

# CABBAGE PRODUCTION



# SHERP

**Training Title:** Cabbage Production

**Objective:** To provide a guideline on production of Cabbage

**Specific Objective:**

- To provide basic information on production, post-harvest handling, and marketing of Cabbage

**Contents:**

1. Introduction: Background, Some Common Varieties and Optimal Ecological Requirements
2. Pre-Cultivation Preparation 1 – 5
3. Cultural Practices 1- 9
4. Harvest
5. Post-Harvest Handling
6. Cost & Income Analysis
7. Post-Training Evaluation Exercise

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#### **Disclaimer**

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The proposed agrochemicals are in accordance with "Pest Control Product Registered for Use in Edition, 2015". The registered agrochemicals are subject to change. Please refer to the latest registered agrochemicals by Plant variety release, protection and seed quality control directorate .

#### **Preface**

- This training material applies the fundamental practices essential for crop production and successful marketing to put into perspective the case of horticultural crop production.
- The fundamental practices are categorized into seven (7) broad topics and twenty (20) sub-topics; the twenty sub-topics are referred to as the General Horticulture Crop Production and Post-Harvest Handling Techniques (GHCP&PHHT20). This categorization is based on the Smallholder Horticulture Empowerment & Promotion (SHEP ) experience in mitigating production and marketing challenges facing smallholder horticultural farmers.
- The seven (7) broad topics are: Pre-Cultivation Preparation; Land Preparation; Crop Establishment (Planting/Transplanting); Crop Management; Harvest; Post-Harvest Handling; and Cost and Income Analysis.
- The sub-topics under each topic are as follows: **Pre-Cultivation Preparation** (market survey, crop planting calendar(s), soil sampling & analysis, composting, and quality seed/planting material(s)); **Land Preparation** (land preparation practices, incorporation of crop residues, and basal application); **Crop Establishment** (raising seedlings, planting/transplanting, fertilizer application); **Crop Management** (water requirement, managing of weeds, top-dressing, pests & diseases management practices, and safe & effective use of pesticides); **Harvest** (harvesting indices); **Post-Harvest Handling** (appropriate containers/standard packaging materials, and value addition techniques); and **Cost and Income Analysis** (cost and income analysis).
- The issues outlined in the twenty (20) sub-topics might not necessarily be applicable in all the cases. But where applicable, it is recommended that the instructions issued be given due consideration.

# 1. Introduction:

## 1.1 Background



**Head Cabbage**

# 1. Introduction:

## 1.1 Background



**Head Cabbage**

### 1. Introduction:

#### 1.1 Background

- Cabbage is a member of the ***Brassicaceae* (Cruciferae)** family which includes crops such as **Kale, Cauliflower, Broccoli** and **Radish**
- Three main types: **Green, Red** and **Savoy**
- One of the most **widely grown, popular** and **nutritious vegetables** in Ethiopia mainly for the domestic market
- Grown by both small and medium scale farmers
- Contains **Calcium, Iron, Vitamin A, C & E, Minerals, Riboflavin, Nicotinamine** and **Ascorbic Acid**
- Cabbage has cleansing effect of stomach and intestinal tract if consumed raw without salt due to high sulphur and chlorine content

# 1.2 Some Common Varieties



**“Copenhagen Market”**



**“Gloria F1”**

# 1.2 Some Common Varieties



“Copenhagen Market”



“Gloria F1”

## 1.2 Some Common Varieties

- The following are the common varieties grown in Ethiopia

### “Copenhagen Market”:

- Requires a cool/warm climate
- **Plant Spacing: 60 cm x 40 cm**
- **Maturity: 90 - 110 days** after transplanting (**early maturing**)
- **Head:** small to medium round shape with uniform size, weighing **2 - 2.5 kg**
- **Yield Potential: 300 - 400 Qt/ha**

### “Gloria F1”

- Has solid blue green color and thick waxy layer. Tolerant to Black Rot disease. It is not prone to splitting and keeps well after harvesting.
- Tolerant to **Black Rot** and resistant to **Fusarium yellows**
- **Plant Spacing: 60 cm x 40 cm**
- **Maturity:** A mid early maturing variety ready for harvesting 90 days after transplanting.
- **Average head weight 2.1 kg**
- Has solid blue green color and **thick** waxy layer
- Not prone to splitting and keeps well after harvesting
- **Yield Potential: 750 Qt/ha**

# 1.2 Some Common Varieties Cont'



**“Landini F1”**

# 1.2 Some Common Varieties Cont'



**“Landini F1”**

## 1.2 Some Common Varieties Cont'

### “Landini F1”

- Requires a cool/warm climate
- Disease resistance and reliable growth even in hot weather
- Large heads with excellent flavour
- **Plant Spacing: 60 cm x 40 cm**
- **Maturity: 60 – 70 days** after transplanting (early maturing)
- **Head:** small to medium round shape with compact head , weighing **4 kg**
- **Relatively with long shelf life**
- **Yield Potential: 700 Qt/ha**

### Other grown varieties including:

- Bandung
- K-500
- Oxylus F1
- Victoria F1
- Rotanda F1
- Tomas F1
- Green boy F1



# 1.3 Optimal Ecological Requirements

<b>Altitude</b>	<b>Above 2,000 meter above sea level</b>
<b>Rainfall</b>	<b>380 - 500 mm</b>
<b>Growing Temperature</b>	<b>10 – 25 °C</b>
<b>Soils</b>	<ul style="list-style-type: none"><li>• <b>Well drained sandy or silty loam soils</b></li><li>• <b>High organic matter content</b></li><li>• <b>pH range 6.5 – 6.8</b></li></ul>

# 1.3 Optimal Ecological Requirements

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## 1.3 Optimal Ecological Requirements

- **Altitude:** Cabbage can be grown in altitudes **above 2,000 m** above sea level. At low altitude the crop should be grown during the cool months of the year.
- **Rainfall:** Cabbage has a **high water requirement** and at least **380- 550 mm** of rainfall well distributed throughout the growing period is required.
- **Temperature:** Cabbage perform better under **cool temperatures** and the **optimum temperature** range for production is **10 - 25 °C**. Temperatures above **25 °C** hamper head formation. It is fairly resistant to frost and can survive temperatures as low as **-3°C** without damage. Too low temp. during the growing period can lead to long stems and bolting (flower stalk formation and seeding)
- **Soil:** Cabbage requires **well drained sandy or silty loams** with high organic matter content and high water-holding capacity. The optimal soil pH range is **6.5 – 6.**

# 2. Pre-Cultivation Preparation:

## 2.1 Market Survey



## Carrying out a market survey on Cabbage

# 2. Pre-Cultivation Preparation:

## 2.1 Market Survey



**Carrying out a market survey on Cabbage**

### 2. Pre-Cultivation Preparation: 2.1 Market Survey (GHCP&PHHT20: Q1)

#### How to conduct a market survey

- Identify major dealers of the target crops
- Introduce yourself what the purpose of a market survey
- Find the potential market nearby your area (local market, big market in town, hospital, University, boarding school)
- It is important to consider seasonal or religious event, such as Christmas or fasting
- People consume more vegetables during fasting season
- Continuous surveys are important in order to find new market opportunities and also establish business relationships with the market players.

