Japan International Cooperation Agency

Agriculture and Food Authority
Horticultural Crops Directorate

Ministry of Agriculture, Livestock and Fisheries
State Department for Crop Development & Agricultural Research

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 (Kitunguu 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’

Photo: Sakata http://sakata.co.za/project/red-creole-short-day-red-onion/

- 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**

1.2 Common Varieties in Kenya

‘Bombay Red’

Photo: Photo: Safal Seeds & Biotech LTD
http://www.safalseedsbiotech.com/onion-seeds.htm

- 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**

1.2 Common Varieties Cont'

1-3

(https://www.easeed.com/2015-07-16-12-56-29/vegetables/vegetables-6-137)

'Red Star F1'

"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 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'

1-4

Source: http://www.easeed.com/index.php/2015-07-16-12-56-29/vegetables/onion-red-tropicana-f1

"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**

1-5

Soure: Amiran seed catalogue

"Neptune F1"

- **High yielding**
- Firm **shinning 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”

Photo: https://www.royalseed.biz/onions.php

- **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

1.3 Optimal Ecological Requirements

Altitude	**0 – 1,900 metres above sea level**
Rainfall	**500 – 700 mm of rainfall annually**
Growing Temperature	**15 – 30 ^{0}C**
Soils	**• Fertile and well drained soil** **• pH range 6.0 – 6.8**

2. G20 technologies

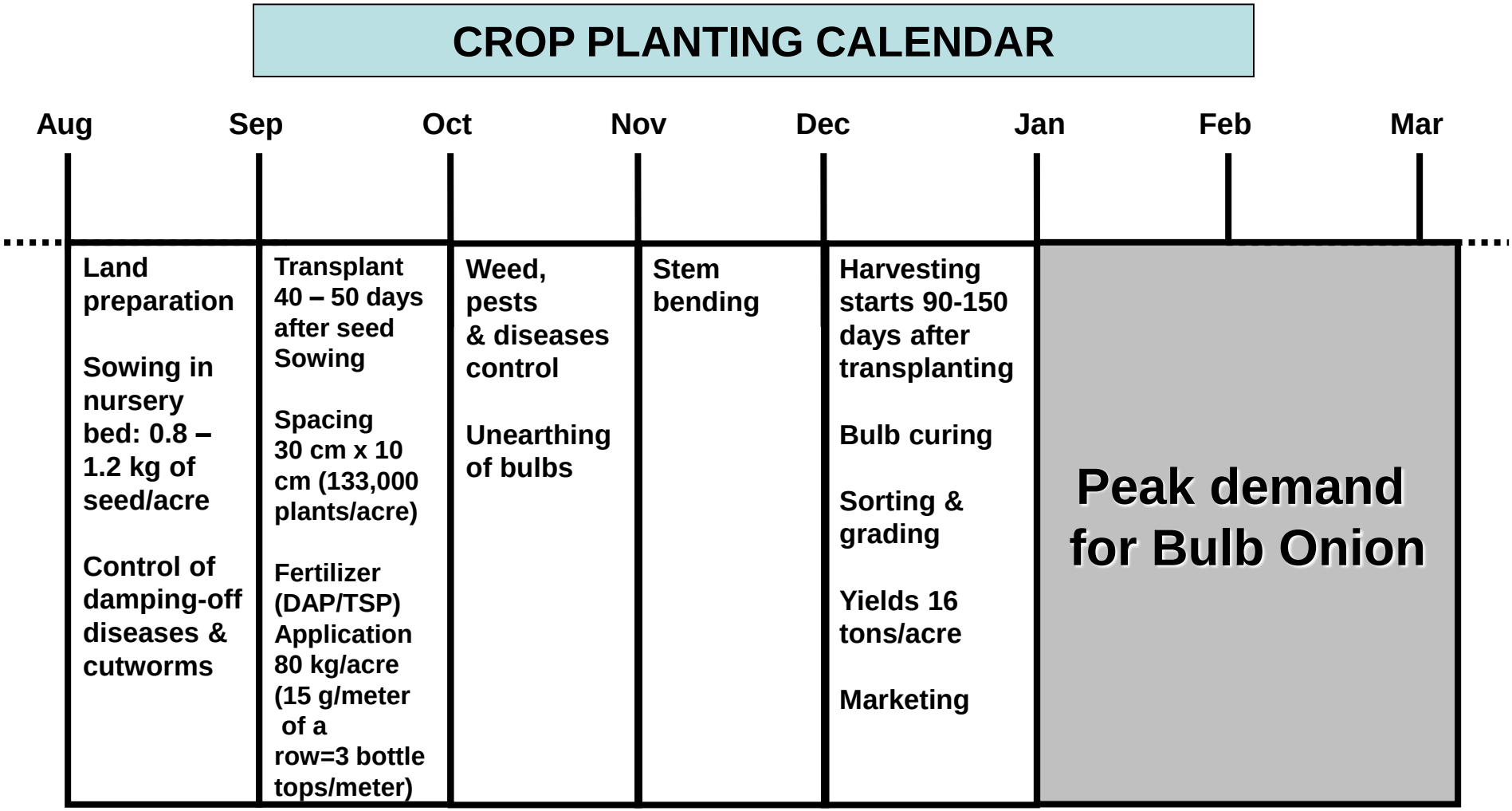
- Make sure to support farmers carry out G20 techniques for any crop

