Welcome to

Florida Small Farms and Alternative Enterprises

Conference

Keeping Produce Fresh and Nutritious
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For more information on Small Farms, visit our website at: http://smallfarms.ifas.ufl.edu/ or contact your local County Extension Agent.

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Keeping Produce Fresh and Nutritious

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Today’s Program

- Overview of Causes of Postharvest Losses
- Demonstration 1
- Overview of Importance of Temperature
- Demonstration 2
Farming on a peninsula gives Florida growers advantages in growing horticultural crops.
## Commercial Farms in Florida:

<table>
<thead>
<tr>
<th></th>
<th>Number of Farms</th>
<th>Acreage/Farm</th>
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<tbody>
<tr>
<td></td>
<td>2000</td>
<td>2010</td>
</tr>
<tr>
<td><strong>Florida</strong></td>
<td>44,000</td>
<td>48,000</td>
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<tr>
<td><strong>U.S. Total</strong></td>
<td>2.17 million</td>
<td>2.20 million</td>
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*U.S. Census of Agr, 2012*
Challenges to Florida Horticulture

- Land availability/use – increasing population
- Higher costs – land, water, inputs, labor, fuel
- Waste/disposal management – plastic mulch, water, culls
- Pest control – new invasive species
- Regulations – environmental restrictions, food safety & security
RECENT TRENDS IN PRODUCE MARKETING

- Produce department is the showcase
- Greater variety
- Highest profits
- $80 billion in sales/year

New concept supermarket
Specialty Crops
Value-added crops
● Fresh-cut fruits & vegetables
- Convenience; cross-marketing
-Food safety & security: “Triple-washed”
The extension/grower interface...

...learning to grow high-value crops for local markets
New Local Growth Markets

Consumers around the nation are increasingly looking for locally grown produce

- Perceived as fresher
- Supports local growers and businesses
  - Farmers markets
  - Restaurants
  - Supermarkets

- State promotional campaigns
Community-Sponsored Agriculture
Two sizes – weekly or bi-weekly pickup
Local restaurant sales
Hydroponic vegetables
U-pick – hydroponically!
Verti-grow System
Postharvest Losses: 10 to 80%
FRESH PRODUCE

ALIVE

LOSES MOISTURE

BREATHE

RELEASES HEAT

CAN EVEN DIE

CAN GET SICK
Challenges to Marketing
Fruits, Vegetables & Herbs

- Harvest: when, container type
- Transport to market: time delays
- Increasing pulp temperature
- Food safety & security
What happened???
What happened???
What happened???
The Goal of Postharvest Technology

Minimize Losses in Postharvest Quality by Retarding Senescence and Decay

Worker removing unsalable produce
QUALITY MAINTENANCE: Harvest & Handling

Three primary concerns:

- Minimize mechanical injury during harvest & handling
- Cool rapidly after harvest
- Minimize risk for cross-contamination with human pathogens
Tomato Harvest
Blueberry harvest

Transfer to field crate
Blueberry harvest

Transfer to packing area
Blackberries & blueberries grown in southern Brazil
Harvest in a controlled environment

*Basil*

*Bell pepper*
Minimize Mechanical Injury

Types:

- **Bruises**
  - Impact: Drops
  - Compression: Excessive pressure
  - Harvest temperature

- **Cuts, Punctures, Abrasion**
Not very gentle ...

Impact bruise
Package closure:
- Stapling into fruit
- Over-filling crate

Sand abrasion from dirty harvest bucket
Packing Operations

- Gentle transfer to packing table
  - *Dry vs. wet*
- Minimize drop heights
  - (< 4 inches tomato; < 2 inches apple)
- Cushion transfer points
- Fruit wax reduces abrasions, water loss
Packinghouses should be designed for unrestricted flow.
Manual transfer of blueberries
Cushion packing line transfers

Severe transfer

Soft transfer
Worker comfort is important: adequate lighting and
Set up packing station efficiently
Manual: toss by size

