A Farmer’s Guide to Crop Quality For Wholesale Market Outlets: Tomatoes, Cucurbits, and Greens

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This Crop Quality Guide aims to support Northeast beginning farmers who are looking to improve quality and consistency of farm produce in order to expand sales to include wholesale accounts. For our purposes, wholesale accounts can be grocery stores, Food Hubs, restaurants, cooperatives or other food distribution sites.

This guide will provide information that will help improve harvest and post-harvest handling and storage techniques that will enhance crop quality and marketability.

We hope to provide quick reference sheets that will help producers with crop production, harvest, pest and disease identification, post-harvest care and storage needs for three very specific specialty crop varieties. Tomatoes, cucurbits and greens have been observed to have the most quality challenges, preventing many growers from finding success within wholesale markets. It is written as a series of independent Fact Sheets that can be used separately as needed or together as a complete guide.
Key Points:

- Growing tomatoes for wholesale can be a great decision for growers because of their high value, prolific yields and high demand. However, harvesting them at the correct ripeness and uniformity can be challenging. It can also be difficult to pack, cool, and cool and ship tomatoes, while maintaining quality fruit without damage.

- Good production methods and harvest methods must be followed to ensure top quality fruit, including using trellis techniques to keep fruit from rotting and frequent harvesting.

- Choosing tomatoes that grow uniformly, with high yields is important for farmers wanting to sell to larger, wholesale accounts.

- Be in contact with your client to see the level of ripeness that they desire.

Harvest:

- Harvest frequently—at least every other day.

- Handle fruit gently, as they are delicate and prone to bruise.

- When picking, pull down and gently twist the stem to remove fruits from the vine. If harvesting tomatoes that grow in more of a cluster form, it is acceptable to cut at stem with clippers.

- Check for signs of pest or disease damage, leave in field or in “seconds” bin if there are any imperfections.

- Avoid harvesting when wet—this helps prevents disease spreading on your plants, as well as on harvested fruit.

- Pack tomatoes directly into boxes or “final destination” bins, when possible. If harvesting into buckets, fill only a few layers high—for a standard five-gallon bucket, fill half, to two-thirds full, depending on ripeness.

- Wear cotton gloves, or bring a rag/cloth into the field when harvesting, or packing bins, to clean off dirt or debris off of fruit.

- When harvesting, remove stems. (this may be different if harvesting specialty heirloom varieties). Stems can damage and puncture the other fruits in the bucket, making them not suitable for sale.

- When packing boxes or bins, store tomatoes “shoulder side” down—(stem side down)

- Best to harvest between “the breakers” and “pink” stages. This is when the tomatoes are between 10%-50% colorful. Depends on how far your tomatoes are travelling, and when they will be marketed.

- Try to pack boxes with relatively uniformly sized tomatoes.

Tomatoes
When to Harvest Tomatoes

- High quality fruit are firm, swollen and shiny in appearance.
- No signs of mechanical injuries, shriveling or decay.
- **Turners/breakers are generally preferred by wholesalers** so communicate with your buyer on the maturity desired.
- Light red and red tomatoes are more appropriate for direct marketing, CSAs and farmers' markets. Green tomatoes are preferred for long distance wholesale supply chains.
Tomatoes

Washing, Cooling & Storing:

- Try to keep tomatoes dry. Clean them with a cloth glove or rag at the time of harvest and pack into clean, sanitized bins or boxes.
- Store at room temperature, best between 55 and 65 degrees. Keep in a shaded place, out of direct sunlight, which could sunburn and damage your fruit.
- Pack in bins, no more than two layers high, and do not stack too many boxes on top of one another. Best to layer the bottom of your bins/boxes with newspaper, or some other, softer surface than the textured grooves of the bin, which may mark and damage your fruit.
- Keep tomatoes above 55 degrees, otherwise you risk a cold damage (changes flavor and texture of fruit).
- Keep in place with high humidity when possible, preferably around 95%.
- Be vigilant about culling bad fruit from previously harvested bins. It can be helpful to separate tomatoes into less ripe and more ripe groupings.