**Note:** It is recommended to conduct a market survey when you go to local market during your local market day

# 2. Pre-Cultivation Preparation:

## 2.2 Market Survey Questionnaire

### Market Survey Questionnaire

Date : \_\_\_\_ / \_\_\_\_ / \_\_\_\_

Region: \_\_\_\_\_

Zone: \_\_\_\_\_

Woreda: \_\_\_\_\_

Name of Group: \_\_\_\_\_

Name & Contact of the Produce Dealer	Produce & Variety	Produce Quality Market Requirements	Peak Demand (months)	Quantity (kg) & Frequency (daily/weekly etc.) of Supply	Place of Production	Purchasing Unit Price (ETB/kg)	Mode of Payment	Terms of Payment	Marketing Challenges	Dealer's Willingness to Purchase the Produce from the farmers
Mr. Abdela Qasim (0917-xxxxxx)	Cabbage (Copenhagen Market)	Medium size	January to March	90 qt/week (1 qt = 100 kg)	Golja	300 ETB / qt	Cash	Cash on Delivery	Poor quality (diseased)	Willing to buy at shop
Mr. Kernal Husen (0911-xxxxxx)	Cabbage (Euro)	Big size	December to June	5qt / day (1qt = 100kg)	Debre eyesus	450 ETB / qt	Credit	Within a week	Poor quality (rotten, mixing good and bad)	Willing to buy if quality product supplied

# 2. Pre-Cultivation Preparation:

## 2.2 Market Survey

### Market Survey Questionnaire

Date : \_\_\_\_ / \_\_\_\_ / \_\_\_\_

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### Market Survey Questionnaire

### 2. Pre-Cultivation Preparation: 2.2 Market Survey Questionnaire

Prepare sample questions to enable you gather the following information

- **When (month) is the peak demand for Cabbage**
- The price of cabbage during the peak demand
- The cabbage variety(s) that has the highest demand
- Supply requirements (quantities and frequency)
- Quality market requirements
- Potential buyers and terms of payment etc.

# 2.2 Crop Planting Calendar

## A Sample of a Cabbage Planting Calendar

Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
<p>Land preparation</p> <p>Sowing in nursery bed: <b>400 g of seed/ha</b></p> <p>Control of damping-off diseases &amp; cutworms</p>	<p>Transplant 30 days after seed germination (At <b>3-4 true leaves</b> stages)</p> <p>Spacing 60 cm x 40 cm</p> <p><b>Fertilizer (NPS) 242 kg/ha (6 g/hole = 1 bottle tops/hole)</b></p> <p>Manure application <b>12 tons/ha (2 – 3 handfuls /hole)</b></p>	<p>Weed, pests &amp; diseases control</p> <p><b>1<sup>st</sup> top-dress 50 kg Urea</b> per ha <b>21 days</b> after transplanting</p>	<p><b>2<sup>nd</sup> top-dress 50 kg Urea</b> per ha</p> <p>Before start forming head, apply wood ash</p> <p>Weed, pests &amp; diseases control</p>	<p>Harvesting starts <b>75 – 120 days</b> after transplanting</p> <p>Sorting &amp; grading Based on size</p> <p><b>Yields: 300-750 qt/ha</b></p> <p><b>Marketing:</b> Start searching potential buyers Before harvesting</p>	<p><b>Peak demand for Cabbage</b></p>		

# 2.2 Crop Planting Calendar

## A Sample of a Cabbage Planting Calendar

Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Land preparation	Transplant 30 days after seed germination (At 3-4 true leaves stages)	Weed, pests & diseases control	2 <sup>nd</sup> top-dress 50 kg Urea per ha	Harvesting starts 75 – 120 days after transplanting	<b>Peak demand for Cabbage</b>		
Sowing in nursery bed: 400 g of seed/ha	Spacing 60 cm x 40 cm	1 <sup>st</sup> top-dress 50 kg Urea per ha 21 days after transplanting	Before start forming head, apply wood ash	Sorting & grading Based on size			
Control of damping-off diseases & cutworms	Fertilizer (NPS) 242 kg/ha (6 g/hole = 1 bottle tops/hole) Manure application 12 tons/ha (2 – 3 handfuls /hole)	Weed, pests & diseases control	Yields: 300-750 qt/ha	Marketing: Start searching potential buyers Before harvesting			

### A Sample of a Cabbage Planting Calendar: Targeting a peak market demand beginning just after November

#### 2.2 Crop Planting Calendar (GHCP&PHHT20: Q2)

- A tool used by farmers to plan for production to ensure that marketing coincides with the period of the year when the market price of a produce is highest

#### Procedure:

- Determine from the market survey results (2.1) when there is peak demand for Cabbage
- Work backwards from the month when there is peak demand to prepare a monthly farm activities preceding the peak period
- Use the monthly activities preceding the peak as a procurement plan for farm inputs and a guide for farm operations

#### Notes:

- To meet the peak demand period of the market, there may be need of supplemental irrigation

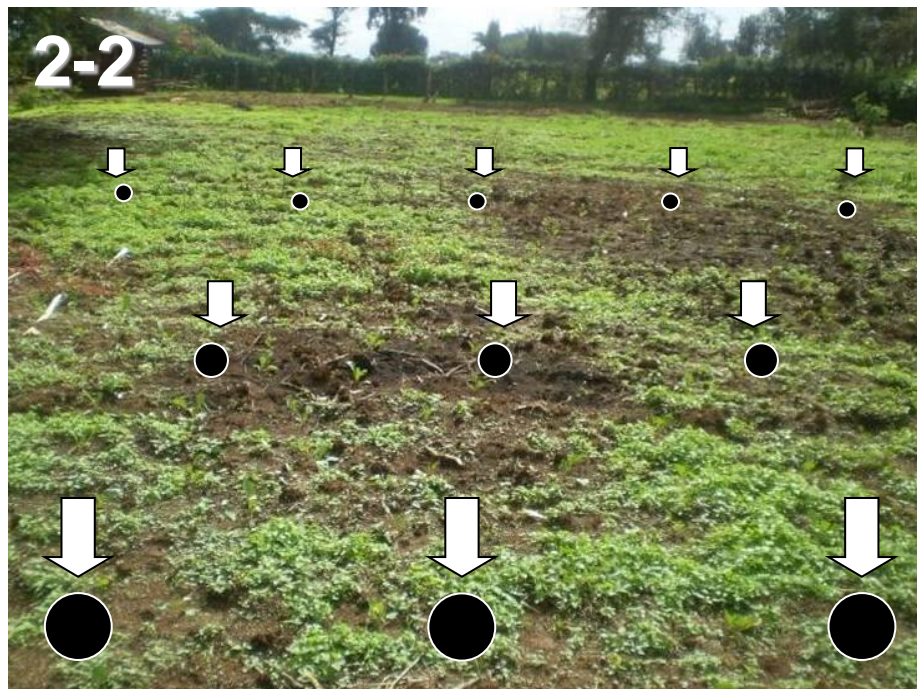


# 2.3 Soil Sampling & Analysis



**Depending on the farm, sample the soil using the most appropriate method**

## 2.3 Soil Sampling & Analysis



### 2.3 Soil Sampling & Analysis (GHCP&PHHT20: Q3)

- It is recommended to have the soils analyzed for nutrient availability and other factors vital to crop production **after every 2 – 3 years**
- The results of the soil analysis can be used to determine fertilizer and manure requirement

