Smallholder Horticulture Empowerment & Promotion Project for Local and Up-Scaling (SHEP PLUS)

“Changing Farmers’ Mindset from “Grow and Sell” to ”Grow to Sell””

BULB ONION PRODUCTION

Presented to the County & AFA (HCD) Staff in charge of the SHEP PLUS Model Farmer Groups during the FT-FaDDE

Prepared by SHEP PLUS
1. Introduction:

1.1 Background

Photo: SHEP PLUS

Bulb Onion (Kitunguuu Maji)
1. Introduction:

1.1 Background

- Onion is a member of the *Amaryllidaceae* family, *Alliodeae* Subfamily, Genus- *Allium*, Species *Allium cepa*
- Bulb Onion is one of the most *widely grown* & *consumed vegetables* in Kenya
- It is a biennial plant but considered an annual because it is harvested in its first growing stage
- It is a profitable crop however requires a lot of labour during transplanting and weeding
1. Introduction:

1.1 Background

Uses

• It is an important spice for foods when cooked or served raw
• Used to make pickles or chutneys
• It is rich in Calcium, Iron, Potassium, Vitamin B6 & B9, Vitamin E and has medicinal properties
1.2 Common Varieties

‘Red Creole’

- A popular variety which produces red, flat-round, globular bulbs
- Maturity; 150 days from transplanting
- It has very pungent taste
- Excellent in storage
- Yield: 16 tones per acre

Photo: Sakata http://sakata.co.za/project/red-creole-short-day-red-onion/
1.2 Common Varieties in Kenya

‘Bombay Red’

- Variety for dry and warmer conditions
- Produces small to medium sized bulbs, which are globe shaped, Deep purple red colour and very pungent
- Maturity 150 days from transplanting
- Yield: 16 tones per acre

Photo: Photo: Safal Seeds & Biotech LTD
http://www.safalseedsbiotech.com/onion-seeds.htm
1.2 Common Varieties Cont’

“Red Star F1”
- Matures in 110-120 days after transplanting
- Very high yielding 25 tons per acre
- Globe shape, uniform medium to big bulbs
- Excellent bulb colour; deep dark red
- Good field holding capacity
- Stores up to 5 months
- Tolerant to neck rot and purple blotch diseases

‘Red Star F1’

“Red Passion F1”:
- Deep red, matures in 120 days
- Stores up to 5 months
- Tolerant to Pink Rot and Purple Blotch
- Yield: 23 tones per acre
1.2 Common Varieties Cont’

Other varieties grown in Kenya:

“Jambar F1”:
- Dark red globe bulbs easy to cure
- Can be grown in open field and greenhouses
- Matures in 80-120 days
- Yield: 23 tones per acre

“Red Pinoy F1”
- Deep red attractive bulbs
- Maturity only 90 days from transplanting
- Strong pungency
- Long shelf life of up to 6 months at room temp
- Tolerant to Downy Mildew and Purple Blotch
- Yield: 30 tones per acre
1.2 Common Varieties Cont’

“Tropicana F1”
- Very productive and produces large red, thick flat bulbs with firm pungent taste
- Maturity 90-100days after transplanting
- Yield: 25 tones per acre

“Neptune F1”
- High yielding
- Firm shining red bulbs, good pungency
- Good for salads, red-skin, flattened globe-shape
- Mid-late maturing, (110-120 days)
- 5-6 months storage period
- Pink root resistant
1.2 Common Varieties Cont’

“Texas Grano”

- White colour with golden exterior
- Bulbs large
- Maturity 120 days from transplanting
- Does Not store well.
- It has mild pungency which is good for salad
- Yield: 21 tones per acre

Photo: https://www.royalseed.biz/onions.php
## 1.3 Optimal Ecological Requirements

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<td><strong>Altitude</strong></td>
<td>0 – 1,900 metres above sea level</td>
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<td><strong>Rainfall</strong></td>
<td>500 – 700 mm of rainfall annually</td>
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<td><strong>Growing Temperature</strong></td>
<td>15 – 30 °C</td>
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<td><strong>Soils</strong></td>
<td>• Fertile and well drained soil</td>
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<td>• pH range 6.0 – 6.8</td>
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2. G20 technologies

