Harvest Determination for Small Fruits

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Outline

• The ripening process in berries
• Harvest determination for fresh market
  – Strawberry
  – Blueberry
  – Blackberry and raspberry
• Harvest determination for processing
  – elderberry
Ripeness is an elusive concept for many people

• Ripeness is often entirely subjective
• How is ripeness defined?
• How do we measure ripeness parameters to assist in harvest decisions?
How do I know that my berries are ripe?

- Calendar
- Visual cues
- Taste
Why is it important to harvest at the right time?

• Fruit size development generally follows a double sigmoidal curve
  – Phase 1 – cell development
  – Phase 2 – seed development
  – Phase 3 – cell enlargement
Why is it important to harvest at the right time?

– Risk of harvesting too early
  • Problems with fruit quality
  • Problems with ripeness
  • Reduced storage potential

– Risk of harvesting too late
  • Disease or insect problems
  • Depredation by birds or other pests
  • Dehydration
  • Shattering and loss of fruit
  • Reduced storage potential
Ripening process in berries

- Changes in carbohydrate composition
- Change in color
- Flesh softening and textural change
- Formation of aroma volatiles
- Accumulation of organic acids with associated development of flavor
Climacteric vs Non Climacteric Fruit

• Climacteric fruit
  – Rapid synthesis of ethylene as ripening progresses
  – Fruit will ripen after harvest (blueberry flavor does not improve after harvest)
  – Examples: blueberry, apple, pear, tomato

• Non-climacteric fruit
  – Much lower levels of ethylene synthesis
  – Fruit quality does not improve following harvest
  – Example: strawberry, grape, brambles
The Ripening Process - Brambles

• Blackberries grow in size and weight during ripening
  – 35-45 days from flowering to ripe fruit
  – 85% of fruit size is gained during last days before harvest
  – Color changes from green to red to black
The Ripening Process

• Changes in fruit quality during ripening:
  – Flavors and sugars increase
  – Fruit softens and loosens from receptacle or stem
  – Acids decrease
The Ripening Process

- Blackberry quality does not improve after harvest
Blackberry Harvest

- Blackberries for fresh market are hand-harvested
- Machine harvest is possible for processing-quality fruit
Blackberry Harvest

- Ripening stages
  - Red fruit - unripe
  - Shiny black
    - Berries are less sweet
    - Berries are firmer; best stage for handling and shipping
  - Dull black
    - Sweeter berries
    - Softer fruit, reduced shelf life
    - Only for local sales
Bramble Harvest

- Harvest season in MO
  - Floricane: mid June to August
  - Primocane: August-frost
- Harvest at least twice per week
- Harvest in morning when fruit is cool and full of water (turgid)
- Fruit should separate easily from stem or torus (raspberry) – unripe if you have to tug!
- Handle carefully during harvest
- Gently place berries no more than 2 inches deep in harvest or sales containers
- Cool the fruit as soon as possible after harvest
The Ripening Process - Strawberry

- Strawberries grow in size and weight during ripening
  - 28-30 days from flowering to ripe fruit
  - Fruit size increases during last days before harvest
  - Color changes from green to white to pink to red
The Ripening Process

• Changes in fruit quality during ripening:
  – Flavors and sugars increase
  – Fruit softens and loosens from cap
  – Acids decrease
The Ripening Process

- Strawberry quality does not improve after harvest
Strawberry Harvest

- Strawberries for fresh market are hand-harvested
Strawberry Harvest

• Ripening stages
  – Green fruit
  – White tip fruit
    • Berries are less sweet
  – Ripe fruit
    • Sweeter berries
Strawberry Harvest

• Strawberry season in Missouri
  – June bearing: late April to early June
  – Day neutral: May-frost
• Harvest at least three times per week
• Harvest in morning when fruit is cool and full of water (turgid)
• Harvest with stems and caps intact
• Handle carefully during harvest
• Gently place berries no more than 3-4 inches deep in harvest or sales containers
• Cool the fruit as soon as possible after harvest
• Shelf life – 1-5 days
The Ripening Process - Blueberry

- Blueberries grow in size and weight during ripening
  - 60-80 days from flowering to ripe fruit
  - Fruit size increases during last days before harvest
  - Color changes from green to red to blue
The Ripening Process

• Changes in fruit quality during ripening:
  – Flavors and sugars increase
  – Fruit softens and loosens from stem
  – Acids decrease
The Ripening Process

- Blueberry quality does not improve after harvest
Blueberry Harvest

- Blueberries for fresh market are hand-harvested
- Machine harvest is possible for processing-quality fruit
Blueberry Harvest

- Ripening stages
  - Green fruit
  - Pink fruit
  - Blue with pink stem ends
  - Blue fruit
Blueberry Harvest

- Blueberry season in Missouri: June - July
- Harvest every 7 days
- Harvest in morning when fruit is cool and full of water (turgid)
- Ripe fruit separates easily from stem; avoid fruit with pink stem ends
- Handle carefully during harvest; fruit bloom is vulnerable to damage
- Gently place berries no more than 4-6 inches deep in harvest or sales containers
- Cool the fruit as soon as possible after harvest
- Shelf life – 5-14 days
Postharvest Handling
Postharvest Handling

• Berries may be held in cold storage for 2 to 14 days, depending on:
  – Cultivar (berry firmness)
  – Ripeness stage
  – Careful handling

• Ideal cold storage conditions:
  – Temperature: -0.5 - 0°C (31.1-32°F)
  – Relative humidity: >90%
Postharvest Handling

- Precooling is critical, to remove field heat in advance of longer term storage
  - Cool to 5°C within 4 hours
Postharvest Handling
Postharvest Handling

• Berries for processing
  – Process as soon as possible (within 24 hours)
  – Freeze berries for long term storage
    • IQF (individual quick frozen)
    • Bulk pack
Elderberry for Processing

• Processors commonly have a target for elderberry ripeness, based upon the product that they will produce from the fruit
  – Jelly/jam
  – Juice
  – Wine
  – Health supplements
Elderberry Ripening

- Berries develop color
- Berries soften and size increases due to cell enlargement
- Sugar content increases, acidity decreases, and pH increases
- Bioactive compounds likely synthesize and accumulate
- Aromas and flavors develop
Determining Elderberry Ripeness

• Collect a representative sample of fruit
• Collect a juice sample from the fruit
• Measure the following:
  – TSS (with refractometer)
  – Juice pH (with pH meter)
  – Juice titratable acidity (with titration equipment)
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Any Questions?