**Depending on the farm, sample the soil using the most appropriate method**

# 2.4 Composting



## Heap method of compost preparation

# 2.4 Composting

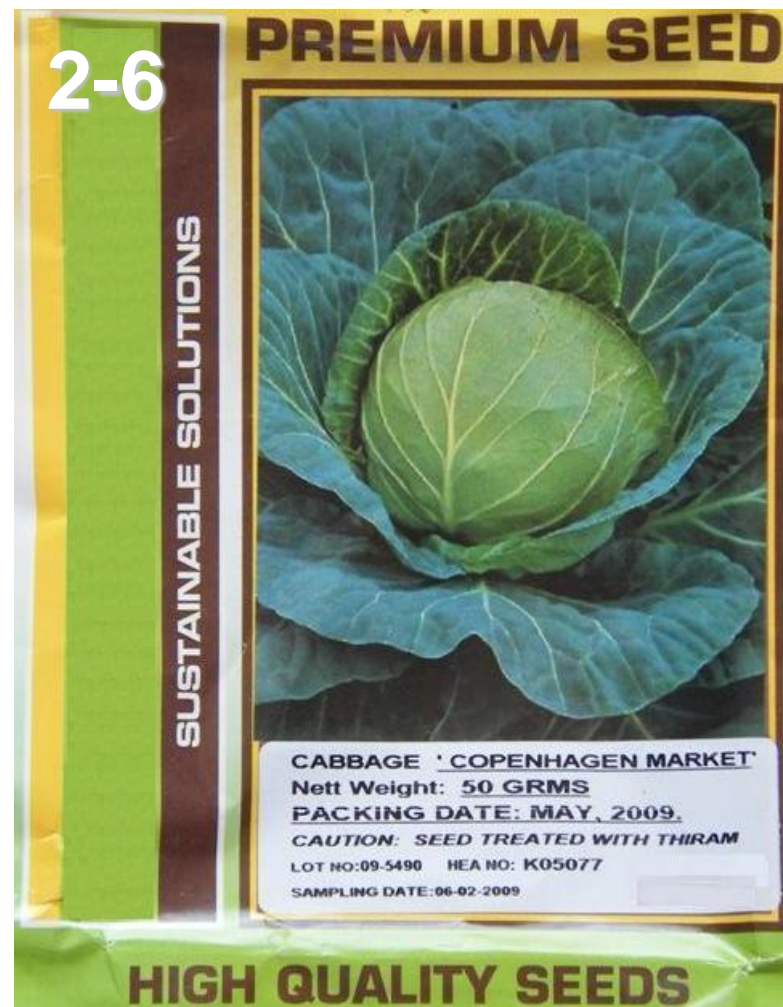


**Heap method of  
compost preparation**

## 2.4 Composting (GHCP&PHHT20: Q4)

- During compost making, the organic matter need to be covered to prevent leaching of nutrients
- Cabbage, like most leafy vegetables, is a heavy feeder and does well in soils with high organic content
- Based on the results of the soil analysis, prepare adequate compost for application
- The recommended rate of application ranges from **80-120 qt/ha**

# 2.5 Quality Seed/Planting Materials



## Samples of certified seeds on sale

# 2.5 Quality Seed/Planting Materials



## 2.5 Quality Seed/Planting Material (GHCP&PHHT20: Q5)

- Ensure you purchase certified seed from **authorized dealers** (or seedlings from **registered and certified commercial nurseries**)
- Purchase **just enough seed** for the season
- **Insist on receipt** from the dealer and **keep it with seed package** until end of season
- Seed should be checked for their **purity percentage, germination percentage and expiry date**

**Samples of certified seeds on sale**

# 3. Cultural Practices:

## 3.1 Land Preparation

3-1



**Raised beds prepared for transplanting  
of Cabbage**

# 3. Cultural Practices:

## 3.1 Land Preparation

3-1



**Raised beds prepared for transplanting of Cabbage**

### 3. Cultural Practices:

#### 3.1 Land Preparation

##### Land Preparation Practices:

**(GHCP&PHHT20: Q6)**

- Soils should be ploughed sufficiently to eliminate debris and clods
- Plough to a fine tilth
- Avoid field operations when it is wet to avoid soil compaction and hard pans which affect proper root development of the Cabbage
- It is recommended to have the land ploughed at least **1 month** before transplanting



# 3.2 Incorporation of Crop Residues



**Crop residues to be incorporated in a field**

## 3.2 Incorporation of Crop Residues



**Crop residues to be incorporated in a field**

### 3.2 Incorporation of Crop Residues (GHCP&PHHT20: Q7)

- Incorporating crop residues in the farm land can significantly increase the soil organic matter content
- The crop residues should be incorporated at a depth of about **30 cm**, **1 – 2 months** before transplanting the Cabbage
- **If the crop residues belong to the Brassicaceae family (such as broccoli, cabbage, cauliflower, radish, kale (sukuma) etc.), , remove and burn the residue to avoid possible risk of disease build up**