- Make sure to support farmers carry out G20 techniques for any crop

1. Market survey
2. Crop planting calendar
3. Soil testing
4. Composting
5. Use of quality planting materials
6. Recommended land preparation practices
7. Incorporating crop residues
8. Basal application of compost/ manure
9. Recommended practices of seedling preparation/ seedlings from registered nursery
## 2. G20 technologies

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<td>Recommended spacing</td>
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<td>Recommended fertilizer application rate</td>
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<td>Supplementing water</td>
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<td>Keeping farm records</td>
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# 2.1 Crop Planting Calendar

## CROP PLANTING CALENDAR

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<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
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<tbody>
<tr>
<td><strong>Land preparation</strong></td>
<td><strong>Sowing in nursery bed:</strong> 0.8 – 1.2 kg of seed/acre</td>
<td><strong>Transplant:</strong> 40 – 50 days after seed Sowing</td>
<td><strong>Weed, pests &amp; diseases control</strong></td>
<td><strong>Stem bending</strong></td>
<td><strong>Harvesting starts 90-150 days after transplanting</strong></td>
<td><strong>Bulb curing</strong></td>
<td><strong>Peak demand for Bulb Onion</strong></td>
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<td><strong>Control of damping-off diseases &amp; cutworms</strong></td>
<td><strong>Spacing:</strong> 30 cm x 10 cm (133,000 plants/acre)</td>
<td><strong>Unearthing of bulbs</strong></td>
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<td><strong>Fertilizer (DAP/TSP) Application:</strong> 80 kg/acre (15 g/meter of a row=3 bottle tops/meter)</td>
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**A Sample Planting Calendar for Bulb Onion**
2.2 Basal Application (GHCP&PHHT20: Q8)

- The manure/compost should be broadcasted (10 – 16 tons/acre) then worked into the soil (incorporated) preferably using a hoe.
- Manure/compost should be applied at least 1 – 2 weeks before transplanting.
- Onions respond very well to well decomposed organic manure.
2.3 Raising Seedlings

A Bulb Onion nursery

Photo: SHEP PLUS
2.3 Raising Seedlings (GHCP&PHHT20: Q9)

- Onion is propagated by seed (fresh)
- Seed rate is 0.8 – 1.2kg per acre
- The seed is sown in a nursery under a mulch cover

Nursery Establishment:

- Prepare beds maximum 1m wide and incorporate well-decomposed manure at a rate of 20kg per square metre. Apply DAP/TSP fertilizer at a rate of 20grams per square metre.
- Make rows about 15cm apart, drill the seed thinly in 1cm furrows and cover lightly with soil and mulch
2.4 Raising Seedlings Cont’

Nursery Management:

• Irrigate the nursery bed regularly
• Germination takes 7-10 days
• After the seed emerges, remove the mulch
• Prepare a raised cover
• Manage weeds, pests and diseases
2.5 Transplanting

Recently transplanted Bulb Onion seedlings

Photo: SHEP PLUS
2.5 Transplanting

2.5.1 Appropriate Time

• Seedlings are transplanted **6 – 8 weeks** after sowing or at 3-5 well formed leaves

2.5.2 Recommended Spacing *(GHCP&PHHT20: Q10)*

• The seedlings are transplanted in **2.5 – 3 cm** deep trenches at a spacing of **30 cm** between rows and **8 – 10 cm** between plants (when using furrow irrigation)
2.5 Transplanting Cont’

2.5.2 Transplanting method

• Soil analysis results should be used to determine the nutrient requirements of the soil prior to planting
• Irrigate the seedbed prior to pulling out the seedlings
• **Apply 80 kg/acre of TSP**
• Irrigate field well a day before transplanting
• Carefully pull out the seedlings to avoid damage
• Cut off 50 per cent of the green tops to hasten take off
• When planting onion sets, don’t bury them more than one inch under the soil
2.6 Water Requirement

