Grading, Packaging and Handling of Fresh Produce

Patrick Byers
Regional Horticulture Specialist
University of Missouri Extension
Southwest Region
417-881-8909 – ByersPL@missouri.edu
1. Are there ‘official’ standards?
2. How to grade produce
3. Considerations on packaging
4. Proper handling of produce
USDA Grade Standards Exist

Administered by AMS
(Agricultural Marketing Service)

AMS charges to inspect
- Offices in KC & St. Louis

Grading, Certification and Verification

Fresh Fruit, Vegetable, Nut and Specialty Crop Grade Standards

U.S. Grade Standards provide the produce industry with a uniform language for describing the quality and condition of commodities in the marketplace. In partnership with industry members, AMS develops and revises these documents so that they always reflect modern business practices.

Fresh Fruit and Vegetable Grade Standards:
- Vegetables for Fresh Market
- Fruit for Fresh Market
- Vegetables for Processing
- Fruit for Processing
- Nuts and Specialty Crops

Fresh Products Grading and Quality Certification

If you are part of the vast U.S. fruit and vegetable market, the Agricultural Marketing Service (AMS) official grading services can make your farm or company more profitable. For sellers, these services ensure that their products meet specified grade or contract requirements; for buyers, grading services ensure that they get the quality that they expect.

What's new?
- Newsletter on Training Initiatives for Industry (PDF)
- Current Inspection Fees (PDF)
USDA Grade Standards Exist

Enforcement is another matter

Domestic
- Normally triggered by a ‘complaint’
- Starts at $151
- Plus mileage
- & an hourly fee while driving
- Required for a
  - marketing agreement or
  - marketing order

International
- Required for imports
- Only a certain % of shipments are inspected
- & those are just sampled

You can sell substandard product, poorly packed in whatever form you want, as long as no one complains!
AMS Grade Standards

• 166 developed
• For 86 different fresh fruits, vegetables, tree nuts, peanuts, and related commodities
AMS Grade Standards - example

Fresh (Field) Tomatoes

- 14 page document
- Specific definitions on color, cleanliness, size, softness, maturity, shape, similarity, smoothness, damage & development
- US Grades 1, 2 & 3 established, including
- Allowable tolerances
In general, what is wanted—

Example Fresh (Field) Tomatoes

<table>
<thead>
<tr>
<th>Consistency of-</th>
<th>Minimum of</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Size (and/or weight)</td>
<td>• Defects (e.g. blemishes, bug bites, freeze damage, sunscald)</td>
</tr>
<tr>
<td>• Color</td>
<td>• Decay</td>
</tr>
<tr>
<td>• Shape</td>
<td>• Dirt or other unhygienic contamination</td>
</tr>
<tr>
<td>• Maturity</td>
<td>• ‘Any other damage’</td>
</tr>
<tr>
<td>• Similarity</td>
<td></td>
</tr>
<tr>
<td>• Smoothness</td>
<td></td>
</tr>
<tr>
<td>• Firmness</td>
<td></td>
</tr>
</tbody>
</table>

Packing size, quantity, or materials are not addressed
What are common packing weights and quantities?

Check AMS wholesale market price reports

- 15 cities covered
- Including St. Louis
- Dec. 17, 2010 report listed 37 vegetables
- Tomatoes - 25 lb cartons
- Asparagus - 11 lb crates, bunched
- Carrots - sacks, 48 one pound film bags
You do not ‘need’ to sell by weight

Weight
- Is often expected
- Will make comparing values easier
- Can sometimes be approximated
- If weight is ‘stated’ it then falls under the rules of weights and measures

Common non weight units
- Bunches- e.g. dozen
- Multiples of dozen- e.g. 6 dozen sweet corn
- Total number- x number of cantaloupes in a bin or cucumbers in a box. Number may be variable (e.g. 36 to 40) or exact
- Heads, as in lettuce
- Volume- bushel, or variation of it
Developing your own ‘standards’—Missouri’s produce auctions

Central Missouri Produce Auction (CMPA)

- ½ bushel box is common (25 lb tomato box)
- Bins (melons)
- 12 pint ‘berry’ flats
- Iced wax boxes (spinach)
- 5 dozen in a ‘corn bag’
- Bulk
- & various other special interest boxes