# 3.3 Basal Application



## Manure incorporation as a basal application

# 3.3 Basal Application

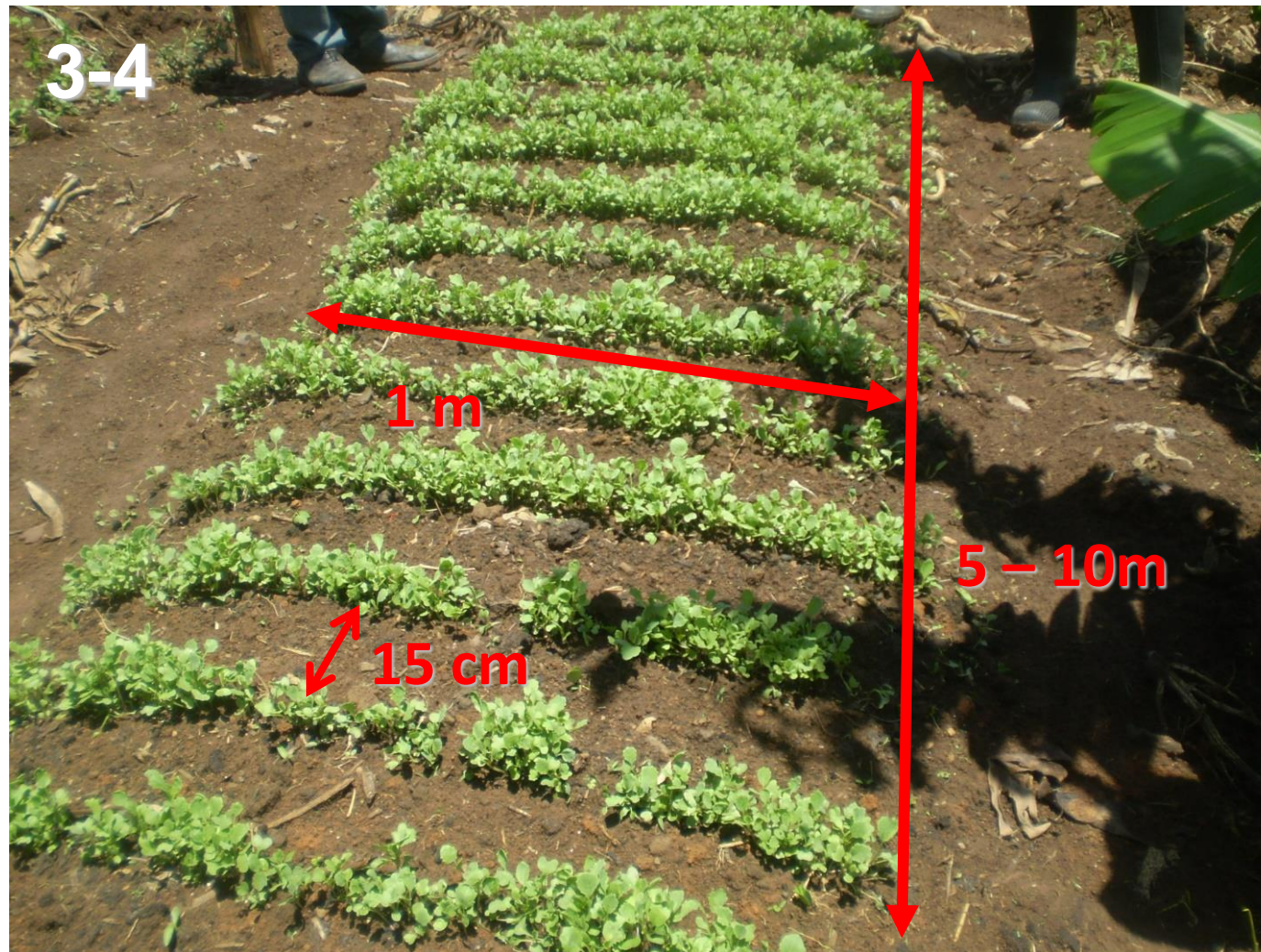


## 3.3 Basal Application (GHCP&PHHT20: Q8)

- The manure/compost should be broadcasted (**80-120 qt/ha**) then incorporated in to the soil preferably using a hoe
- Manure/compost should be applied **1 – 2 weeks** before transplanting the cabbage

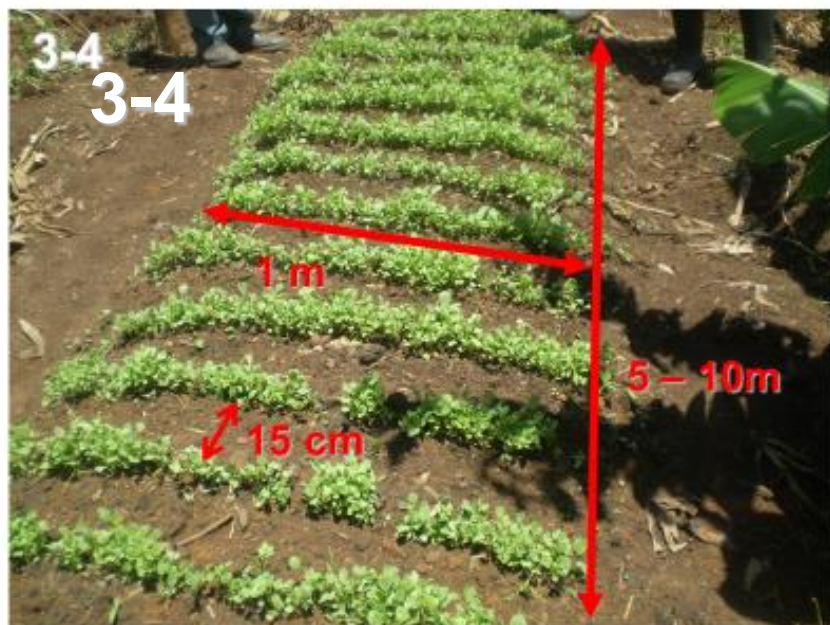
**Manure incorporation as a basal application**

# 3.4 Raising Seedlings



**A Cabbage nursery**

## 3.4 Raising Seedlings



**A Cabbage nursery: seedlings  
2 weeks after germination at an  
interrow spacing of 15 cm**

### 3.4 Raising Seedlings (GHCP&PHHT20: Q9)

- Use certified seed with special attributes, such as tolerance/resistance to pest and diseases and high yielding
- The seed rate is about **400 g/ha**

#### Nursery Site Selection:

- Avoid setting up the nursery in fields previously having a cabbage crop

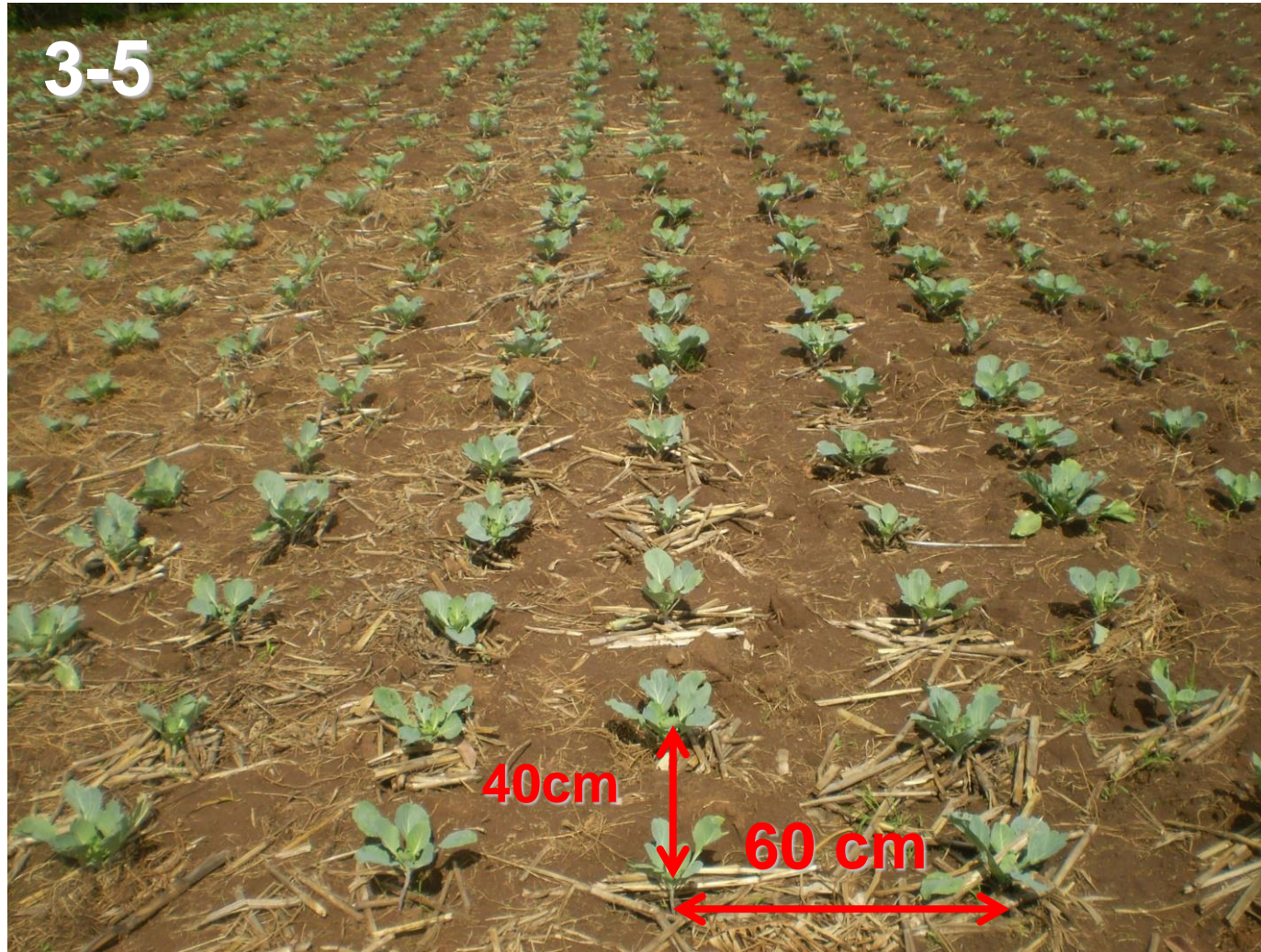
#### Nursery Establishment:

- Prepare a seedbed of **1 m width** and of a convenient length
- Make drills on the seedbed at a spacing of **15 cm apart**
- Sow seeds **5cm apart in the row**. Cover the seeds with light soil and gently compress the soil with your hand
- Put dry grass on top of the bed to stop the soil drying out

#### Management of Nursery:

- Water the seedlings regularly
- However, avoid **over-watering** which can lead to “**Damping-off**” disease
- Start hardening the seedlings **1 – 2 weeks** before transplanting by reducing the amount and frequency of watering and the shade over the nursery

# 3.5 Transplanting



**Cabbage crop 2 weeks after transplanting**

# 3.5 Transplanting



**Cabbage crop 2 weeks after transplanting**

## 3.5 Transplanting

### 3.5.1 Appropriate Time

- Seedlings are transplanted **30 days** after seed germination or **3-4 true leaves** (10-15cm long)
- It is recommended that transplanting should be done either early in the morning or late in the evening

### 3.5.2 Recommended Spacing (**GHCP&PHHT20: Q10**)

- The recommended spacing is **60 cm between rows** and **40 cm between plants** depending on the variety
- Plant population: **41,667 plants/ha**
- Transplant them a little deeper than they stood in the nursery

### 3.5.3 Fertilizer Application Rates (**GHCP&PHHT2: Q11**)

- The manure/compost should be broadcasted (**80-120 qt/ha**) then incorporated in to the soil preferably using a hoe. Apply 242kg of NPS (24g/m<sup>2</sup>, 5.8g/plant)

#### [Note]

- All DAP/NPS should be applied during transplanting
- The **DAP/ NPS** fertilizer should be mixed thoroughly with the soil to avoid possible scorching of the seedlings
- Only thoroughly decomposed manure should be used to avoid possible introduction of cutworms in the field



# 3.6 Water Requirement



**Cabbage Crop being Irrigated using  
Furrow Irrigation**

# 3.6 Water Requirement



**Cabbage crop being irrigated using a furrow irrigation**

## 3.6 Water Requirement (GHCP&PHHT20: Q12)

- The optimal amount of rainfall required for cabbage during the growing period is **380-550 mm**
- About 3.5cm per week is required
- Regular watering ensures uniform head formation, prevents **head splitting** and increases the size of the head
- Watering should be reduced as crop matures
- Excessive watering increases water-logging hence deficiencies of **Magnesium** and **Phosphorus**

### Irrigation Methods:

- Irrigation can be **overhead, drip** or **furrow**
- Too much water, once the heads have formed, can cause them to crack
- Cracking can also result from watering inconsistently