Bulb Onion seedlings under irrigation

Photo: SHEP PLUS
2.6 Water Requirement
(GHCP&PHHT20: Q12)

- Onions require **light** and **frequent irrigation**:  
  - Irrigate moderately and timely  
    - **At the growing stage**: excessive moisture must be avoided  
    - **At the bulbing stage**: need a substantial amount of water  
    - Watering should be **reduced/discontinued** towards bulb maturity
- Lighter soils need **more frequent water applications**, but less water applied per application  
- Increase the water application as plant and roots increase in size
2.6 Water Requirement Cont’
(GHCP&PHHT20: Q12)

• Increase the water application as plant and roots increase in size

• Proper moisture management is important in:
  – Alleviating “Pink Root” problems (Refer to the slide No. 44 – 46)
  – General root health
  – Vigorous bulb growth

• Drought stress will cause splitting or formation of double/multiple bulbs
2.7 Top-dressing
(GHCP&PHHT20: Q14)

- Top-dressing can be done in 2 splits
  - 1\textsuperscript{st} Top-dressing: \textbf{30 days} after transplanting at \textbf{40 kg/acre} of CAN
  - 2\textsuperscript{nd} Top-dressing: \textbf{45 days} after transplanting at \textbf{80 kg/acre} of CAN
- Strip/banding method is preferred over broadcasting as it is more effective
- Too much nitrogen results in thick necks
- Top-dressing should be completed before initiation of bulbing
2.8 Unearthing

- **Unearthing** is removal of excess soil around the bulb/loosening soil to allow the bulb to expand or develop well
- **Unearthing** can also facilitate the colouring and curing
- If the soil is hard during bulb formation, loosen the soil to allow bulbs to develop well
- Unearthing is carried out during 2nd and subsequent weeding and is done by removal of the soil from the bulbs by hand
- Watch out not to damage or expose the roots
2.9 Pests & Diseases Control:  
(GHCP&PHHT20: Q15 & 16)

2.9.1 Major Pests

- The following are the major pests of Bulb Onion in Kenya

Major Pests:
- Onion Thrips
- Onion Fly
2.9.1.A: Onion Thrips

Identification:
• Adult thrips are **small** (0.5 – 2.0 mm), slender and **winged**
• Wings are long, narrow and fringed with long hairs
• Nymphs are **white or yellow**
• Both adults and nymphs feed on the base of the plant within the leaf sheaths
2.9.1.A: Onion Thrip

Damages:
- Attacked leaves have sunken silvery patches
- Under severe attack, the entire plant appears silvery and later the leaves wither, dry up and die
- The pest excreta appears as black spots on the silvery leaves

Photo: © A. M. Varela, icipe
http://infonet-biovision.org/PlantHealth/Crops/Onion(CC BY-NC-SA 3.0)
2.9.1.A: Onion Thrip Cont’

Control:

• Keep plants well irrigated since water stressed plants are more susceptible to thrips damage
• Maintain weed-free plots
• Rogue heavily infested plants
• Neem extracts can be sprayed on attacked plants
• Spray with insecticide, such as **Spinosad** (Tracer®), Abamectin + Acetamiprid (AMAZING TOP 100 WDG® PHI:21days), Acephate (ASATAF SP® PHI: 3-7days)
2.9.1.B: Onion Fly

Identification:

• The onion fly maggots measure 8 mm long and are white cream in color
• They are the most destructive stage of the fly
2.9.1.B: Onion Fly

**Damage:**

- They eat the lateral roots causing tunnels into the stem then the plants become **shriveled** or eventually **die**
- They are also found inside developing onion bulbs and their feeding exposes the plant to infection by diseases, such as Bacterial Soft Rot

Photo: © Jarmo Holopainen
http://infonet-biovision.org/PlantHealth/Crops/Onion (CC BY-NC-SA 3.0)
2.9.1.B: Onion Fly Cont’

Control:

• Practice crop rotation
• Use well decomposed manure/compost
• Practice field sanitation: remove and destroy infested plants
• Carefully plough in crop residues immediately after harvest
2.9.2 Major Diseases

