Training of Trainers on Postharvest Management of Onion

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World Vegetable Center - West & Central Africa, Dry regions
1. Postharvest losses

Nigeria’s post-harvest losses rise to $9bn –FIIRO DG

By Charles Nwaoguji

The Director General of the Federal Institute of Industrial Research, Oshodi (FIIRO), recently in Lagos, lamented that the country post-harvest losses have risen to over $9 billion annually.

Prof. (Mrs.) Gloria Elema, who was the keynote speaker at a two-day workshop of GAIN-PLAN Nigeria Cold Chain Summit 2017, held in Ikeja, Lagos, stated that post-harvest losses in Nigeria are estimated to be about 50 per cent of foods produced.

She explained that some experience more than 50 percent loss like in the case of fruits and vegetables due to their perishable nature, adding that crops like grains record less than 50 per cent post-harvest losses.
2. Onion bulb

- Biennial plant
- Bulb= simple layered structure formed by the swelling of the initially cylindrical leaf bases, which enclose a number of fleshy leaves or scales
- Bulbing-water and assimilates from the foliage leaves are stored in the fleshy leaf bases
- Bulb= storage organ (water & nutrients)
- ‘Dormancy’: state of the bulb at harvest time, little cell division, biological activity is low
3. Harvesting

• Maturity indices for harvesting
  • 75 – 80% of plants have their leaves fallen over
  • Plant does not put on new leaves
  • Leaves start drying (for. e.g. external leaf)
  • Resistance to pull-out of the ground
  • Counting from date of sowing (bulbs mature within 100 to 140 days)
3. Harvesting

• Harvest of onion bulbs
  
  • Stop irrigation at maturity- 1 (soils with low water retention) or 2 weeks (soils with high water retention) before harvest to prevent bulbs from being waterlogged.

  • Harvest bulbs during the cooler part of the day (early morning & late evening).

  • Manual harvesting- levering the bulbs with a fork to loosen them and pulling the tops by hand

• Avoid to damage the bulbs
4. Curing

- **Curing** – drying of the outer scales to a rustling dry stage when they have become papery
  - dry off the neck
  - prevent moisture loss
  - prevent decay (neck rot & bacterial diseases)

- Successful curing of bulbs: tight neck and shrieking dried outer layer scales when bulb is held in the hand

- Bulbs loose 3 to 5% of their weight in ambient condition/ 10% weight with artificial drying

- Important factors: Temperature & Ventilation

- Generally curing requires 1 to 2 weeks depending of the methods used and the climatic condition
4. Curing

- Windrowing or field drying method
  - Mature bulbs harvested and laid on their sides on the surface of the soil to dry for 1 or 2 weeks
  - Pulled onions are oriented in the way that the leaves lay over top of the bulbs
  - Simple & cheap
  - Weather dependent, risk of sunscald or sunburn (direct exposure to sun), rotting in storage & brown strains
  - Not suitable for large scale onion production business
4. Curing

• Curing in a shade, room, greenhouse
  ▪ Bulbs laid in trays or racks in a warm, covered and good ventilated area
  ▪ Spread out the onions in a single layer on a clean, dry surface
  ▪ Improve bulbs quality and reduces losses
  ▪ Require additional cost
  ▪ Relative humidity: 65% - 80% & Temperature should not exceed 30°C
4. Curing

Onions drying in a ventilated room on racks

Onions drying in a high tunnel covered with shade cloth
5. Topping of bulbs

• Bulbs should be topped only when the neck is dry and has no green tissue

• Leave around 4-5 cm of neck on the bulb when topping.

• For cultivars for which foliage falls down at maturity, generally topping should be done slightly above the point where leaves had fallen down.
6. Cleaning & Grading

• Sort-out: thick neck, bolted, doubles, injured, decayed and misshapen small bulbs, remove soil and foreign matters
6. Grading

Mechanically or pest damaged bulbs

Bulb with thick neck

Bulbs with mold growth
6. Grading

Sprouting bulbs

Double or split bulbs
# 6. Grading

## Grading and classification of onions

Onions are graded into two classes (Class 1, Class 2) and subdivided into five categories.

### Classes of onions

<table>
<thead>
<tr>
<th>Quality factors</th>
<th>Class 1</th>
<th>Class 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Dry clean, firm clean and well developed</td>
<td>Dry clean, firm clean and well developed</td>
</tr>
<tr>
<td>Roots</td>
<td>No roots longer than 20 mm Light greening on not more than 50% of the total bulb is permissible</td>
<td>No roots longer than 30 mm Light and dark greening not deeper than two fleshy bracts are permissible</td>
</tr>
<tr>
<td>Tops</td>
<td>Shall be cut or clipped off and may not be longer than 60 mm</td>
<td>Shall be cut or clipped off and may not be longer than 60 mm</td>
</tr>
<tr>
<td>Foreign matter; Double bulbs; Decay; Heat / cold damage; Onions of another colour</td>
<td>Not permissible</td>
<td>Not permissible</td>
</tr>
</tbody>
</table>
6. Grading

Categories of onions

Accepted onion sizes:

<table>
<thead>
<tr>
<th>Category</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra Large</td>
<td>Over 90 mm</td>
</tr>
<tr>
<td>Large</td>
<td>70-90 mm</td>
</tr>
<tr>
<td>Medium</td>
<td>40-70 mm</td>
</tr>
<tr>
<td>Small</td>
<td>35-50 mm</td>
</tr>
<tr>
<td>Prickle</td>
<td>10-35 mm</td>
</tr>
</tbody>
</table>
7. Storage

- **Objective** - extend the period of availability of crop, maintain optimum bulb quality and minimize losses from physical, physiological, and pathological agents.