# 3.7 Managing of Weeds



**Cabbage field kept weed free using  
the appropriate weeding tools**

# 3.7 Managing of weeds

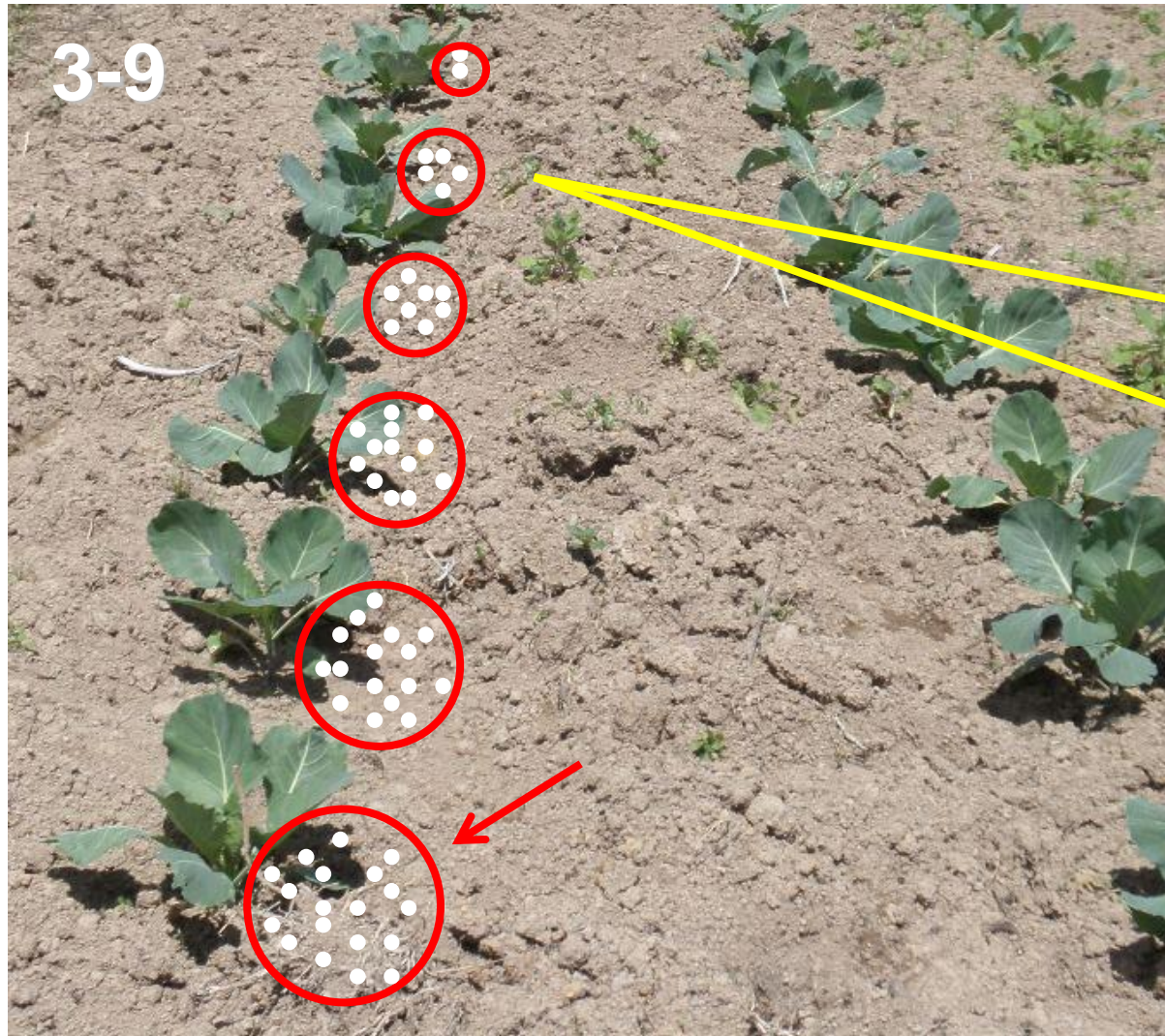


**Cabbage field kept weed free using the weeding tools**

## 3.7 Managing of Weeds (GHCP&PHHT20: Q13)

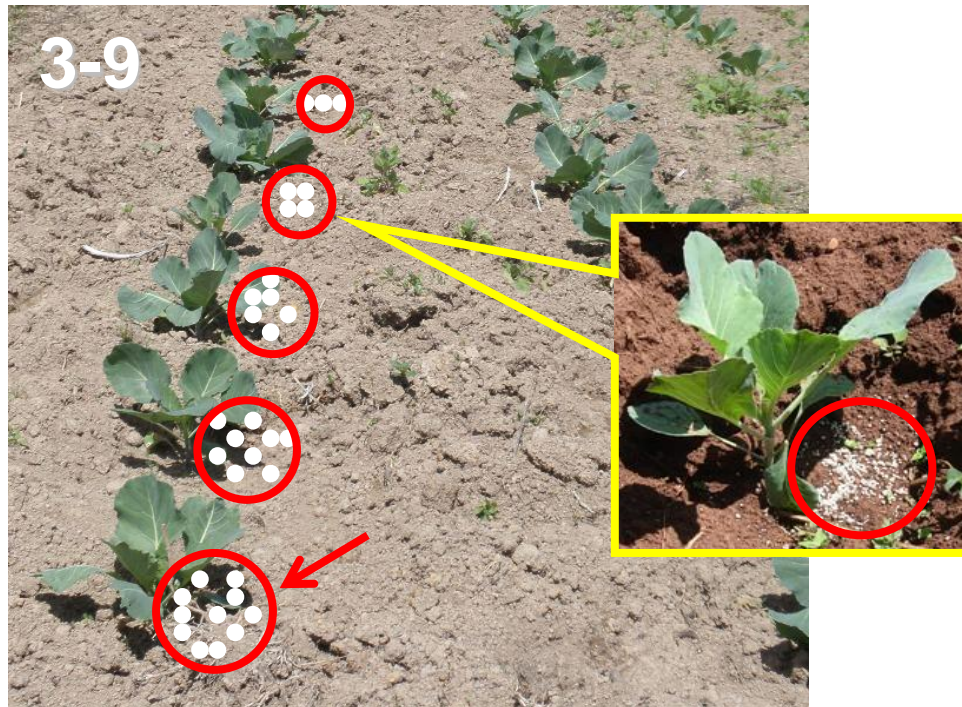
- Cabbage has a shallow root system. Care should therefore be taken to avoid bruising the roots during weeding
- This can be done through use of appropriate weeding tools, such as zabia, or locally available tools The frequency of weeding depend on weed infestation
- Keep the field weed free as much as possible to avoid competition for **nutrients, sunlight and moisture**

# 3.8 Top-dressing



## Top-dressing using the placement method

# 3.8 Top-dressing



**Cabbage top-dressed with Urea using the placement method**

## 3.8 Top-dressing (GHCP&PHHT20: Q14)

- (NPS 242kg or DAP 200 kg)/ha as a basal dress and Urea (as a top dress) 100kg/ha should be applied
- The crop should be top dressed with **urea fertilizer** in **2 splits** to avoid nutrient loss through leaching as well as excessive soil salinity
- The first split is applied at a rate of **50 kg/ha 2-3 weeks** after transplanting
- The second split is applied at a rate of **50kg/ha** at 6-7 weeks after transplanting or at the onset of head formation
- **Placement method** is preferred over broadcasting as it is **more effective** and **economical**
- Before start forming head, apply wood ash since plants require more potassium during this periods
- Applying the top dressing late, when the cabbages are already forming heads, can cause **splitting** or the development of more leaves, resulting in poor or **loose head formation**

# 3.9 Pests & Diseases Control

## 3.9.1. Control/Management Strategies

<b>1.</b>	<b>Cultural Control</b>
<b>2.</b>	<b>Mechanical Control</b>
<b>3.</b>	<b>Biological Control</b>
<b>4.</b>	<b>Chemical Control</b>
<b>5.</b>	<b>Integrated Pest Management (IPM)</b>