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

10. Recommended spacing
11. Recommended fertilizer application rate
12. Supplementing water
13. Timely weeding
14. Top-dressing
15. IPM practices
16. Safe and effective use of pesticides
17. Use of harvesting indices
18. Appropriate post harvest handling containers
19. Value addition techniques
20. Keeping farm records

2.1 Crop Planting Calendar



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

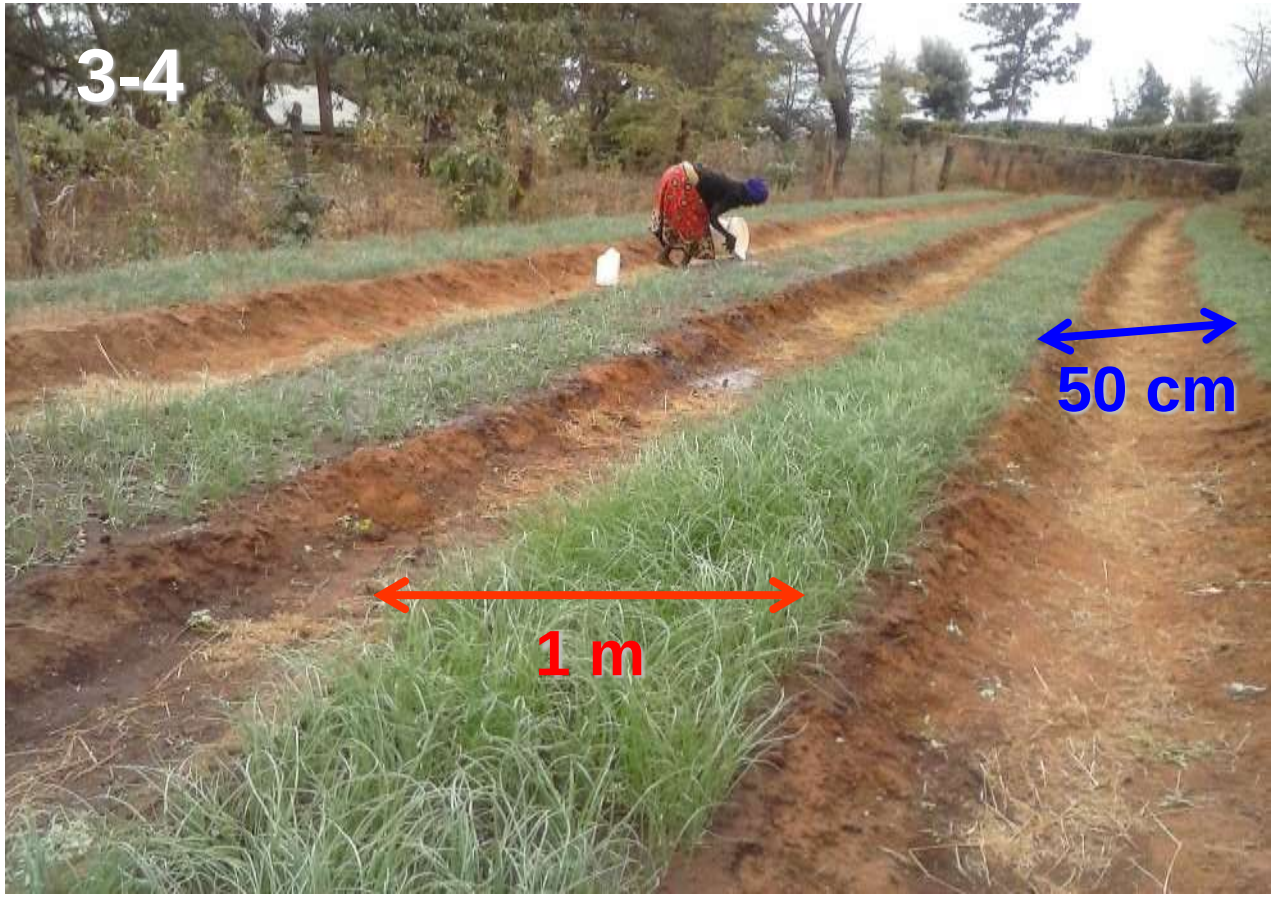


Photo: SHEP PLUS

A Bulb Onion nursery

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

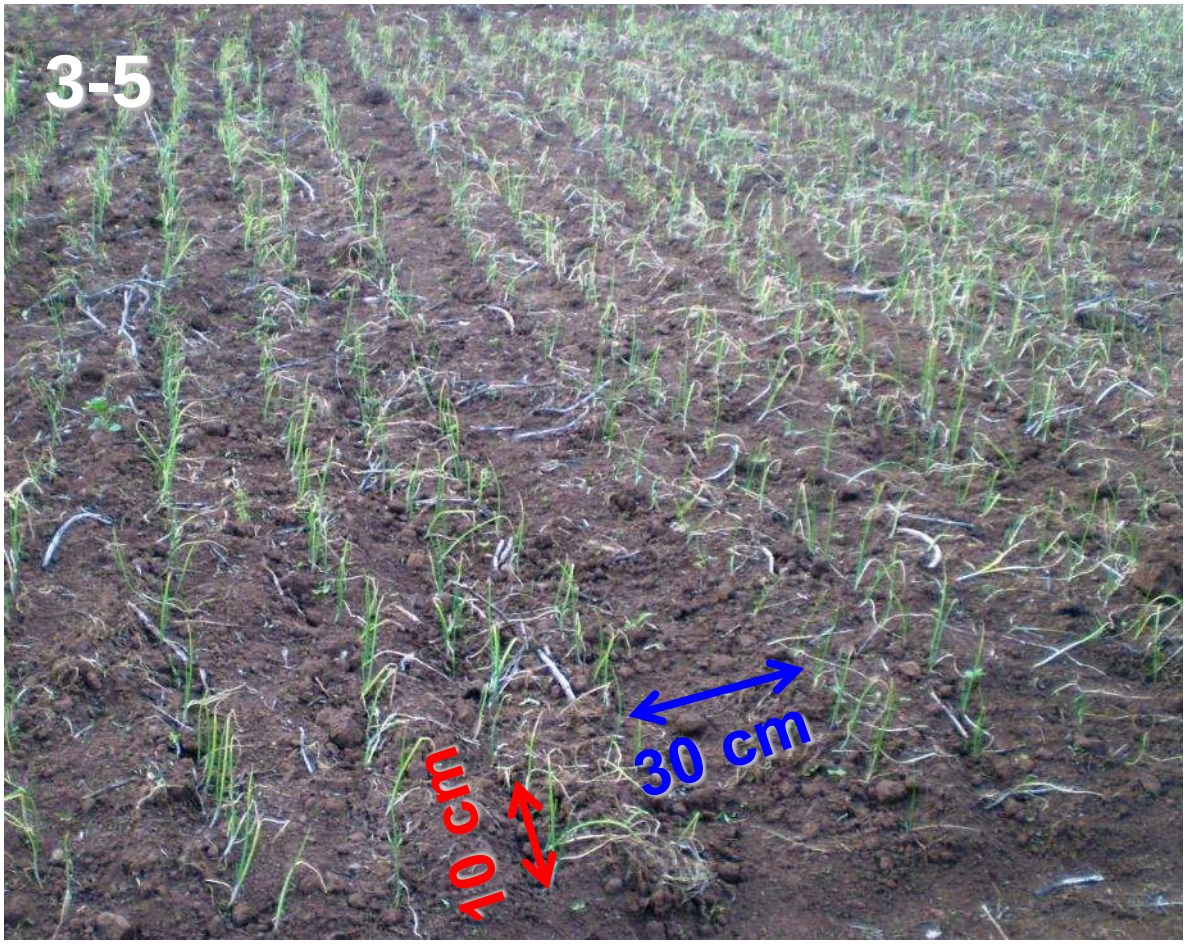


Photo: SHEP PLUS

Recently transplanted Bulb Onion seedlings

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

Photo: SHEP PLUS

Bulb Onion seedlings under irrigation

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
  - 1st Top-dressing: **30 days** after transplanting at **40 kg/acre of CAN**
  - 2nd Top-dressing: **45 days** after transplanting at **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:

A.Onion Thrips

B.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

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

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

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

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

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org (CC BY 3.0 US)

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**

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** (**Cadilac®**, **Dithane M45®** etc.)

2.9.2.b: Purple Blotch

General Descriptions

Purple blotch on onion. Leaf-tip dieback is a typical symptom of infection by *Alternaria porri* on onion and shallot.

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

2.9.2.b: Purple Blotch Cont'd

Source: Howard F. Schwartz, Colorado State University, Bugwood.org (CC BY 3.0 US)

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

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

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

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**), **Difenoconazole** (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

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org (CC BY 3.0 US)

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**

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

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org (CC BY 3.0 US)

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.

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

Photo: SHEP PLUS

Harvested Bulb Onions

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

Photo: SHEP PLUS

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

5.1Value 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

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