• The following are the major diseases of Bulb Onion in Kenya

Major Diseases:
  a. Onion Downey Mildew
  b. Purple Blotch
  c. Rust
  d. Pink Root
  e. Neck rot
2.9.2.a: Onion Downey Mildew

General Descriptions:

• The disease is caused by a fungus
• It is prevalent in cool, humid and poor drainage conditions
2.9.2.a: Onion Downey Mildew
Cont’d

Symptoms:
• Formation of lesions near the tips of the older leaves
• Yellow patches covered with grey wet fields
• Leaf tips shrink, turn pale brown and later die

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org (CC BY 3.0 US)
2.9.2.a: Onion Downey Mildew Cont’d

Control:

• Crop rotation
• Field hygiene
• Use of tolerant varieties e.g.) Red Pinoy F1
• Use of fungicides e.g.) Mancozeb (Cadillac®, Dithane M45® etc.)
2.9.2.b: Purple Blotch

General Descriptions

- The disease is caused by a fungus *Alternaria porri*

*Purple blotch* on onion. Leaf-tip dieback is a typical symptom of infection by *Alternaria porri* on onion and shallot.
2.9.2.b: Purple Blotch Cont’d

Symptoms:
- **Small white spots** on the foliage
- Under moist condition, the spots rapidly increase to **large purplish blotches** often surrounded by a **yellow to orange border**
- Lesions extend to girdle the leaf which leads to its collapse
- Infection may spread to the **bulb**, where it may cause a **wet, orange rot** starting at the neck

Source: Howard F. Schwartz, Colorado State University, Bugwood.org (CC BY 3.0 US)
2.9.2.b: Purple Blotch Cont’d

Control:

- Use tolerant varieties e.g. Red Passion F1 and Red Pinoy F1
- Crop rotation
- Field Sanitation: remove crop remains after harvest, do not leave volunteer plants in the field
- Avoid over fertilization
- Recommended spacing and good drainage to decrease humidity in the plant stand
- Use of fungicides such as Mancozeb (Dithane M45®), Difenoconazole (Domain 25% EC®), Propineb + Cymoxanil (Milraz WP 76®), Eugenol (e.g. Explorer 0.3 SL®)
2.9.2.c: Rust

General Descriptions:

• The disease is caused by a fungus

• High humidity, high temperatures, dense plant population favor the disease development

• Excessive nitrogen in the soil favours disease development.
2.9.2.c: Rust Cont’d

Symptoms:
• Symptoms include reddish to dusty orange spots (pustules) on leaves
• Heavily infected leaves turn yellow and die prematurely
2.9.2.c: Rust Cont’d

Control:

- Application of Good Agronomic Practices i.e. Crop rotation, proper nutrition and spacing
- Use of fungicides such as Mancozeb (e.g. Dithane M45), Difenconazole (e.g. Domain 25% EC®), Eugenol (e.g. Explorer 0.3 SL®)
2.9.2.d: Pink Root

General Descriptions:

• Similar to nutrient deficiencies or stress associated with extremely dry conditions
2.9.2.d: Pink Root Cont’d

**Symptoms:**
- Light pink to yellowish-brown discoloration on roots that becomes **dark pink** then **red** and eventually **purple**
- In advanced stages roots eventually **shrivel**, become **brittle** and die

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org (CC BY 3.0 US)
2.9.2.d: Pink Root Cont’d

Control:

• Good management practices that reduce plant stress
• Crop rotation
• Use tolerant cultivars e.g.) Red Passion F1
2.9.2.e: Neck Rot

General Descriptions:

• Disease visible when onions are in store
• Caused by a fungus called *Botryitis aclada / allii* which enters the onions through wounds or cracks in the fleshy neck part of the bulb.
2.9.2.e: Neck Rot

Symptoms:

- Top part of the bulb will turn browner and the skin will be darker brown.
- Top of the bulb will be softer than the lower parts.
- Grey mold and sometimes speckled with small black spots will appear, and the bulbs will deteriorate even further.

