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Harvest Determination for Small Fruits

Patrick Byers
Regional Horticulture Specialist
MU Extension – Greene County
Springfield, Missouri, USA

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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

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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?

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How do I know that my berries are ripe?

- Calendar
- Visual cues
- Taste

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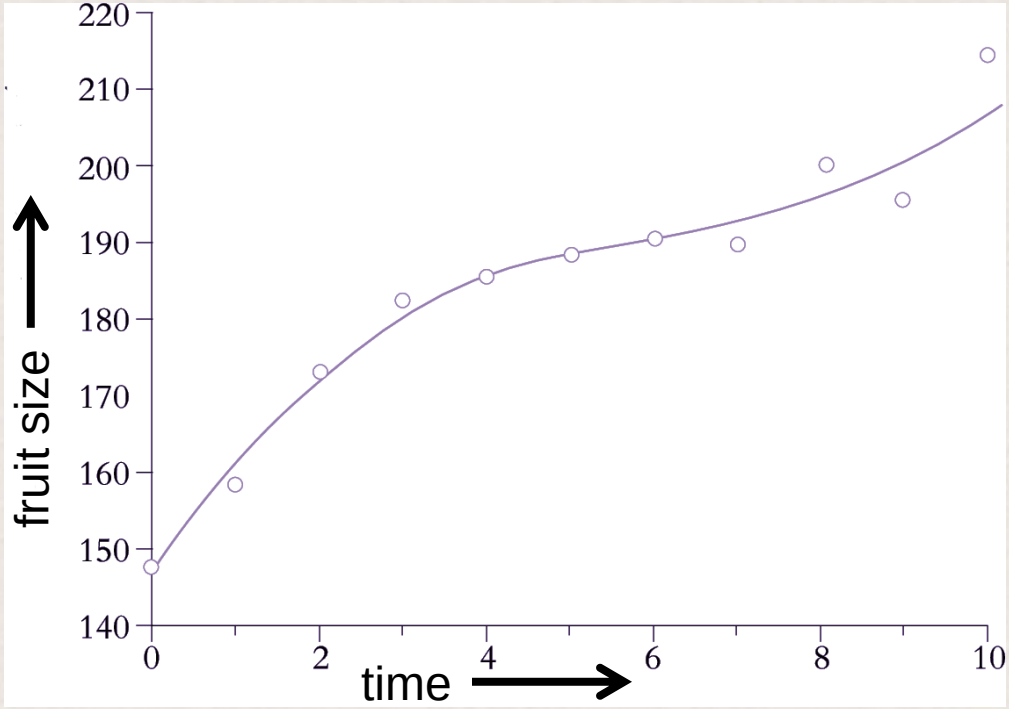
Why is it important to harvest at the right time?

- Fruit size development generally follows a double sigmoidal curve
  - Phase 1 – cell development
  - Phase 2 – seed development
  - Phase 3 – cell enlargement



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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

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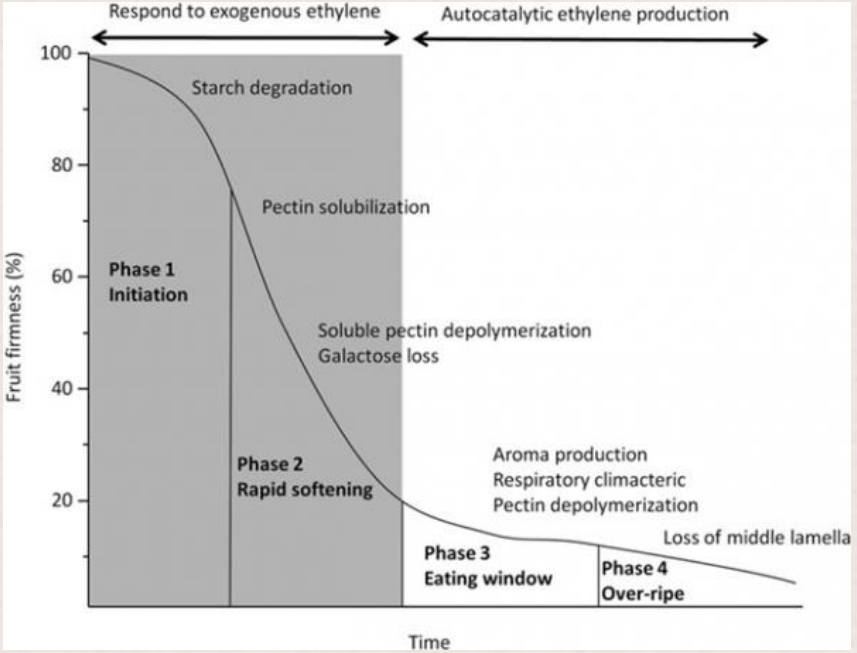
Ripening process in berries