# 3.9 Pests & Diseases Control

## 3.9.1 Control/Management Strategies

1.	Cultural Control
2.	Mechanical Control
3.	Biological Control
4.	Chemical Control
5.	Integrated Pest Management (IPM)

### 3.9 Pests & Diseases Control

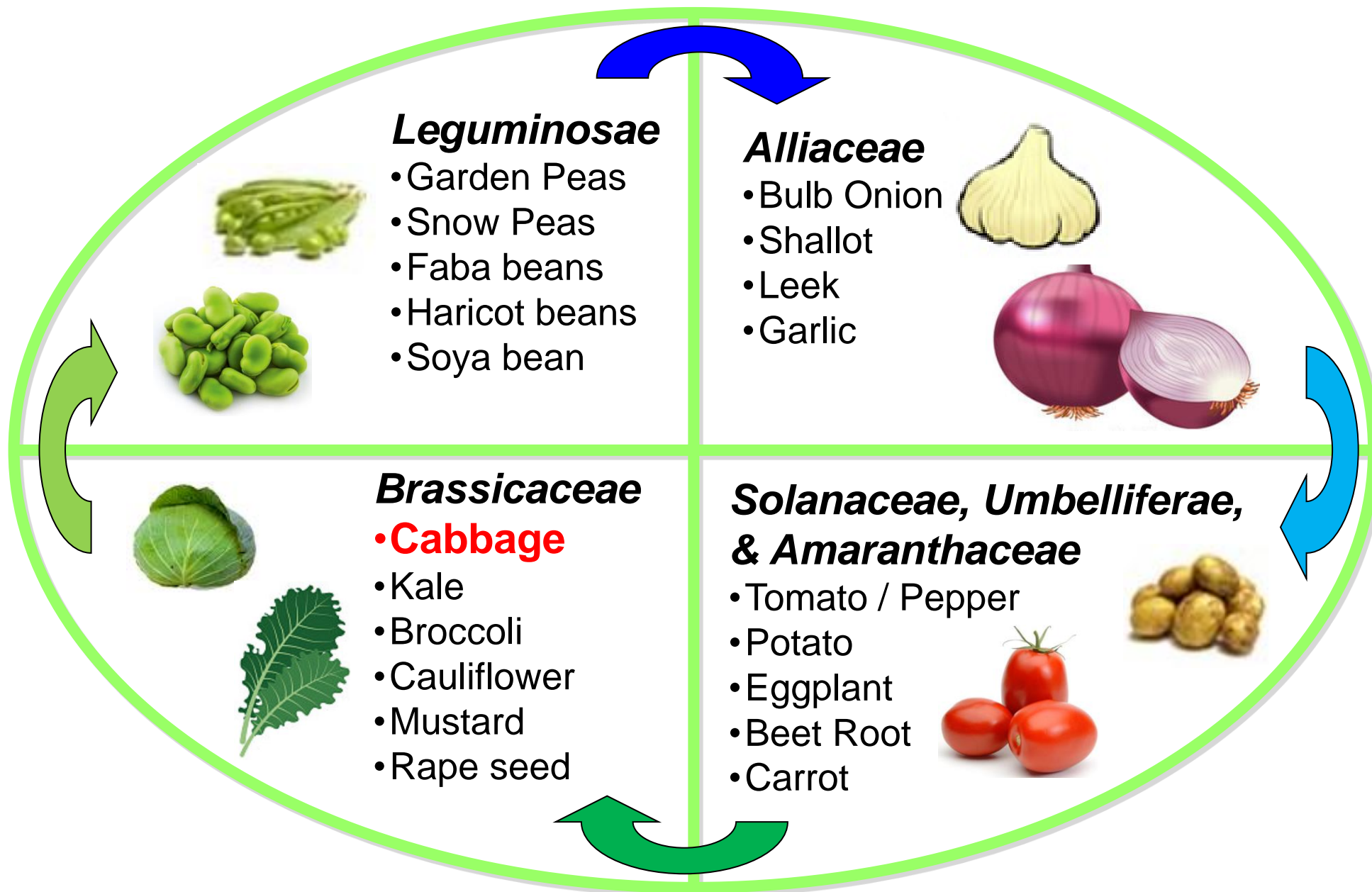
#### 3.9.1 Control/Management Strategies (GHCP&PHHT20: Q15)

Pests and diseases can be managed through either single control strategies or an integration of two (2) or more methods. The single control strategies are: cultural; physical; biological; and chemical.

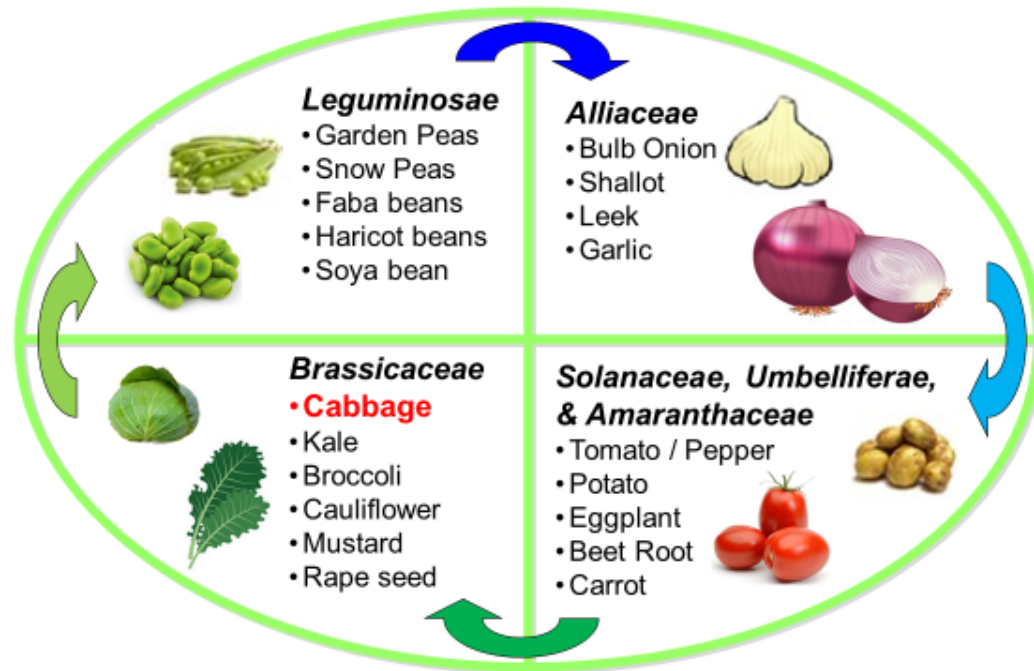
- 1. Cultural Control:** This involves managing the environment in which the crop is growing/grows with a view of maintaining pest and disease below the harmful level. The cultural methods include: field sanitation/hygiene, intercropping, crop rotation, furrowing, flooding, solarization etc.
- 2. Mechanical Control:** This involves use of insect traps, hand picking, screening house, weeding etc.
- 3. Biological Control:** This involves use of natural enemies (predators and parasitoids), resistant/tolerant varieties, trap plants, push and pull system, and repellent plants
- 4. Chemical Control (GHCP&PHHT20: Q16):** This involves use of pesticides. Pesticides are preferred because of the quick knock down effect; they have high efficacy. Pesticide usage has been linked to environmental degradation and should be used as last resort
- 5. Integrated Pest Management (IPM):** Due to limitation of a single control strategy, use of IPM is a more recommended strategy. IPM integrates cultural, mechanical, biological and as a last resort, chemical control to minimize the crop loss caused by pests and diseases.



# 3.9.2 Crop Rotation



## 3.9.2 Crop Rotation



**An example of a Crop Rotation**

### 3.9.2 Crop Rotation

- One of the most important strategies of IPM is crop rotation
- Crop rotation prevents pest and disease build-up and in addition, it replenishes soil nutritional status
- It is recommended to rotate crops with those from different families; an effective rotation program should last for 3 – 4 years
- Cabbage is a **heavy nitrogen feeder** and should **be rotated with leguminous crops** such as beans, which fix nitrogen, as well as with grain crops like maize for their high production of biomass.
- Avoid growing same family such as broccoli, Chinese cabbage and kale(yabesha gomen), as they can act as hosts for pests and diseases

# 3.9.3 Major Insect Pests



## 3.9.3 Major Pests



### 3.9.3 Major Pests

- Pests damage causes a reduction in quality and quantity of produce
- The following are the major pests of Cabbage in Ethiopia:

- A. Diamond Back Moth (DBM)**
- B. Aphids**
- C. Cutworms**

# 3.9.3.A: Diamond Back Moth (DBM)



Information Source: <http://www.infonet-biovision.org>

## Cabbage plant damaged by the DBM larvae

## 3.9.3.A: Diamond Back Moth (DBM)



**Cabbage plant damaged by the DBM larvae (inset)**

### 3.9.3.A: Diamond Back Moth (DBM)

#### Identification:

- Male adult is **small grayish moth** with **diamond pattern on his back** when wings are closed
- **Eggs** laid on upper surface of leaves (one female can lay 400 eggs)