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org (CC BY 3.0 US)
2.9.2.e: Neck Rot Cont’

Control/Prevention:

• Use fungicide treated seeds or sets
• Avoid damaging onion bulbs at or during harvest
• Don't bend over foliage to hasten drying out
• Only harvest onions when the necks have ripened and fallen over on their own accord.
• Avoid using high nitrogen fertilizers
2.9.2.e: Neck Rot Cont’

Prevention cont’d:

• Crop rotation at least 3 years
• Dry the bulbs out thoroughly after harvest
• Good ventilation is important in the drying process than sun.
• Store only bulbs with dried out thin necks
• Store bulbs in a cool and dry place
• Sort out bulbs which show signs of rot.
3. Harvesting

Harvested Bulb Onions

Photo: SHEP PLUS
3. Harvesting

• Harvesting can be done **90-150 days** after transplanting depending on the variety
• The last three weeks before harvest, the weather should be absolutely rain-free/dry
• Trim the roots and foliage during harvesting
3. Harvesting

3.1 Harvesting Indices *(GHCP&PHHT20: Q17)*

- At maturity, leaf tops begin to **discolor, bend** and **dry** towards the ground
- Bulb Onions are ready for harvesting when **the leaves collapse** or when **75 % of the tops of the crop have dried and fallen over**
- **Reduced thickness of sheath leaves surrounding the bulbs** *(papery/shiny membranous cover)*
4. Curing:

What is “Curing”?  

• Curing is a process intended to dry off the necks and outer leaves of bulbs  
• The main objective is to prolong shelf life by preventing moisture loss and attack by diseases  
• It can be done in the field or in a protected environment away from adverse weather conditions, such as rain or direct sunlight
4. Curing Cont’d

4.1 Field Curing

Photos: SHEP PLUS
4. Curing Cont’d:
4.1 Field Curing Cont’

• Curing can be done in the field if the maturity and harvesting coincides with dry months
• Harvested onions are placed in rows with leaves partially covering the bulbs to prevent sunburn or greening
• Onions are then left in the field until the outer leaves and neck are completely dry and papery
• Field curing can take 2 – 3 weeks depending on the environmental condition
4. Curing Cont’d:

4.2 Protected Curing

Drying of Onions in a protected environment

- Curing is done in a warm, dry and well ventilated location protected from direct sunlight and rain

- The process involves the following:
  - Removal of excess soil
  - Trimming of foliage leaving 2.5cm of section of stem at neck
  - Placing onions in single layer in large flat tray

- Onions can also be cured by tying tops of bulbs in bunches and hanging on a horizontal pole in well ventilated shade
5. Post Harvest Handling

5.1 Value Addition Techniques

Bulb Onions packed in the nets
5. Post Harvest Handling
5.1 Value Addition Techniques (GHCP&PHHT20:Q19)

5.1.1 Sorting

- Before storage, Bulb Onions are graded to remove the following:
  - Onions with thick necks
  - Onions which have bolted
  - Injured onions
  - Decayed onions
  - Doubles and small bulbs
5.1 Value Addition Techniques Cont’

5.1.2 Grading

• Grading should be done before & after storage
• For domestic market onions are put into 3 Grades: large, medium and small
• Bulbs must be:
  – Intact with firm flesh which is not exposed
  – Clean and free from visible foreign matter
  – Sufficiently dry with the first two outer skin and stem fully dry
  – Free from abnormal external moisture
  – Free from foul smell
5.1 Value Addition Techniques Cont’d

5.1.3 Packaging Materials (GHCP&PHHT20: Q18)

• Store/package Bulb Onions in nets
5.2 Storage

- Well ventilated structure with shelves
- Free from dampness
- Darkness to reduce sprouting
Reference

- The proposed agrochemicals are in accordance with “Products Registered for Use on Crops Version 1_2018”. The registered agrochemicals are subject to change. Please refer to the latest registered agrochemicals by Pest Control Product Board.
- Infonet Biovision
THANK YOU

ASANTE SANA

DOMO ARIGATO

GOZAIMASU

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