POST-HARVEST HANDLING OF FRESH FRUITS AND VEGETABLES

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Estimates of post harvest losses of highly perishable produce such as fruits, vegetables and root crops in developing countries can be as high as 50%.

Reduction in this wastage, particularly if it can economically be avoided, would be of great significance to growers and consumers alike.
Factors Affecting Post Harvest losses

- Factors affecting post-harvest food losses of perishables vary widely from place to place and become more and more complex as systems of marketing become more complex.
  - Pre-harvest production practices (irrigation, fertilizers, pesticide and herbicide use)
  - Harvesting and field handling
  - Packing or packaging
  - Transport
  - Market handling; possibly storage or refrigeration
  - Perishability of the produce.
Quality cannot be improved after harvest, only maintained; therefore it is important to harvest produce at the proper stage and size and at peak quality.

Harvest should be completed during the coolest time of the day, which is usually in the early morning, and produce should be kept shaded in the field.

Handle produce gently. Crops destined for storage should be as free as possible from skin breaks, bruises, spots, rots, decay and other deterioration.
Harvesting and Field Handling

- Bruises and other mechanical damage not only affect appearance but provide entrance to decay organisms as well.

- Post harvest rots are more prevalent in fruits and vegetables that are bruised or otherwise damaged.

- Mechanical damage also increases moisture loss.
MECHANICAL DAMAGE

Oil spotting on lemons (the result of mechanical damage during the harvesting and handling of turgid lemons)
Symptoms of decay (caused by various fungi)
Damage can be prevented by:

- training harvest labor to handle the crop gently;

- harvesting at proper maturity;

- harvesting dry whenever possible;

- handling each fruit or vegetable no more than necessary (field pack if possible);

- installing padding inside bulk bins;

- and avoiding over or under-packing of containers
FRESH PRODUCE

- IS ALIVE
- RELEASES HEAT
- LOSES MOISTURE
- BREATHES
- CAN EVEN DIE
- CAN GET SICK
For the most part, the preparation of produce for market is carried out in a packing house, which may range from a simple, on-the-farm thatched shed to an automated regional packaging line handling large tonnages of a single commercial crop like citrus fruit.
Pack House Handling

Pack house handling include:
- **Sorting**: removes foreign matter (stones, leaves, debris)
- **Cleaning and washing**: hand washing or on a line use only clean running water
- **Fungicide treatment**: post-harvest application of fungicide is usual on crops such as bananas, yams and citrus fruit which are to be stored for a long period or those which undergo long periods of transport to distant markets.
- **Quality selection and grading**: manually or on a packing line
GAPs in Packing Houses

- Use chlorinated water to wash produce
- Change water when dirty
- Wash, rinse and sanitize packing lines surfaces at end of each day
- Store packaging material in a clean area
Packing or Packaging

- Suitable packages and handling techniques can reduce the amount of damage to which fresh produce is exposed during marketing.

- Packaging should be designed to prevent physical damage to produce, and be easy to handle.
Selection of packaging for fresh produce

Besides providing a uniform-size package to protect the produce, there are other requirements for a container:

- it should be easily transported when empty
- it must be easy to assemble, fill and close either by hand or by use of a simple machine;
- it must provide adequate ventilation for contents during transport and storage;
- its capacity should be suited to market demands;
Selection of packaging

- its dimensions and design must be suited to the available transport in order to load neatly and firmly;
- it must be cost-effective in relation to the market value of the commodity for which used;
- it must be readily available, preferably from more than one supplier.
Storage

Temperature is the single most important factor in maintaining quality after harvest. Refrigerated storage retards the following elements of deterioration in perishable crops:

- aging due to ripening, softening, and textural and color changes;
- undesirable metabolic changes and respiratory heat production;
- moisture loss and the wilting that results;
- spoilage due to invasion by bacteria, fungi, and yeasts;
- undesirable growth, such as sprouting of potatoes.
One of the most important functions of refrigeration is to control the crop's respiration rate.

The higher the storage temperature, the higher the respiration rate will be.

For refrigeration to be effective in postponing deterioration, it is important that the temperature in cold storage rooms be kept as constant as possible.