Common Production Issues & Disease and Pest Issues:

- Make sure to trellis plants and keep fruit and vines off the ground. This will increase air flow to your plants, keeping them healthier and less-prone to disease pressure. Twine often, every other week once they are roughly two feet tall.
- Scout plants often for signs of pest and disease pressure, walking through crops at least three times per week.
- Keep well irrigated and keep watering consistent. Tomatoes are prone to blossom-end-rot, which usually occurs due to inconsistent watering.
- Water using drip irrigation methods, try to keep foliage dry and clean to prevent disease.
  - Early and late blight are common plant diseases in tomato fields.
  - Common pest issues are tomato horn worm and Colorado potato beetle (often early on in plant growth)
<<horn worm and horn worm damage  
late blight on plants & fruit>>
In our region, we grow many types of cucurbits for our markets. All have slightly different needs when it comes to harvest, washing, cooling and storage. Most cucurbits share preferred growing conditions and battle similar disease and pest issues. We will review:

- **Cucumbers**
- **Summer Squash**
- **Winter Squash**
- **Melons**

**Key Issues for All Cucurbits:**

- Keep clean of weeds.
- Leave ample space in between rows to be able to pull bins through and harvest without trampling plants.
- Don’t let fruit get too large (specifically cukes and summer squash), by harvesting at least every other day.
- Plants are very susceptible to fungal diseases that spread quickly in wet weather—try to harvest when plans are relatively dry.
- Plants are very susceptible to damage from the cucumber beetle. Cover all plants with reemay or scout daily if using IPM practices.
- Beware of physical damage to fruit that will impact storage life and marketability of plants. Use caution and protective gloves when harvesting.

- Plants and fruit can be injured by frost—pay attention to early and late season temperatures.

<< downy mildew effects most cucurbit plants >>

*cucumber beetle damage*
Packing Cherry Tomatoes & Specialty Varieties:

Cherry Tomatoes:

- Commonly field packed.
- Use pint containers in the field. Consider carrying pints using a bread tray (below left) or quart/pint tray (below right).
- Common cherry tomato packaging includes a 15-pound 12-pint flat (below left) or the bread tray (below center).
- Beware that stems can puncture other fruit when packaged.
- Place a piece of cardboard between layers to prevent punctured fruit.

Slicer & Heirloom Tomatoes:

- Vine-ripened tomato packaging: 20-lb two-layer flat, 30-lb 1/2 bushel carton, 50- to 55-lb bushel basket, 10-lb carton and 25-lb carton (seldom used).
- Mature green tomato packaging: 25-lb loose carton
- Commonly used: Tomato boxes (25 lbs) or 1/2 bushel box; or a 10 lbs. (carton).
- Pack tomatoes stem side down/blossom end up, as this is the part that ripens first and bruises most easily. This puts less weight on the riper, softer, more sensitive side.
- Beware that stems can puncture other fruit when packaged.
Cucumbers

Harvest:
- Harvest in mid-to-late morning, when the plants are drying off, but fruit is still cool.
- Harvest frequently—at least every-other-day for best quality fruit.
- Fruit should be firm, shiny and smooth. Harvest when the fruit has “filled out” to form a smooth texture on the skin. [Note: some varieties are not smooth, so know your specific variety]
- Try to leave the stem on for better storage life. Use a twist and pull method when harvesting.
- Harvest with bin or box by your side and use cloth gloves to both clean fruit as you go, as well as minimize damage to fruit.
- Handle fruit gently when harvesting and putting into bins to avoid physical damage to fruit which jeopardizes marketability as well as storage capacity.

