be removed at the abscission point.
CAUTION: The pepper fruit is attached directly to the main stem which is brittle. Hold the main stem firmly while removing the pepper fruit to minimize stem cracking. The pepper fruit can also be cut off with a sharp, STERILIZED blade.

Cucumber

*Long cucumber fruit can also be harvested 2-3 times per week.
Since these grow ~twice as fast as the tomatoes, we will harvest 2 times per week.

*The young fruit have ridges along its length, small prickly hairs and a pointed flower end (furthest from the stem). Wait until the fruit fills out and the flower end is somewhat rounded before harvesting.

*Cut the fruit off near the stem.

CAUTION: The cucumber fruit has a thin skin and will lose moisture quickly after harvest. Wrap it in plastic for storage and/or transport.

FRUIT GRADING AND PACKING

Tomato

*Beef Steak Tomato:

*Simplified system: Beef steak tomatoes can be categorized as #1's, #2's or culls.
#1's = good shape; no or minor blemishes; equal to or greater than 150 g.
#2's = boat shaped; larger blemishes (scars, minor cracking, etc.); any size.
Culls = large boats, cat face, blossom end rot, cracking, extra smalls, etc.

*Commercial system: Currently greenhouse beef steak tomatoes are graded by weight:

Small	= Under 3.5 ounces	(~100grams)
Medium	= From 3.5 to 9 ounces	(~100 to 255 grams)
Large	= Over 9 ounces	(>255grams)

*However, the July 2004 Discussion Paper - For Possible Revision of U.S. Grade Standards for Greenhouse Tomatoes proposed a change to a “size classification”:

Small	= 2 4/32” to 2 9/32”	
Medium	= 2 8/32” to 2 17/32”	(Note: These are in inches!)
Large	= 2 16/32” to 2 25/32”	
Extra Large	= 2 24/32” and larger	

*Commercial beef steak tomatoes: Sorting and grading is usually done by machine. The tomatoes are brought in from the greenhouse and placed on a conveyor belt. They pass under a camera and any defective fruit (boats, cat face, scarred, sunscald, etc.) are ‘tagged’ electronically by workers with special wands. The tagged fruit are directed to the cull bins while the other fruit are carried along the conveyor in cups that drop the fruit gently into the appropriate lane according to size and color.

*Greenhouse hydroponic beef steak tomatoes are typically placed in single layer boxes containing thin plastic inserts with molded cups to accommodate and protect each fruit. However, deeper boxes, with 2-3 layers, are sometimes used.

*Commercial TOV’s:

- Sorting and grading is done by hand.
- Typically, entire trusses are cut off the plant and all of the tomatoes must be #1’s. Ex. If a TOV cluster has 5-6 tomatoes and 1 or 2 are not #1’s, they must be removed before packaging.
- Preliminary sorting, grading & boxing are done in the greenhouse by the pickers.
- Boxes for TOV’s and cherries are smaller than those for beef tomatoes, have a thin, flat, cushion layer to protect the fruit and accommodate 7-10 clusters.
- TOV’s may also be packaged in net bags depending on the buyer’s specifications. Many supermarkets prefer cluster packaging to distinguish individual TOV tomatoes that could easily be removed from the cluster from the less expensive field grown tomatoes also available in the store.

*Mini-Plum, Grape and sometimes Cherry Types:

Sorting and grading is done by hand: as individual fruit or clusters
Usually packaged in “clam-shells” or “net bags” for sale to the market.

Pepper

*As with beef steak tomatoes, colored peppers can be categorized as #1’s, #2’s and culls.

#1’s = good shape and color; no or only minor blemishes

#2’s = somewhat oddly shaped; larger blemishes

Culls = very oddly shaped; sunscald, withered, blossom end rot, etc.

*Since large bell peppers are hollow inside, they are usually graded by diameter size rather than by weight: 50-60 mm, 60-70 mm and 70-90 mm. They should also have 4 lobes, equally rounded and the fruit wall should be fairly thick. Mini-bells are rounded or flattened and graded by weight, depending on variety.

Cucumber

- *Cucumber fruit should be sorted by length and should be uniform in each box.
Crooked (bent) or scarred fruit should be separated and marketed as #2's or culls.
- *Fruit MUST be wrapped in plastic to retain water in the fruit. The greenhouse cucumber fruit (long & mini) have thin skins that lose water very quickly after picking and therefore, must be wrapped immediately after harvest.

FRUIT STORAGE

Tomato

- *Tomato fruit should be stored in a cold room between 50° and 65°F.
- *Put not-quite-ripe fruit on the counter, NOT in the refrigerator (will stop ripening).
When the fruit is ripe or after it is cut, it should be placed in the refrigerator.
Also, DO NOT place ripening fruit in direct sunlight.

Pepper

- *Pepper fruit should also be stored in a cold room.
However, even if picked half way turned in color, the color change will continue even in the refrigerator.
- *Do not leave pepper fruit on the counter for very long as it will begin to lose water and the skin will wrinkle. Wrap pepper fruit in plastic and store in the refrigerator.

Cucumber

- *Cucumber fruit should be stored in a cold room at 50-55°F or can be stored in the refrigerator for up to 2 weeks. Keep fruit wrapped in plastic to retain moisture.

REFERENCE MATERIAL

- 1. Growing Greenhouse Seedless Cucumbers In Soil And In Soilless Media.** 1994. A.P. Papadopoulos. Agriculture and Agri-Food Canada Publication 1902/E from the Communications Branch, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada, K1A 0C7. ISBN 0-662-22118-4.
- 2. Growing Greenhouse Tomatoes In Soil And Soilless Media.** 1991. A.P. Papadopoulos. Agriculture and Canada Publication 1865/E from Communications Branch, Agriculture Canada, Ottawa, Ontario, Canada, K1A 0C7. ISBN 0-662-18859-4
- 3. Peppers As A Commercial Crop: Grower Guide No. 3 – 2nd Series.** 1995. Edited by P. Rogers. Grower Books, Nexus Media Limited, Swanley, Kent, BR8 8HY. ISBN 1-899372-03-2.
- 4. Web Sites:** “Google” the crop and greenhouse production for a wide variety of sites that discuss or show (videos) how to grow, harvest, etc.