Keep It Fresh from the Field

A Lesson Plan, Power Point Presentation, and Supporting Materials for Agricultural Producers

By Barbara H. James, M.A., CFCS
Extension Agent, Geauga County
Family and Consumer Sciences/Community Development
Audience

This lesson is to be used for teaching small volume fruit and vegetable producers. It can be taught to Amish and non-Amish audiences. These producers may sell through their own retail market, a wholesale or retail produce auction, cooperative or directly to supermarkets or restaurants. Most of the principles taught are also applicable for larger scale production. However, the lesson should be expanded to include more information on plant metabolic processes, pre-cooling the product, packaging and controlled atmosphere storage.

Teaching Objectives

Participants will learn:

1. Why it is important to provide high quality produce to consumers.
2. Why it is important to use effective postharvest practices.
3. The natural processes of plants after harvest.
4. General principles of postharvest handling.

Equipment (for Power Point presentation)

- Screen
- Video Projection Unit & laptop computer or overhead projector or slide projector

Handouts

- When to Harvest
- Recommended Storage Temperature and Related Humidity Compatibility Groups
- Check Sheets for High Quality Fruits and Vegetables

Optional Demonstrations/Visual Aids

Before the meeting submit produce items to various forms of abuse and show results. Examples: lettuce and carrots left out of plastic bag and refrigerator. Apples dropped and bruised. Potatoes sprouting from being left in light. Frozen and thawed cucumber. Fingernail through a tomato and left for several days.
I. Introduction

A. It is estimated that 5 to 25% of produce harvested in this country never makes it to sale. This is most often because of poor handling practices resulting in damage and disease.

B. Loss is money out of the pocket of the farmer.

C. Fight back. In this lesson you will learn why produce spoils and how to handle produce to reduce loss and increase profitability.

D. Principles of postharvest handling are the same whether you are growing for your own retail market, a wholesale or retail auction, or for sale directly to supermarkets or restaurants.

E. There is a lot of high quality produce on the market. Small volume producers have the opportunity to differentiate their fruits and vegetables from those grown in large volumes outside the state. Customers are eager to purchase a high quality, locally grown product.

II. The importance of selling high quality produce.

A. Customers are willing to pay more for high quality produce they perceive as fresh. Selling high quality produce also results in repeat customers. Perception of quality is based on:

1. Appearance and feel
   a. Size, color, shape
   b. Firmness
2. Eating quality
   a. Texture
   b. Flavor
   c. Juiciness

3. Freshness
   a. Water content
   b. Gloss or sheen
   c. Aroma

B. Customers make initial decision to purchase based on appearance and feel. They base satisfaction on eating quality and freshness.

III. Why postharvest handling practices important

A. Harvested produce are living systems that continue to change and age.

B. They are diverse (roots, stems, leaves, flowers, fruit) and have their own requirements for maximum postharvest life.

C. They are very high in water content (susceptible to wilting, shriveling, injury, attack by bacteria and fungi). This hastens breakdown of tissues resulting in ultimate death.

D. Produce quality can be maintained to as close to when picked (slow the aging process) by using good growing and postharvest handling practices.
IV. Learn the natural processes of plants. This will help you understand what you are trying to accomplish with postharvest handling techniques.

A. Respiration

1. Sugar and starch in plants are oxidized to produce energy/heat and carbon dioxide (keeps produce alive)

2. Vital for life and must be slowed down after harvest

3. Takes place before and after harvest, through storage and marketing

4. Losses from Respiration
   a. Food value—every hour after picking nutrition is reduced
   b. Weight
   c. Flavor and texture

5. Respiration rate varies by commodity
6. Respiration increases as temperature increases (Discuss respiration differences in six commodities and effects on perishability)