Storage rooms should be well insulated and adequately refrigerated, and should allow for air circulation to prevent temperature variation.
<table>
<thead>
<tr>
<th>Commodity</th>
<th>Recommended Minimum Storage Temperature (°C)</th>
<th>Potential Chilling Injury Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>0-7</td>
<td>Core or flesh browning, fermented flavour, spongy texture, susceptibility and symptoms vary with cultivar</td>
</tr>
<tr>
<td>Asparagus</td>
<td>2-4</td>
<td>Occurs primarily at the tips – darkened and water-soaked followed by bacterial soft rot</td>
</tr>
<tr>
<td>Avocado</td>
<td>7-13</td>
<td>Darkening of vascular tissue, discolouration of flesh and skin, off-flavours and odours, abnormal ripening</td>
</tr>
<tr>
<td>Banana</td>
<td>&gt;13</td>
<td>Green fruit: brown under peel discolouration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ripe fruit: brown to black peel discolouration, off-flavours, abnormal ripening</td>
</tr>
<tr>
<td>Bean (snap)</td>
<td>7-10</td>
<td>Russetting, pitting</td>
</tr>
<tr>
<td>Cantaloupe</td>
<td>2-5</td>
<td>Pitting, surface decay</td>
</tr>
<tr>
<td>Cucumber</td>
<td>7-10</td>
<td>Pitting of surface, lenticel area affected first, followed by Fusarium and other rots</td>
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<td>---------------------------------------------------------------------------------------------------</td>
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<tr>
<td>Egg Plant</td>
<td>7-13</td>
<td>Scald-like browning, pitting, flesh browning, decay and loosening of capstems, Alternaria rot</td>
</tr>
<tr>
<td>Grapefruit</td>
<td>10-15</td>
<td>Brown pitting of rind, watery breakdown of internal and external tissues, fermented odour</td>
</tr>
<tr>
<td>Honeydew Melon</td>
<td>7-13</td>
<td>Water-soaking of the rind, softening, greying or browning, surface becomes soft and sticky resulting in increased decay</td>
</tr>
<tr>
<td>Lemon</td>
<td>10-14</td>
<td>As for grapefruit, plus red blotch</td>
</tr>
<tr>
<td>Lime</td>
<td>9-12</td>
<td>As for grapefruit</td>
</tr>
<tr>
<td>Mango</td>
<td>&gt;13</td>
<td>Greyish skin discolouration, pitting, uneven ripening, poor flavour, increased susceptibility to Alternaria rot</td>
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<tr>
<td>Okra</td>
<td>7-10 pitting</td>
<td>Pitting of surface, lenticel area affected first, followed by Fusarium and other rots</td>
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<tr>
<td>Orange</td>
<td>2-5</td>
<td>As for grapefruit</td>
</tr>
<tr>
<td>Papaya</td>
<td>7-13</td>
<td>Pitting, olive or brown discolouration, abnormal ripening</td>
</tr>
<tr>
<td>Pepper</td>
<td>7-13</td>
<td>Water soaked appearance, sheet pitting, darkening, predisposition to Alternaria and Botrytis</td>
</tr>
<tr>
<td>Pineapple</td>
<td>7-13</td>
<td>Flesh watery, followed by browning or blackening</td>
</tr>
<tr>
<td>Potato</td>
<td>3-10</td>
<td>Mahogany browning, sweetening</td>
</tr>
<tr>
<td>Pumpkin/winter squash</td>
<td>10-15</td>
<td>Rot, primarily Alternaria</td>
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<td>Sweet potato</td>
<td>&gt;13</td>
<td>Flesh discolouration, internal breakdown, increased decay, off-flavours, hard core when cooked</td>
</tr>
<tr>
<td>Tomato – ripe green</td>
<td>7-13 &gt;13</td>
<td>Rubbery texture, watery flesh, irregular ripening, seed browning</td>
</tr>
<tr>
<td>Watermelon</td>
<td>10-15</td>
<td>Pitting, loss of flavour, fading of red colour</td>
</tr>
<tr>
<td>Zucchini/summer squash</td>
<td>5-10</td>
<td>Surface pitting, rapid decay</td>
</tr>
</tbody>
</table>
Chilling Injuries

Breakdown And Subsequent Decay Of Cantaloupes Stored At 0°C For 4 Days.

Abnormal/Uneven Ripening Of Green Tomatoes Stored At 3°C And Subsequently Ripened At Room Temperature

Water-Soaking of asparagus tips due to storage at 0°C.

Shrivelng and secondary rot Is also occurring.
While temperature is the primary concern in the storage of fruits and vegetables, relative humidity is also important: directly influences water loss in produce.

Most fruit and vegetable crops retain better quality at high relative humidity (80 to 95%), but at this humidity, disease growth is encouraged.
Humidifier
Transportation is a big and often the most important factor in the marketing of fresh produce.

Ideally, transport would take produce from the grower directly to the consumer.

Losses directly attributed to transport conditions can be high.
The goal of every person concerned with transport should be that the produce be kept in the best possible condition during transport and that the haulage of produce be quick and efficient.

To this end, produce should be properly packaged and properly loaded on a suitable vehicle.
The damage and loss incurred during non-refrigerated transport are caused primarily by mechanical damage and by overheating.

- **Mechanical damage**
  - careless handling of packed produce during loading and unloading;
  - vibration (shaking) of the vehicle, especially on bad roads;
  - fast driving and poor condition of the vehicle;
  - poor stowage, which allows packages in transit to sway; the stow may collapse
  - packages stacked too high; the movement of produce within a package increases in relation to its height in the stack
Over heating

This can occur not only from external sources but also from heat generated by the produce within the package itself.

Overheating promotes natural breakdown and decay, and increases the rate of water loss from produce.
The causes of overheating include:

- the use of closed vehicles without ventilation;

- close-stow stacking patterns blocking the movement of air between and through packages, thus hindering the dispersal of heat;

- the lack of adequate ventilation of the packages themselves;

- exposure of the packages to the sun while awaiting transport or while trucks are queuing to unload at their destination.
Ensure vehicle and containers are clean and sanitary.

Fresh produce should not be transported in vehicles that previously held animals or harmful substances.
THANK YOU