- 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



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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

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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

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The Ripening Process

- Changes in fruit quality during ripening:
  - Flavors and sugars increase
  - Fruit softens and loosens from receptacle or stem
  - Acids decrease

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The Ripening Process

- Blackberry quality does not improve after harvest

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Blackberry Harvest

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

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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

Shiny black fruit

Dull black fruit

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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

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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

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The Ripening Process

- Changes in fruit quality during ripening:
  - Flavors and sugars increase
  - Fruit softens and loosens from cap
  - Acids decrease

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The Ripening Process

- Strawberry quality does not improve after harvest

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Strawberry Harvest

- Strawberries for fresh market are hand-harvested

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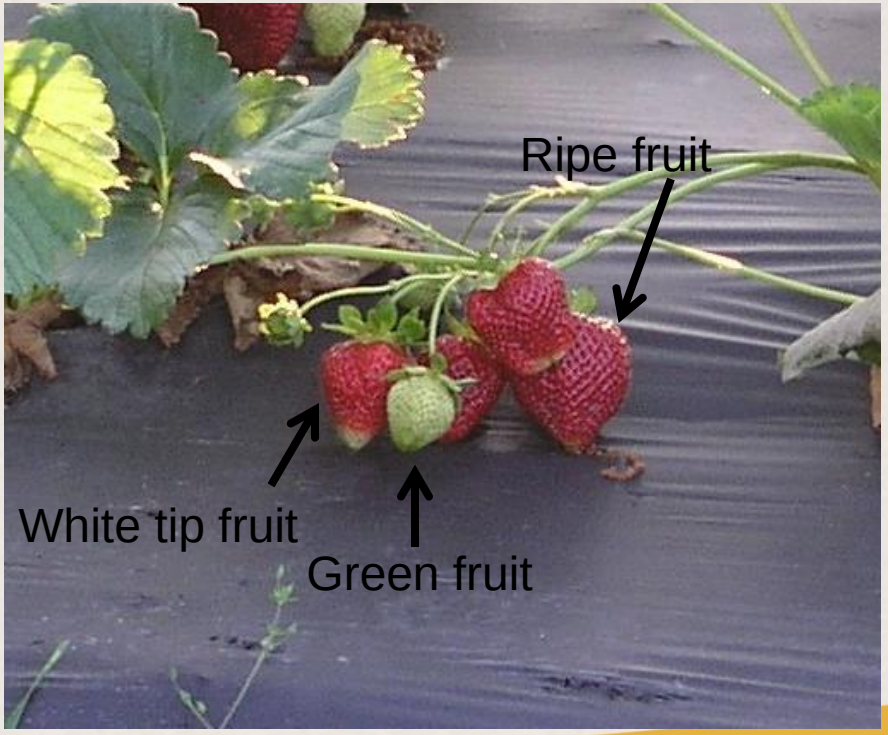
Strawberry Harvest

- Ripening stages
  - Green fruit
  - White tip fruit
    - Berries are less sweet
  - Ripe fruit
    - Sweeter berries



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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

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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

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The Ripening Process

- Changes in fruit quality during ripening:
  - Flavors and sugars increase
  - Fruit softens and loosens from stem
  - Acids decrease

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The Ripening Process

- Blueberry quality does not improve after harvest

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Blueberry Harvest

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

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Shiny black fruit

Blueberry Harvest

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

Dull black fruit

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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

