Postharvest brown rot control by integrated approaches in Italy

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LLEIDA-FRUITCENTRE
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Fruits and vegetables are highly perishable commodities due to high moisture content and higher metabolic activities.
As a result, about 25 to 30 per cent of the production is lost after harvest
The aim of BAPs in postharvest is the reduction of postharvest losses of fruits and vegetables making them available for longer period in the market.

The BAPs (Best Agriculture Practices) repair the pipeline.
FRESH PRODUCE

IS ALIVE

LOSES MOISTURE

CAN GET SICK

BREATHER

RELEASES HEAT

CAN EVEN DIE
Postharvest loss: Is defined as any change in the quality or quantity of the product after harvest that decreases its value.

The losses may range from slight defects to total loss of the produce!
POSTHARVEST LOSSES MAY OCCUR AT DIFFERENT STEPS DURING THE SHELF-LIFE

1. at harvest: injuries, pressure damage
2. at the packinghouse: chemicals, brushes and wax damage
3. during storage: chilling injuries, decay, peel disorders
4. during transport: bruising, deformation, decay
5. at retail: decay, softening, wilting
6. at the consumers: decay, softening, wilting
A ripe fruit is a fruit much appreciated by consumers but it’s more susceptible to damages and has to be harvested with more attention.

To protect the product from direct sunlight, quick transport to the packinghouse...
The cleaning of bins is very important in order to avoid contamination with spore pathogens.

The selection of fruit is another important step: trained personnel, the use of gloves, the cleaning of equipments can reduce wounds and pathogen infections.

Minimize delays before pre-cooling.

Uniform product’s cooling.
What’s wrong with this picture?
Product quality at harvesting
Product quality after improper mechanical grading process.
The use of water as an handling medium spreads inoculum from soil debris and diseased fruits first of all for pathogens like *Penicillium*, *Botrytis*, *Monilinia* that are wound pathogens and that can easily penetrate into fruits trough macro- and microwounds.
……during storage

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Relative speed of spoiling</th>
<th>Shelf-life (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1,0</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>3,0</td>
<td>33</td>
</tr>
<tr>
<td>20</td>
<td>7,5</td>
<td>13</td>
</tr>
<tr>
<td>30</td>
<td>15,0</td>
<td>7</td>
</tr>
<tr>
<td>40</td>
<td>22,5</td>
<td>4</td>
</tr>
</tbody>
</table>
At temperatures above the optimum, the rate of deterioration increases 2 to 3 fold for every 10°C rise in temperature. 

High temperature increases the transpiration rate.
......during storage

<table>
<thead>
<tr>
<th>Specie</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Gala’ group</td>
<td>-0.5 - +0.5 C</td>
</tr>
<tr>
<td>‘Golden’ group</td>
<td>0.5 -1.5 C</td>
</tr>
<tr>
<td>‘Pink Lady’</td>
<td>1.5 - 2 C</td>
</tr>
<tr>
<td>Pear</td>
<td>1 -0 C</td>
</tr>
</tbody>
</table>

Store the product at optimum temperature conditions.

Ship to market as soon as possible.
Use refrigerated loading area.

Cool truck before loading.

Load pallets towards the center of the truck.

Avoid delays during transport.

Monitor product temperature during transport.
At harvest the fruits were divided in two different classes of maturity. They seem the same, but for DA-index are different.
**DA-Meter experiment**

- Springbelle IAD: 0.2-0.9
- Redhaven IAD: 0.0-0.3

- Springbelle IAD: 0.2-0.4
- Redhaven IAD: 0.4-0.6
Monilinia *spp. rots*

<table>
<thead>
<tr>
<th>Variety</th>
<th>Class</th>
<th>$I_{DA}$</th>
<th>Artificial infection$^1$</th>
<th>Natural infection$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lesion diameter (mm)</td>
<td>Infected fruit (%)</td>
</tr>
<tr>
<td>‘Springbelle’</td>
<td>I</td>
<td>0.2-0.4</td>
<td>10.1*±0.4a**</td>
<td>60.0±3.7a</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>0.5-0.9</td>
<td>7.5±0.5b</td>
<td>10.0±3.5b</td>
</tr>
<tr>
<td>‘Redhaven’</td>
<td>I</td>
<td>0.0-0.3</td>
<td>13.0±1.1a</td>
<td>61.3±13.3a</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>0.4-0.6</td>
<td>9.0±0.3b</td>
<td>1.3±1.3b</td>
</tr>
</tbody>
</table>

$^1$ Artificial infection: fruits were wounded, infected by 20 µl of conidia suspension ($10^3$ conidia/mL) of *Monilinia fructicola* and stored at 20 °C for 3 d.

$^2$ Natural infection: fruits were stored at 20 °C for 6 d.
HOT WATER TREATMENT

Disease control without fungicides

![Infected Fruits (%)](chart)

- **Control**
- **HW**

- **2013**: 47.5%
- **2012**: 61.1%
- **2011**: 39%

**HW** vs. **Control**

- **HW**: 4.3, 26.7, 1
- **Control**: 75, 25, 50
**New approach**

**Hot water treatment (60 °C for 1 min)**

*LDS test (P<0,05)*

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Control</th>
<th>Hot water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Royal Glory</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>Rich Lady</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>Lucie Tardibelle</td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>Big Top</td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>Plus plus</td>
<td>a</td>
<td>b</td>
</tr>
<tr>
<td>Silver Giant</td>
<td>a</td>
<td>a</td>
</tr>
</tbody>
</table>

**El %**

- Royal Glory: 81,2
- Rich Lady: 1,4
- Lucie Tardibelle: 43,9
- Big Top: 60,7
- Plus plus: 63,2
- Silver Giant: 12,0
New approach

Hot water vs fungicide

* LDS test ($P<0.05$)

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Control</th>
<th>Hot water</th>
<th>Fungicide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Royal Summer</td>
<td>a</td>
<td>b</td>
<td>b</td>
</tr>
<tr>
<td>Big Top</td>
<td>a</td>
<td>b</td>
<td>c</td>
</tr>
<tr>
<td>Symphony</td>
<td>a</td>
<td>b</td>
<td>c</td>
</tr>
<tr>
<td>Alitop</td>
<td>b</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>Sperimental</td>
<td>a</td>
<td>b</td>
<td>b</td>
</tr>
<tr>
<td>Orion</td>
<td>a</td>
<td>a</td>
<td>b</td>
</tr>
</tbody>
</table>

**EI %**

- 61,8 – 67,2
- 60,7 – 75,8
- 42,5 – 86,9
- 45,5 – 92,0
- 63,2 – 69,6
- 15,8 – 52,8
1. BAPs are fundamental to reduce postharvest fruit losses and keep an high quality of fruits

2. BAPs could be easy to performe, but they are not always adopted

3. Before storage, the use of AD-meter allows to select asymptomatic lots of fruit with high or low percentage of infections of brown rot or lenticel rot

4. The use of HW treatment can reduce the infections of *Monilinia* and *P. vagabunda*. The treatment is safe for consumers and sustainable for enviroment
Thank you for the attention