- The art of the store manager - keep the bulb in a dormant state for as long as possible, until the time is right for it to be sold.

- Major biological factors leading to onion bulb deterioration:
  - respiration
  - resumption of growth
  - pathogen attack

- Different onion types have different storage potential.
  For e.g size of the bulb, color, landrace & hybrid.
7. Storage

- Optimal temperatures (Temp.) for onion bulb storage

<table>
<thead>
<tr>
<th>Temp. (°C Ranges)</th>
<th>0 – 4</th>
<th>7-25</th>
<th>25 – 31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remark</td>
<td></td>
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</tbody>
</table>

- Storage up to 12 months
- No sprouting
- Weight loss considerably less
- Rewarm the bulbs to ambient temperature to avoid condensation at the time of marketing

- Bulbs loose dormancy = promotes sprouting
- Fungi & bacteria are very active
- Very dangerous for bulbs storage

- Storage up-to 8-9 months
- Easily adapted to hot & tropical conditions
- No sprouting
- Fungi & bacteria less active
- Discourage neck rot

- Optimal Relative humidity for onion bulb storage: 65 – 75%
7. Tips for storage

• Only store visibly healthy and non stained bulbs

• Storage of bulbs on wooden rack - bulbs should be spread on rack in layer of height of 3 bulbs maximum

• Rudus stores – height of bulbs pile should not exceed 30 cm to allow easy periodical monitoring

• Apply «FIRST IN, FIRST OUT»

• Periodical monitoring in average every 15 days to remove decayed & sprouting bulbs and bulbs showing sign of molds infection
7. Storage structures

Prototype Burkina Faso

Modern Rudu
7. Storage structures

Prototype Mali (Jiege ni Jaba)
8. Packaging

• Meet three criteria:

  ▪ Strong enough to retain the required weight of onions under the conditions of transport and storage

  ▪ Allow sufficient ventilation for the air around the bulbs to maintain relative humidity in the required range

  ▪ Provide a means of displaying legally required and commercially necessary information
8. Packaging
8. Packaging

ONIONS

Producer: ABC Farming
P.O. Box 1122
Douglas
0070

PUC: D 0980

<table>
<thead>
<tr>
<th>Class 1</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>40 – 60 mm</td>
</tr>
</tbody>
</table>

Product of South Africa

Nett mass: 25 kilograms
9. Onion diseases in storage

• Onion diseases in storage mainly favored by:
  ▪ Environmental conditions (Temperature & Relative humidity (> 80% prone to pathogens growth))
  ▪ Mechanic or biological damages to bulbs
  ▪ Onion seeds transmission (e.g. *Botrytis allii*)

• Major diseases
  ▪ Neck rot
  ▪ Soft rot
  ▪ Brown rot
  ▪ Black mold
9. Onion diseases in storage

• Neck rot disease

  ▪ **Pathogen:** *Botrytis allii*
  
  ▪ **Symptoms:** Infection around the neck tissue; Bulb scale soften and turn brown; Cut open bulbs show water-soaked brown tissues near the neck region
  
  ▪ **Management:** use healthy seeds, proper curing, leave several inches of neck on the bulb when topping
9. Onion diseases in storage

• Soft rot disease

  ▪ **Pathogen:** *Erwinia caratovora*
  
  ▪ **Symptoms:** Severe discoloration with soft rotting and water soaking of one or more of the inner fleshy scales; foul odor may ooze from the bulb, if squeezed.

  ▪ **Management:** proper curing, harvest only at right maturity, reduce doses of nitrogenous fertilizers
9. Onion diseases in storage

- **Brown rot disease**
  - **Pathogen**: *Pseudomonas aeruginosa*
  - **Symptoms**: Dark brown discoloration on bulb scale; Rotting starts from inner scales and spreads to outer scales; bulbs seems to be healthy, but when pressed, white ooze is noticed from the neck.
  - **Management**: proper curing, leave several inches of neck on the bulb when cutting
9. Onion diseases in storage

- **Black mold**

  - **Pathogen:** *Aspergillus niger*
  
  - **Symptoms:** neck of bulbs infected and occasionally the pathogen penetrates from side and basal end of the bulb when damaged; In advance stages, the entire surface of bulbs turns black and all scales get infected.

  - **Management:** proper curing, Avoid bruising/ injury of bulbs during handling
Thank you