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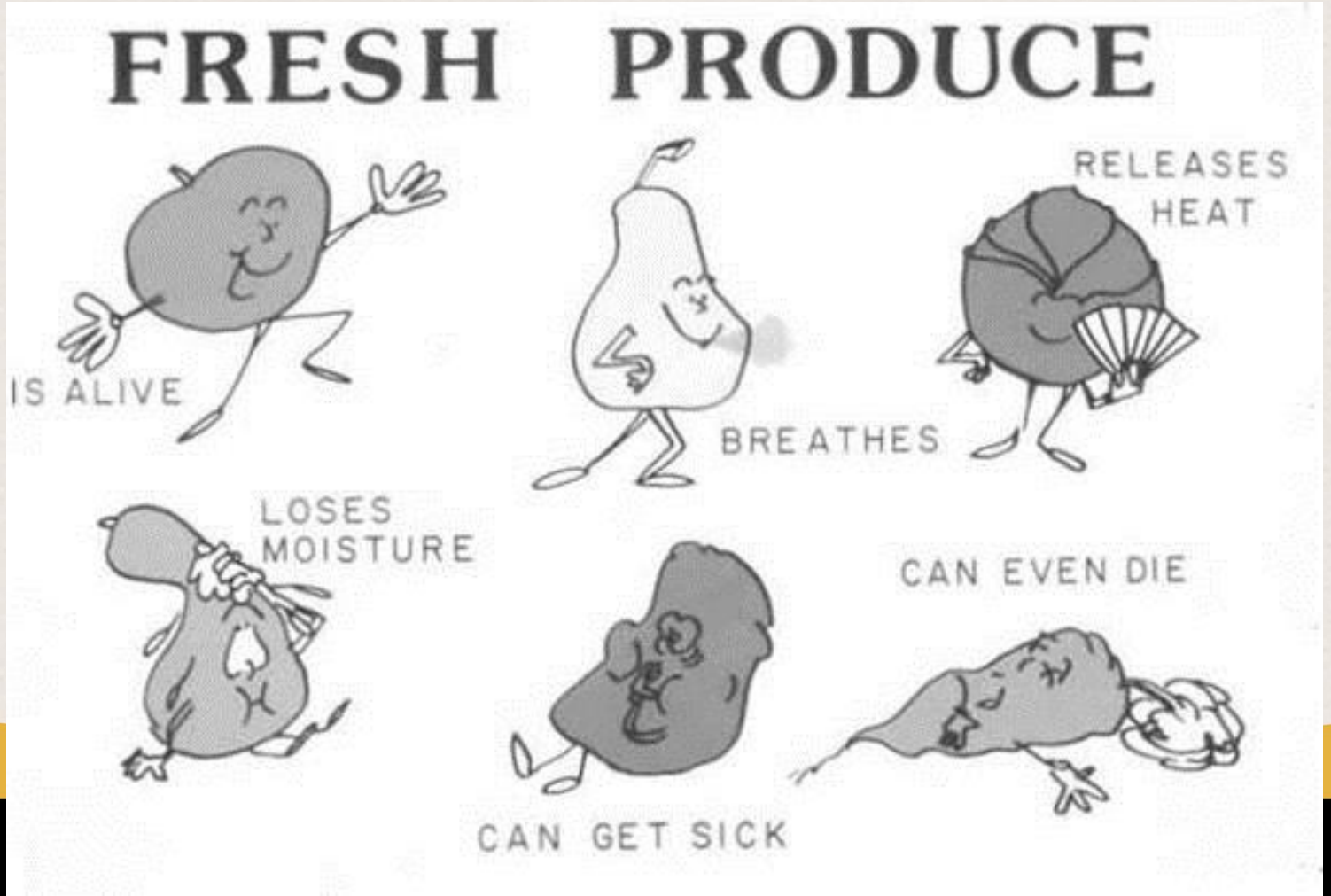
Postharvest Handling



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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%

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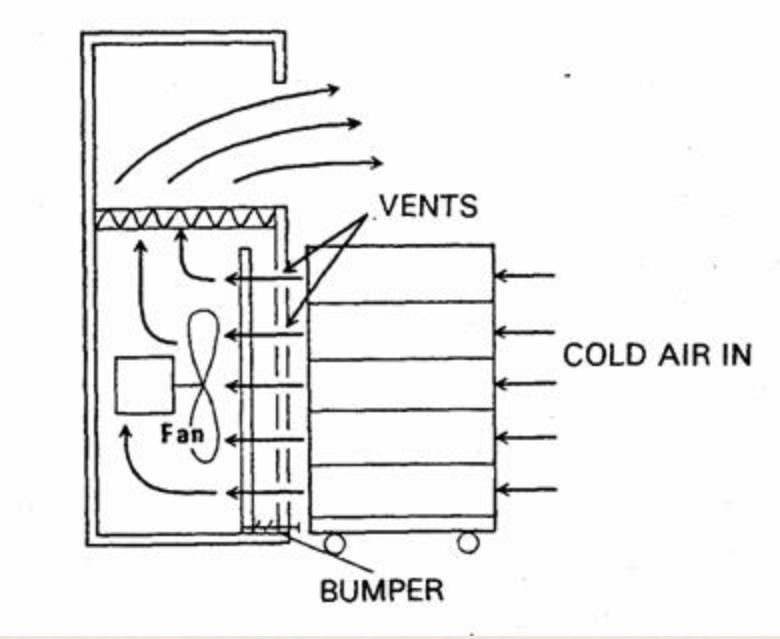
Postharvest Handling

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



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Postharvest Handling

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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

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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

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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

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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?