Washing, Cooling & Storing:
- Dunking cucumbers in cold water can help cool them down as you wash if they are holding a lot of field heat. Spraying with water or wiping with a cotton cloth is another way to get dirt off the fruit.
- Cool to between 40-50 degrees, with cool air, or dunking into cold water.
- Store between 38-50 degrees. Beware of cold damage to fruit if stored too cold. Usually, fruit can keep for up to 10-14 days.

Quality Control & Best Growing Practices:
- Mulch around plants to keep fruit from touching bare soil, which can, at times, damage fruit
- Harvest as often as possible to avoid over-ripe, swollen, bloated or yellow fruit. Older, larger fruit can taste bitter and are often filled with seeds
- Avoid harvesting when plants are wet, as this will increase the likeliness or disease spreading
- Aim for consistency in size and texture of plants and avoid harvesting fruit from older plants

<< poor quality cucumbers; not suitable for sale
^^ top picture is smooth, consistent, uniform slicers.; perfect for sale
Summer Squash

Harvest

- Harvest when fruit is shiny and firm. Become familiar with the many different varieties that you are growing to know what size and shape is optimal for best flavor.
- Harvest often—at least every other day, if not every day.
- Harvest when fruit is from 6-10 inches (in general—varieties may differ)
- Harvest in mid-to-late morning; plants are drying off, but fruit is still cool.
- Harvest with a knife, cutting cleanly about one inch from the top of the fruit.
- Harvest with bin or box by your side and use cloth gloves to both clean fruit as you go, as well as minimize damage to fruit.
- Handle fruit gently when harvesting and putting into bins to avoid physical damage to fruit which jeopardizes marketability and storage life.
- For your own comfort—wear gloves and long-sleeved shirt to avoid skin damage from prickly leaves and stems.
- Remove any blossoms that may remain on the ends of harvested fruit.

Washing, Cooling & Storage

- Dunking summer squash in cold water can help cool them down as you wash if they are holding a lot of field heat, although washing is not required.
- Spraying with water or wiping with a cotton cloth is another way to get dirt off the fruit.
- Cool to between 40-50 degrees, with cool air, or dunking into cold water.
- Store between 38-50 degrees. Beware of cold damage to fruit if stored too cold. Fruit can usually keep for up to 14 days.
- Do not stack too many layers of fruit. Store in fairly shallow bins or boxes, as too many layers of fruit can damage each other.

Quality Control & Best Growing Practices

- Mulch around plants to keep fruit from touching bare soil; can damage fruit.
- Harvest as often as possible to avoid over-ripe, swollen, bloated or yellow fruit. Older, larger fruit will loose their shine and their flavor suffers.
- Avoid harvesting when plants are wet, as this will increase the likeliness of disease spreading.
- Aim for consistency in size and texture of plants and avoid harvesting fruit from older plants.

^^ Top right: good, uniform, quality harvest
<< Top left: discolored & damaged zucchini, due to physical damage and resting on soil for too long
<< Bottom left; bicolor, Zephyr squash, ne slightly too small, one slightly too large—try to harvest for consistency and best quality
Winter Squash

Harvest:

- Winter squash should be harvested when they are fully mature with a hard rind, and good ripe color (usually this means, not green—but each variety is different; it is important to understand the optimal color & ripeness of each variety).
- Harvest with good, sharp clippers and leave a short, clean-cut stem.
- Very important to stack fruit gently and carefully against one another—trying not to puncture the skin of other squash with the hard stems.

Washing, Cooling & Storage:

- Washing is generally not needed—but you can wash, sanitize & dry if you desire—or depending on the needs of your market and your food safety plan.
- Although you can distribute winter squash without curing, it is generally recommended to cure squash before handing out to optimize flavor and storage life.
- To cure, store squash in a warm, dry place for about 10-14 days-at roughly 85 degrees.
- Store in a dry place at temperatures between 50-60 degrees. Do not let temperatures drop below 50, or you risk damaging the fruit and altering the flavor.