7. Slow respiration by lowering temperature

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**ENERGY/HEAT PRODUCED AT VARIOUS STORAGE TEMPERATURES**

<table>
<thead>
<tr>
<th>Commodity</th>
<th>B.t.u. per ton per day</th>
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<tbody>
<tr>
<td></td>
<td>32°F</td>
</tr>
<tr>
<td>Blueberries</td>
<td>500 - 2,300</td>
</tr>
<tr>
<td>Broccoli</td>
<td>6,000 - 6,700</td>
</tr>
<tr>
<td>Cabbage</td>
<td>1,000 - 1,400</td>
</tr>
<tr>
<td>Muskmelon</td>
<td>- - -</td>
</tr>
<tr>
<td>Strawberries</td>
<td>2,700 - 3,900</td>
</tr>
<tr>
<td>Sweet Corn</td>
<td>8,600 - 11,300</td>
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</tbody>
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**NATURAL PROCESS – ETHYLENE GAS PRODUCTION**

- Regulates growth and development
- Rate different for each community
- Slow by lowering temperature
- Can be good
- Can damage

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B. Ethylene gas production

1. A plant hormone
2. Regulates and stimulates growth and development
3. Can be good—ripens fruit

4. Can be bad—some products produce high amounts of ethylene. Storage of high ethylene producing products, such as apples, pears, cantaloupes, tomatoes, peaches can damage ethylene sensitive products. Some ethylene sensitive products are leafy greens, flowers, herbs, root vegetables and watermelon
5. Damage can occur when produce is accidentally exposed. May cause
   a. Rapid deterioration
   b. Poor flavor
   c. Toughening

6. Sources
   a. Internal combustion engines
   b. Ripening fruit
   c. Propane powered equipment
   d. Decomposing or wounded produce
   e. Cigarette smoke
   f. Rubber materials exposed to UV light or heat

7. Slow ethylene production by reducing temperature

C. Transpiration
   1. Produce is 80-95% water
   2. Loss of water (evaporation of water out of plant)
3. Result
   a. Wilting—caused by loss of water in cells
   b. Shriveling—cells collapse
   c. Softening

4. Transpiration rate influenced by
   a. Characteristics of produce surface (thickness and waxiness) (example: carrots vs. apples)
   b. Amount of surface area (example: lettuce = high rate and squash = low)

5. Slow transpiration
   a. Increase humidity
   b. Lower temperature
   c. Reduce (not eliminate) air movement
   d. Use protective packaging

D. Other processes
   1. Growth and development (examples: asparagus grows, potatoes sprout)
   2. Temperature injury (freezing and chilling)
   3. Physical damage (handling)
   4. Disease (bacteria and fungi)
V. Postharvest quality is directly related to decisions and practices from variety selection by the grower to consumption by the customer

A. Grower’s responsibility

1. Variety selection (characteristics genetically programmed)
   a. Choose for superior flavor, texture, color
   b. Look at shelf life, storage potential
   c. Take advantage of niche market (early or late harvest)
2. Soil preparation (postharvest problems—too much nitrogen, too little calcium)
3. Planting and growing
   a. Spacing, thinning
   b. Timing planting
   c. Trellising
   d. Pruning
   e. Water and nutrition management
   f. Pest and disease control
4. Harvest, postharvest care

B. Customers’ responsibility

1. Purchase
2. Storage

C. Product can be damaged, diseased or die at any point
VI. Learn harvest and postharvest practices to slow change through careful handling and environmental control.

A. Harvest (train employees)
   1. Pick in morning (coolest time of day before 10:00 am)
   2. Shade to keep temperature down
      a. Tarp, shade cloth or roof held above (not on) product—adjustable to be moved with sun, on wheels to move along edge of field
      b. Nearby tree
   3. Keep moist by covering lightly with wet clean burlap (exception—berries)
   4. Provide air circulation around product and containers
   5. Learn when mature
      a. Small producer can pick ripe
      b. Learn what products continue to ripen after picking—tomatoes and peaches and which don’t—berries, veggies
   6. Gentle and clean picking
      a. Place, don’t drop
      b. Clean gloves, wash every day, use exclusively for harvesting
      c. Wash hands, trim fingernails, no jewelry
      d. Appropriate sized, clean containers (wash & sanitize daily), no rough spots
         1) Stackable reusable plastic crates
         2) Plastic vented crate
         3) Steel or plastic bucket
e. Minimize handling—pick into retail/wholesale ready containers, use small cart between rows