CMPA guidelines are available at-
http://agebb.missouri.edu/hort/auction/pack.htm
One of six MO auctions
CMPA- oldest & largest produce auction in Missouri

- Buys packaging in bulk for resale
- Sets CMPA standards, does not claim USDA
- E.g. their medium tomatoes are as large as USDA X-large
- Will sell ‘culls’, noted as such
- Lots of tips and suggestions
- Many exchanged verbally amongst growers

- Eggplant - pick in tender stage, not old and leathery. Classic types.
- Potatoes - New potatoes gently clean, but do not scrub.
- Rhubarb - ½ pound bunches in ½ bushel boxes. Trim 75% of leaf.
- Turnips - Leave about 1" top.
- Cucumbers - ½ bushel boxes 40-45 count to full box. Pack oversize and odd shapes separate.
Your standard & grading

Keep your focus on-

- Consistency of color, size, shape, etc.
- Minimum of defects; no decay; cleanliness

Select packaging
- most appropriate for your product &
- economical

Choose sale unit
- Weight?
- Other?
- Combination?

Establish grading criteria
- Size
- Shape
- Length
- Trimming

Modify for customer
- Minor changes?
- What about major ones?
- Benefit to both!
Subject to rapid dying
• E.g. leafy greens, broccoli, cabbage, asparagus, herbs, & cauliflower
• Consider some type of plastic film protection
• Also consider plastic film protection if storing
  – Beets or carrots (trim tops)
  – Green beans

Tolerant of drying
• Tomatoes, peppers, melons, squash, sweet potatoes, onions
• Plain cardboard boxes
• Cucumbers with waxy skin (plastic wrap if not)
• If handled very quickly, cardboard boxes for-
  Beets, carrots, green beans, sweet corn
Packaging considerations

Special situations

Berries & like small items
- Consider pint or quarts
- Cardboard OK, but
- Plastic clamshells for longer term storage; consider not just your storage, but your customer’s needs
- No need to refrigerate new potatoes

‘Softer’ products
- E.g. peaches or heirloom tomatoes
- Consider containers that make a single layer
- Or just two deep, e.g. ½ peck box
Other Packaging

**Bulk or volume**
- Various bins are popular for melons, pumpkins & squash
- Consider stackable units or boxes sturdy enough to stack
- ‘Farm to retail’ box product line

**Miscellaneous**
- Paper bags
- Mesh sacks for corn or onions
- Waxed boxes for products that get wet or are iced
- Custom printed
- Custom die cut
Let’s talk plastic

**Advantages**
- Can be cleaned
- Excellent for storage, wet or dry
- Stackable & sturdy
- In use by shippers, market vendors and food service
- Some can insulate

**Disadvantage**
- PRICE!
- Would need to have a reuse/recovery system
- By the FAO- Management of reusable plastic crates in fresh produce supply chains- A technical guide
Reusing containers

Plastic
- Can be cleaned effectively
- Including sterilized, if needed
- There are a number of products for cleaning and sterilizing
- Stacked upside down to dry

Cardboard or wooden
- Cannot be sterilized or effectively washed
- Can be wiped out, with moist clean cloth or similar
- If too dirty, discard
- Used cardboard boxes are sold at produce auctions
- Bring about 75% original price
Safe handling of produce—before and after harvesting

Kansas State University- Kansas Food*A*Syst-A Food Safety Risk Management Guide for the Producer- Chapter 3

Overall Farm
- Site Conditions
- Wildlife, Vermin & Pests
- Water Source
- Crop production issues, e.g. soil contact, use of manure or similar, pesticides/fertilizers including storage

Harvesting and Handling
- Employee hygiene
- Consumed raw?
- Washing, packing, & transport equipment
- Equipment and facility cleaning
- Cross contamination possibilities

*Only ‘touches’ use of wash water. Directs to GAPs or GMPs.*
Two rules for handling produce

**Handle with care**

- Damage = decay
- Damage increases respiration

**Keep it cool**

- Respiration increases as temperature does
- Pick in cool of day - dawn is normally coolest
- Keep out of sun
- Keep produce ‘subject to drying’ wet or moist, and chill to appropriate temp
- If storing for any length of time, cool to appropriate temperatures
Talk about keeping your nose to the ground?

