Post-Harvest Handling and Characteristics of Blueberries

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Survey

• Before I start, we have a few questions we would like you to answer and pass back to me.

• The results as well as answers on the questions will be posted with Eric and sent to you if you want.

• THANK YOU
Factors Affecting Fruit Quality

• Intensity and uniformity of blue color
• Juiciness
• Sweetness
• Flavor
• Sweet/acid balance
• Firmness/crunch
• Size
• Shelf life: handling resistance
• Antioxidant capacity and related properties

Note: These and other factors are important to all but they vary in importance depending on audience. Producers care about variety (early...), handlers and retailers rely on color and shelf life, processors may rely on juiciness, nutritionists may rely on health properties, consumers may rely on sweetness
Quality of Blueberries by Type

• Which Blueberry Type do you like?
  – Highbush
  – Rabbiteye
  – Southern Highbush
  – Lowbush
  – All equal

Note: Most consumers prefer Highbush blueberries. These are the most common and perceived as not as tough as rabbiteyes. However, rabbiteyes are usually hand picked and thus tend to be sweeter (more mature in the market) and handle better than Highbush. Lowbush blueberries are usually used for processing.
True or False

• Rabbiteyes are more “seedy” than Highbush blueberries?
• Rabbiteyes have tougher skin than Highbush blueberries?
• Rabbiteye blueberries get tougher after freezing?

Note: We will answer the first question soon but it appears that seediness is lower in Rabbiteyes than highbush berries. This depends on maturity, berry size, cultivar, etc. Rabbiteyes have a tougher skin than highbush blueberries but in some cases this is not Noted by consumers. In general, blueberries do not get tougher upon freezing.
Blueberries and Safety

- There have been no documented cases of outbreaks from blueberries
- The cases documented have been from foreign blueberries
- *Salmonella* and *E. coli* 0157:H7 or others cannot survive on acid blueberries
- Hepatitis has not been associated with blueberries
- Parasites like Cyclospora have not been associated with berries/blueberries

Note: There have been at least two Hepatitis outbreaks and one Salmonella outbreak directly linked to blueberries. Other outbreaks implicated blueberries (in berry mix) as one of a mix of possible sources. Outbreaks have been reported with US and foreign berries. Salmonella, *E. coli* O157:H7 and other pathogens can survive in blueberries. Hepatitis has been associated with at least two outbreaks. Parasites have been associated with berries, including blueberries.
Skin Thickness (um) of Blueberries

Garcia et al, 2012
Blueberry Seediness

Rabbiteye Variety

Volume (mm^3)  Seeds
## Conventional vs. Organic Production

<table>
<thead>
<tr>
<th>Production type</th>
<th>Antioxidant capacity, ORAC</th>
<th>Total phenolics</th>
<th>Total anthocyanins</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>μmol of Trolox (TE)/g of fresh weight (fwt)</td>
<td>mg/100 g of fwt</td>
<td>mg/100 g of fwt</td>
</tr>
<tr>
<td>Organic</td>
<td>46.14</td>
<td>131.2</td>
<td>319.3</td>
</tr>
<tr>
<td>Conventional</td>
<td>30.8</td>
<td>82.4</td>
<td>190.3</td>
</tr>
</tbody>
</table>

Wang et al, 2008
Maturity and Hand Harvesting

• Hand harvest BBs have higher sugars and sensory acceptance, are more uniform in maturity and quality

• Machine harvest BBs vary in maturity and quality
Harvesting BBs with dew
Rate of Respiration

http://berrygrape.org/post-harvest-handling-of-blueberries/
Field and Room Cooling

Diagram: Precooling vs. room cooling

- Room cooling
- Precooling
Cooling rates for blueberries in forced air and still air. (Room air temperature of 44 F)

Boyette et al, 1993
Decay in packaged blueberries stored at various temperatures

Boyette et al, 1993
Aerobic (APC), E. coli and Yeast & Mold (Y&M) Counts on Blueberries in Farm

Silva, unpublished)
Aerobic (APC), E. coli and Yeast & Mold (Y&M) Counts on Blueberries in Packing Line

P1 = non-chloro wash water
P3 = washed fruit
P5 = contact surface tray before belt
P6 = wash water (chlorinated)
P8 = plant floor/wall
P9 = 1st conveyor belt
P10 = 2nd conveyor belt after chloro wash
P11 = contact surface after blow dry
P12 = 3rd/last conveyor belt
P13 = blue bags in Blueberry box containers

APC
E coli
Y&M
Modified and Controlled Atmosphere

- Conventional: 32 F at high RH yields ~ 3 weeks shelf life.
- Shrink-wrapped pint containers -modified atmosphere packaging or MAP): High RH resulted in less shrink but fungal growth
- Placing filled flats in cold storage under conditions of various concentrations of carbon dioxide and oxygen (referred to as controlled atmosphere storage, or CA): 1.8% O2 & 12% CO2 at 32F for 46 days
Reveille after 5w cold storage + 3d shelf life

Air (control)  3% CO₂  6% CO₂

SO₂ 100 (μL/L)h + air  SO₂ 100 (μL/L)h + 3% CO₂  SO₂ 100 (μL/L)h + 6% CO₂

Cantin and Crisosto, 2011
Ozone on Shelf-Life

250 or 1000 ppb ozone for 24 or 48 h
Then 4 wks storage

Beth Mitcham &
Andrew Macnish
UCDavis
UV-C Radiation

- UV-C radiation on Blueberries (*Vaccinium corymbosum*, cvs. Collins, Bluecrop) prior to storage, can decrease decay caused by ripe rot (*Colletotrichum acutatum*)
- UV-C radiation may enhance antioxidant levels
- Stimulation of antioxidants by UV-C radiation appears to be dependent on cultivar
- Weight loss and firmness was not affected by light treatment.

Perkins-Veazie et al. (2008)
Effect of treatment [control/air (•), 18.8% CO2 (■), 193 ppm SO2 (A), and 15.5% ozone (x)] & storage time on decay and redness of ‘Tifblue’ at 2°C

Kim et al, 2010
Risks/Hazards Associated with Blueberries

• Production related hazards
  – *Salmonella* (1 documented outbreak)
  – *Eschericia coli* 0157:H7 or related

• Harvest related hazards
  – Hepatitis A (2 documented outbreaks)

• Post-harvest related hazards
  – *Salmonella*
  – *Listeria monocytogenes*
  – *Others* (Recalls bc of plastic, other contaminants)
Effect of treatment [control (●), CO2 (■), SO2 (▲), and O3 (x)] & storage time on Salmonella (logCFU/g) in ‘Tifblue’ at 2°C

Tokitkla, 2004
Conclusions

• Quality of BBs depends on market demands and buyer perception (other than Grade)
• Rabbiteyes are just as good or better than other types of blueberries
• Harvest uniform, firm, mature berries (or sort for these) for optimum flavor and Shelf Life (SL)
• Rapid cooling (field preferably) is key to SL
• Controlled atmospheres can double or more SL
• Beware, pathogens can contaminate BBs and affect humans/consumers
• Prevention of pathogen contamination is key, better than control after being contaminated
CONSUMER TASTE TEST

• We would like to have your opinion on a taste test we have conducted as part of our student’s thesis and a project on Mississippi/Southern Blueberries.

• Please help Amanda by doing the taste test or thank you if you have already done it.
GRACIAS

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