Quality Control & Best Growing Practices:

- Mulch around plants to keep fruit from touching bare soil, which can, at times, damage fruit.
- Keep well weeded early on in the life of the plant, as most winter squash plants want to vine-out, making cultivation difficult. Harvest will be more efficient and yield higher if weeds are managed.
- Pay attention to weather and fruit readiness. Try to harvest before the temperatures are consistently dipping below 50 degrees or you risk damage to fruit in quality and flavor.
- Weed or work in winter squash plants when it is dry. Avoid working in the patch when it is wet, for risk of spreading disease.

Top right: butternut
<< Top left: delicata
<< Bottom left: kabocha
Melons

Harvest:

For watermelons:
- Look for a dead or brown tendril closest to the stem of the fruit.
- Look for a large yellow spot at the bottom of the fruit.
- There should be a deep “thud” sound when the melon is tapped.
- Watermelons do not continue to ripen after harvest.
- Open many to check your ability to judge ripeness—you will get better at it over time!

For cantaloupes or other melons:
- Harvest when stem is at “half slip” which is when the fruit will leave the vine with a medium-to-gentle tug.
- On a cantaloupe, the fruit will mature from green to brown and a netting will become pronounced.
- The ends should be fairly firm.
- Melons will continue to ripen off of the vine.

Washing, Cooling & Storage:
- Most melons do not need to be washed.
- For watermelons, use a cloth to clean any mud or debris off the rind.
- Keep melons at room temperature, no cooling methods required. Try to keep out of direct sunlight or very hot places. Generally, try not to cool melons to below 50 degrees.
- Cantaloupes will continue to ripen after harvest—but if sold and consumed within 5-10 days.
- Watermelons can store for around 2-3 weeks.

Quality Control & Best Growing Practices:
- Mulch around plants to keep fruit from touching bare soil; can damage fruit.
- Keep well weeded early on in the life of the plant, as melon plants will vine-out, making cultivation difficult. Harvest will be more efficient and yield higher if weeds are managed.
- Pay attention to fruit readiness. You may need to harvest every other day for up to three weeks within one succession to catch fruit as they ripen.
- Be gentle with plants during harvest and storage, to avoid physical damage to fruit that will jeopardize their marketability and cause them to rot.
- Weed or work in winter squash plants when it is dry. Avoid working in the patch when it is wet, for risk of spreading disease.

^^ Top right: cantaloupe
<< Left: watermelon
In our region, we grow many types of greens for our markets, usually for three seasons of the year. Greens are one of our most popular and often most lucrative for farmers to grow. All have slightly different needs when it comes to harvest, washing and cooling. Most greens share preferred growing conditions and battle similar disease and pest issues. Greens have a short shelf-life, making harvest, post-harvest, cooling and storage very important to the success of marketing and selling greens. We will review:

- **Bunched**: kale, collards, amaranth, & broccoli raab
- **Heads**: lettuce, tatsoi, bok choi, radicchio, & escarole
- **Bare-root or cut**: arugula & spinach
- **Cut mixes**: lettuce mix, greens mix, & braising mix

**Key Issues for all Leafy Greens:**

- Pay attention to weed management, especially for smaller, cut greens to increase efficiency in harvest and for improved quality.
- Many greens have significant pest pressure. Be sure to cover plants with reemay or scout diligently if using IPM practices.
- Pay attention to correct harvest timing to harvest for optimal tenderness and flavor.
- Harvesting greens early in the morning is the best practice, to capture them at the coolest point in the day.
- Cooling greens quickly and getting the field heat out of the produce is very important for marketability, longevity and quality.
- Connect with your markets to discuss how clean or sanitized your greens must be—specifically around salad greens.
Bunched Greens

Harvest

- Harvest all greens first think in the morning, before field heat wilts greens.