Not a JOKE! Only $3600 for the Crop Care Picking Assistant
Storage life influenced by temperature

Example - grapes
Example - estimated time for lowering temperature to 62°F

Cauliflower - single head, trimmed in a carton

Assumes vegetable temperature of 92°F &

Placed into refrigerator at 32°F or Immersed into water at 32°F

- Refrigerator (no forced air) 5.5 Hours
- Forced air 1.4 Hours
- Hydro-cooled 7.2 min
Keeping it cool in storage

- Stand alone refrigerators
- Commercial walk-in coolers
- “Cool-bot” and other modified air conditioners with homemade boxes.
- Shade
- Air conditioned space
Getting product cool varies among vegetables.

Heat out of product

Heat out of container

Box or carton
Consider stacking patterns

- Avoid ‘stacking patterns’ that may limit the ability of air flow to remove heat from the products.
  - Vent holes in boxes
  - Slightly looser stacking
  - ‘Pull’ cool air through the product
General cooling process—
“Half Cooling Time”

Getting to a final cooling temperature takes a long time—(take most of the heat out quickly and let the final few degrees be done in the refrigerator)

92 F to 32 F = 60 F

Minutes to cool

Generally consider 7/8 cooling to be nearly complete.
Grower example with vegetables subject to rapid drying

- Harvests in cool part of day
- Immerses in water (hydro cooled)
- Spins dry
- Places in plastic tub (non vented)
- Finishes in cooler
Keep it cool, especially if wet!

Monitoring product cooling
• Inexpensive metal probe thermometers available at most discount and auto supply stores (used to check air conditioning temperatures)

Partial cooling may be worse than no cooling at all
• Getting product wet may also encourage growth of diseases and rots that may not ordinarily be present
Chilling injury

• Some vegetables cannot be stored at temperatures approaching 32°F
  – Sweetpotatoes, tomatoes
  – Peppers, eggplant, melons and cucumbers

Degree of injury depends on the crop, the time of exposure, and the temperature….
Chilling injury..

- High respiration
- Uneven ripening
- Off flavors
- Pitting
- Premature rotting
- Discolored or woody
- Fungal disease

Injury is irreversible-
product is permanently injured.
Chilling injury threshold temperatures

- Beans, cucumbers, eggplant, okra peppers, 45 F
- Melons 45-50 F
- Tomato (ripe) 50 F
- Pumpkin and winter squash 50 F
- Sweetpotato 55 F
- Basil 45 F
Ideal storage conditions vary among vegetables

- Different storage temperatures and humidity levels
- Example of an exception- onions
  - Cool & dry storage
  - Warm- they sprout
  - Wet- they rot & root
Set at 36 F
Cooling Made Simple

- Establish 2 temps - 40 F & 60 F
- Check into the CoolBot
- Fairly easy to convert a trailer, for a portable cool room
- Or buy a used cooler from a store going out of business

Low Cost Cold Storage Room for Market Growers

CoolBot web site
http://www.storeitcold.com/index.php
Conclusions

• Review commonly used grading standards
• Your standard is between you and your customer
• Get familiar with packaging options
• Select your best match; be willing to change

• Become familiar with the processes for safe production and handling of fresh produce
• Determine a way to cool your produce sufficient to the product, storage, and delivery needs
Resources to consider

- Various USDA Agricultural Marketing Service web pages
  http://www.ams.usda.gov/AMSv1.0/
- POSTHARVEST HANDLING OF FRUITS AND VEGETABLES- 
  by ATTRA (Appropriate Technology Transfer for Rural Areas)
- Management of reusable plastic crates in fresh produce supply chains; 
  a technical guide- by FAO (Food and Agricultural Organization)
  http://www.fao.org/docrep/012/i0930e/i0930e00.htm
- PACKAGING REQUIREMENTS FOR FRESH FRUITS AND VEGETABLES 
  by North Carolina State University- (1996)
- Kansas Food*A*Syst; A Food Safety Risk Management Guide for the 
  Producer- by Kansas State University
- Low Cost Cold Storage Room for Market Growers- by University of 
- Central Missouri Produce Auction packing & grading standards-
  http://agebb.missouri.edu/hort/auction/pack.htm
Thank You!

Patrick Byers
Regional Horticulture Specialist
University of Missouri Extension
Southwest Region
417-881-8909 – ByersPL@missouri.edu