Sizing Operations
Filling Operations

Potential for crushing
Blueberry grading

Automatic filling of plastic clamshell
Transport
These containers look nice, but what about shipping quality??
Shipping Containers

- **Design to fit 100 x 120 cm pallet**
  - Generally 5, 8 or 10 containers / layer

- **Cooling considerations**
  - 5% vent openings on container side
  - Must align holes to facilitate cooling

- **Package construction**
  - Strength; recyclable
Standard package dimensions

- 40 X 30 cm
- 50 X 30 cm
- 50 X 40 cm
- 60 X 40 cm
Package Materials

Corrugated Fiberboard Carton

Wirebound Wooden Crate
Design innovations
Cooling and Storage

- **Determine optimal conditions**
  - Storage temperature; relative humidity
  - Cooling method; atmosphere

- **Rapid Cool within a few hours of harvest** *(7/8 Cooling)*

- Cool efficiently
This is NOT Cooling
Pony reefers were used to transport the strawberries to northern markets. These were actually two crates, one built into the other. The outside crate held a layer of ice, and the inside crate held the fruit. Dec. 1926.

(Photo courtesy of the Strawberry Lab, Dover.)
Cooling rate of a crop is determined by the 3 T’s:

- **Time**: length of exposure to cooling medium
- **Temperature** of cooling medium
- **Turbulence** (contact & mixing over crop)
Not every cooling method is fast

• **Room cooling**: slowest. Hard squashes, potatoes, bulb onions.

• **Forced-air cooling**: faster; easily adapted to cold room. Peppers, berries,

• **Hydrocooling**: cools 4 to 5 times faster than FA. Sweetcorn, carrot, celery, leafy greens, snap beans, peas.
RAPID COOLING CONCEPTS

Initial Pulp Temperature

Total Temperature Drop

Final Pulp Temperature
Cooling curve for room cooling

Initial product temperature

Average product temperature

1/2 cool

3/4 cool

7/8 cool

Air temperature

15/16 cool

Product temperature (°C)

Hours of cooling

68 °F

59

50

41

37

32

20 (1)

15 (3/4)

10 (1/2)

5 (1/4)

2.5 (1/8)

1.25 (1/16)

0

3

6

9

12

15
Rapid Cooling Concepts

7/8 Cooling

During Cooling Process:
Remove 7/8 of Field Heat

Temperature of Cooling Medium Must Remain Constant

Remaining 1/8 Field Heat Removed During Storage
**EXAMPLE: Calculating 7/8 Cooling**

1) Determine total temperature to cool
   \[85 - 33 = 52 \, ^\circ F\]

2) Calculate 7/8 of total temp:
   \[7/8 \times 52 = 45 \, ^\circ F\]

3) Calculate cool temp
   \[85 - 45 = 40 \, ^\circ F\]
   (Remaining 7 \, ^\circ F Removed in Storage)

**Rapid Cooling Concepts**

Broccoli Pulp Temperature
\[= 85 \, ^\circ F\]

Ice Water Temperature
\[= 33 \, ^\circ F\]
Forced-air cooler – placed in cold room

Blower fan connected to housing
Blower on: air pulled in
Single pallet forced-air cooler
In cold room

Airflow in
Portable Forced-air Cooler in Cold Room
(multiple pallets)

• Front end
Immersion Hydrocooling – ice in sanitized water
Tunnel (shower) hydrocooling

Ag-Pack Inc., Ruskin
Lugs are either pushed or driven under shower
Take care to avoid infiltration with wash or cooling water
Whenever crops contact recirculated water there is the opportunity for cross-transfer of decay and human pathogens
Water + Chlorine (80 ppm)

Sanitation is Critical!!
Top Icing-Not recommended
Minimizing warming during packing

Basil
Minimizing warming during packing
Use Refrigerated Loading Dock
Air Distribution in the Refrigerated Trailer

Loading Pattern
Quality Maintenance

- Consider crop physiology
- Minimize mechanical injury
- Cool quickly and thoroughly