**For Kale & Collards:**

- Allow plants to grow to mature size—approximately 6-8 weeks after transplant—before harvesting.
- Select mature and adolescent leaves from the outside of the plant, leave smaller, younger leaves to continue growing.
- Snap or cut stems at the base of the stem, close to the center stalk.
- Harvest loose into bins or bunch together with 6-12 other large stems.
- Clean off all yellow or brown parts of leaves or stem while you are in the fields & cleanly trim stems.

**For Broccoli Raab & Amaranth:**

- Harvest before plants go to seed/put out their flower, in order to retain tenderness and optimal flavor.
- Cut plants at the base of the soil, about 2 inches above the soil and bunch in the field, or put loose into bins.

Washing, Cooling & Storage:

- Harvest all greens directly into bins as you pick and as soon as bins are full bring into shade, or cover with a cool sheet or cover.
- Put into cold water as soon as possible to remove field heat from greens.
- Dunk first into cold water tank and then again, if needed to more thoroughly remove dirt from produce.
- Once washed and cooled, place gently into bins, boxes, or loosely in perforated bags and keep in cooler at temperatures between 35-40 degrees.
- Greens can be distributed for up to 3-4 days.

Quality Control & Best Growing Practices

- As you harvest leaves, clean all damaged or diseased leaves off of the plants and discard in the pathways or into a compost bucket.
- Allow plenty of space for plants and leaves to grow large for bunching.
- Manage weeds vigorously, in order to make harvest efficient.
- Bunch in field, not at wash station.
- Flea beetle, cabbage moth, cabbage looper & diamond back moth are some of the biggest pest that will damage kale, collards & broccoli raab. Use reemay or scout diligently if using IPM practices.
- Alternaria and other fungal diseases can commonly occur in brassica greens—build healthy soil and cull infected plants and plant material whenever possible.
Greens by the Head

Harvest:

- Harvest first thing in the morning before field heat wilts the tender greens.
- Cut with a knife at the base of the plant where the soil meets the plant. Cut cleanly and smoothly, or trim after harvesting if necessary.
- Clean all dead or yellow leaves off of the plant and leave in the field or in a compost bucket.
- Place gently in harvest bin, either head to toe, (bok choi & tatsoi) or butt-end up (lettuce & radicchio).
- Pack only two or three layers high to keep from damaging plants.
- Carry bin along with you as you harvest and when bins are filled place them in the shade immediately.
- Handle gently, as leaves can bruise, damage or break easily.

Washing, Cooling & Storage:

- Put into cold water as soon as possible to remove field heat from greens.
- Dunk first into cold water tank and then again, if needed to more thoroughly remove dirt from produce. Make sure to clean the stem/butt end thoroughly.
- Once washed and cooled, place gently into bins or boxes, shaking excess water from the heads.
- Greens can be distributed for up to 4-7 days.
- Store in bins in coolers at 33-38 degrees.

Quality Control & Best Growing Practices

- As you harvest leaves, clean all damaged or diseased leaves off of the plants and discard in the pathways or into a compost bucket.
- Manage weeds vigorously, in order to make harvest efficient.
- Bacterial soft rot and gray mold can occur in the crowns or at the base of plants, especially in wet conditions. Try to keep plants clear of large weeds that can retain moisture.
Harvest:

- Harvest first thing in the morning before field heat wilts the tender greens.
- Arugula and spinach can be harvested in many ways:
  - By the root: pull out plants entirely by the root and bunch 10-15 stems together.
  - By cutting: Using a knife cut stems about 2 inches from the soil, for loose greens.
  - By pulling by the leaf (mostly for spinach): Pull of leaves individually, taking mature and adolescent leaves, letting young growth to continue to size-up for a second harvest.
- If bunching, place bunches head-to-toe in a harvest bin.
- If cutting loose or picking by the leaf, harvest into baskets that can be submerged in water.
- Carry bins along with you as you harvest and when bins are filled place them in the shade as soon as possible.
- Handle gently, as leaves can bruise, damage or break easily.

Washing, Cooling & Storage

- Store in bins in coolers at 33-38 degrees.
- Put into cold water as soon as possible to remove field heat from greens.