7. Pick some crops clean (at least every other day for strawberries and tomatoes)

B. Transportation from the field

1. Don’t overfill containers—will result in crushing and bruising (perfect for disease to take over)
2. Grade roads
3. Shade vehicle
   a. Tomatoes left in sun 1 hour will be 25 degrees hotter than in shade
   b. Use light colored tarp
   c. 4” space between tarp and produce

C. Market preparation

1. Remove soil
   a. Never soak in water
   b. Use constant flow of cool clean fresh water
   c. Wash tomatoes, cucumbers, leafy green
   d. Wash after storage sweet potatoes, potatoes, carrots
   e. Dry brush after curing or storage onions and garlic
   f. Do not wash green beans, melons, cabbage, okra, peas, peppers, summer squash
2. Trim
   a. Outer leaves of lettuce and cabbage
   b. Tops off carrots and radishes (transpiration from leaves)

3. Pack
   a. Packing house cool, wet down floors to increase humidity
   b. Clean and sanitize packing area frequently
   c. Workers wash hands, especially after using bathroom
   d. Handle produce as little as possible
   e. Choose ventilated containers that protect from damage

D. Storage
   1. If possible precool before storage
   2. Longer the storage time more environmental control needed—if storage facilities limited, minimize storage
   3. Control temperature
      a. Differs by commodity
      b. Must remain constant
      c. Provide for air circulation
      d. If pallet stacking, leave space between cartons so cool air can move through stack (helps remove field heat)
   4. Control humidity
      a. Short-term fruit storage—dry
      b. Pumpkin and bulb crops—dry
      c. Root crops, leafy greens, corn—high
5. Ideal conditions hard to achieve around most small farms—simply use best storage available
   a. Basement/insulated cellar
   b. Basement with humidifier
   c. Well insulated cool or cold room
   d. Refrigeration if available, check thermometer, calibrate weekly. If possible, cheap cooler can be made from an insulated semi-truck box with an air conditioner attached
   e. Group produce by similar storage temperature (also compatibility with ethylene production)

E. Retail display

1. Protection from sun, wind, rain, frost (move as sun moves)
   a. Tree
   b. Umbrella
   c. Awning
   d. Sides (lattice or roller tarp)—important for corn, baby vegetables
   e. Exception—fall harvested pumpkins, winter squash. Protect from frost, keep off ground. Display on tarp or wood pallets

2. Sort and discard decaying, damaged produce—bag away from display

3. Slow moisture loss by misting with cold, clean water

4. Wash and sanitize floor and displays each week with chlorine bleach (3/4 cup chlorine bleach to 1 gallon of water. Let stand 5 minutes, rinse)
Distribute Handout:
Check Sheets for High Quality Fruits and Vegetables

Discuss how to use in their operations. Some items are not suitable for all operations, especially Amish farms.

VII. Conclusion

A. Customers select by appearance and feel
B. Customer satisfied by eating quality and freshness
C. Harvested produce is living and deteriorates, loses quality as it ages
D. To keep fresh, slow natural systems by controlling temperature and humidity
E. Handle produce gently
F. Manage storage and display to extend quality

IMPORTANT POINTS

- Consumers buy for appearance
- Consumers satisfied by eating quality
- Harvested produce is living
- Control temperatures & humidity
- Handle produce gently
- Manage displays to extend quality
Sources


U.S. Standards for Grades, California Food & Agriculture Code.
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Keith L. Smith, Associate Vice President for Ag. Adm. and Director, OSU Extension
TDD No. 800-589-8292 (Ohio only) or 614-292-1868