For Bunches:

- Dunk first into cold water tank and then again, if needed to more thoroughly remove dirt from produce. Make sure to clean the stem/butt end thoroughly.
- Once washed and cooled, place gently into bins or boxes, shaking excess water.
- Greens can be distributed for up to 3-5 days.

For Loose Greens:

- Dunk entire basket into cold water tank to cool.
- You may need to dunk a second or third time to clean, especially if growing ‘ready-to-eat.’
- Store in bins, boxes, or perforated bags.
- Can be stored in coolers for up to a week—check on quality.

Quality Control & Best Growing Practices

- As you harvest leaves, clean all damaged or diseased leaves off of the plants and discard in the pathways or into a compost bucket.
- Manage weeds vigorously, in order to make harvest efficient.
- Arugula is very susceptible to flea beetle damage; make sure to cover with reemay & scout diligently if using IPM.
- Leaf miner can be very common for spinach. Best to cover with reemay. If you see signs of miner, best to pick and dispose of all damaged leaves and get them out of the field.
Cut Greens Mixes

Harvest:
- Harvest first thing in the morning before field heat wilts the tender greens.
- Cut with a knife at the base of the plant about one inch above the soil.
- Clean all dead or yellow leaves that may be mixed in with the healthy plants; discard in field.
- Harvest directly into basket or bin, dragging bin along with you down the row.
- Once bins are filled place them in the shade as soon as possible.

Washing, Cooling & Storage:
- Put into cold water as soon as possible to remove field heat from greens.
- Dunk first into cold water tank and then again, if needed to more thoroughly remove dirt from produce.
- After dunked: drain, shake or spin off excess water.
- Pack loosely in bins with lids and drain holes, or in perforated plastic bags.
- Greens can be distributed for up to 4-7 days.
- Store in bins in coolers at 33-38 degrees.

Quality Control & Best Growing Practices
- As you harvest leaves, clean all damaged or diseased leaves off of the plants and discard in the pathways or into a compost bucket.
- Manage weeds vigorously, in order to make harvest efficient.
- Bacterial soft rot and gray mold can occur at base of plants or in between tightly planted lettuce, especially in wet conditions.
- If growing brassica greens (arugula, mizuna, kale, mustard greens, etc) you will likely see damage from flea beetles—be sure to cover with reemay or scout and spray if using IPM methods.

^^ Top right: lettuce mix
<< Left: ‘salanova’ lettuce mix, by Johnny’s Select Seeds
>> Bottom right: spinach under reemay
Helpful Resources


Baskets to Pallets Teaching Manual. Teaching manual for small farmers scaling up to wholesale from the Cornell Small Farms Program, Cornell Cooperative Extension and Northeast SARE.

UMASS Amherst Center for Agriculture, Food and the Environment, Commercial Horticulture page: https://ag.umass.edu/topics/commercial-horticulture

UMASS Amherst Center for Agriculture, Food and the Environment, Agricultural Resources page: https://ag.umass.edu/resources/agriculture-resources

Massachusetts Department of Agricultural Resources (MDAR) – Division of Agricultural Markets


New Entry Farmer Resource Library: http://nesfp.org/farmer-training/library

Johnny’s Seeds

Cornell University Extension

University of California Davis

University of California Davis Produce Factsheets

MarketReady for Grocery, Wholesale, and Food Service Sales. University of Kentucky extension.

Scaling-up: Perspectives from Growers and Buyers on Barriers and Benefits to Wholesale Marketing of Local Fruits and Vegetables.
Helpful Resources


Collaborative Regional Alliance for Farmer Training (CRAFT)

National Incubator Farm Training Initiative (NIFTI)

Northeast Organic Farming Association (NOFA)

Squash curing, recipes, seed saving and varieties: http://whatscookingamerica.net/squash.htm
References

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2. Johnny’s Seeds
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