#### Damages:

- The **pale green larvae** feed on the underside of leaves making “**windows**” through it
- Pupation takes place into a silken gauze-like cocoon at underside of leaf
- Infestations are normally serious **in drier months**
- **Failure to form heads** if infected early

#### Control:

- Chemicals like Rimon 10% (novaluron) , **Coragen 200 SC®** (a.i. **Chlorantraniprole 200g/L**)
- Neem based products
- Use of ***Bacillus thuringiensis (Bt)*** based bio-insecticides, and other insecticides

# 3.9.3.A: Diamond Back Moth (DBM) Natural control



Information Source: <http://blog.punjabilokvirsa.com>

**“Mustard” as  
Trap Crop**



Information Source: [http://pestnet.org/fact\\_sheets/](http://pestnet.org/fact_sheets/)

**Parasitoids wasp laying  
eggs in larva of DBM**

## 3.9.3.A: Diamond Back Moth (DBM) Cont'



**“Mustard” as  
Trap Crop**



**Parasitoids wasp laying eggs in  
larva of DBM**

### 3.9.3.A: Diamond Back Moth (DBM) Cont'

#### Control Cont':

- **Intercropping with other crops** which act as **repellants** (e.g. **Tomato**) or **trap crops** (e.g. **Mustard**) reduces DBM destruction on Cabbage
- When Tomato is used as a repellent, Cabbage is planted **30 days after Tomato**
- Use of neem products, such as **neem oil** etc.
- **Use of parasitoids** which act as parasite for the DBM, such as ***Diadegma semiclausum***. ***Diadegma semiclausum*** is a parasitic wasp which is mass-reared in production areas



## 3.9.3.B: Aphids



**Underside of a Cabbage leaf infested with Aphids**

## 3.9.3.B: Aphids



**Underside of a Cabbage leaf  
infested with Aphids**

### 3.9.3.C: Aphids

#### Important Types:

- Mealy Cabbage Aphid
- False Cabbage Aphid
- Green Peach Aphid

#### Identification of Mealy Cabbage Aphid:

- Aphids are **pale green** and are usually covered with a **light dust of mealy powder**
- They suck plant sap from the central part of the plant and near the base of leaves

#### Damage:

- Aphid attack results in curled and distorted leaves which in turn lead to **poor head formation**

#### Control:

- **Field hygiene** through removal and destruction of crop residue and alternate host
- Washing with pressurized water
- Natural enemies (**Parasitic Wasps**)
- **Use of Biopesticide products**, such as
  - **NIMBECIDINE®**
  - **Neemark EC®** (a.i. Azadirachtin)
- **Use of insecticides**, such as
  - **Emerald Gold®** (a.i. Imidacloprid)
  - **Karate Zeon®** (a.i. lambda-cyhalothrin)
  - Sulfoxaflor
  - Appolo
  - Phonix 5% EC

# 3.9.3.C: Cutworms



Information Source: <http://www.infonet-biovision.org>

## A Cutworm larva

## 3.9.3.C: Cutworms



**A Cutworm larva**

### 3.9.3.C: Cutworms

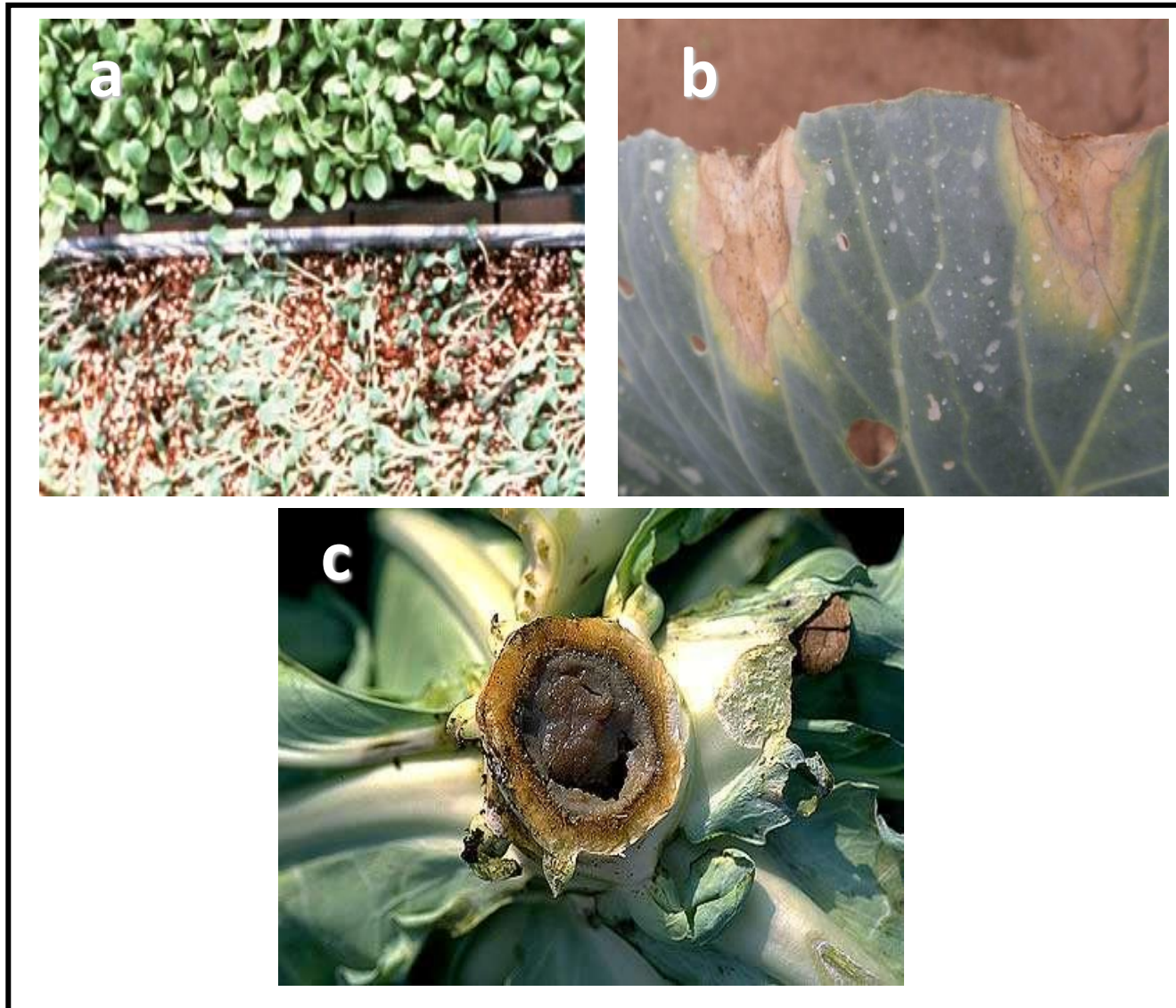
#### Identification:

- The **grayish black larvae** that partially or completely bites out the stem at ground level **causing the plant to fall over**
- They are often found hiding in soil near the cut seedlings

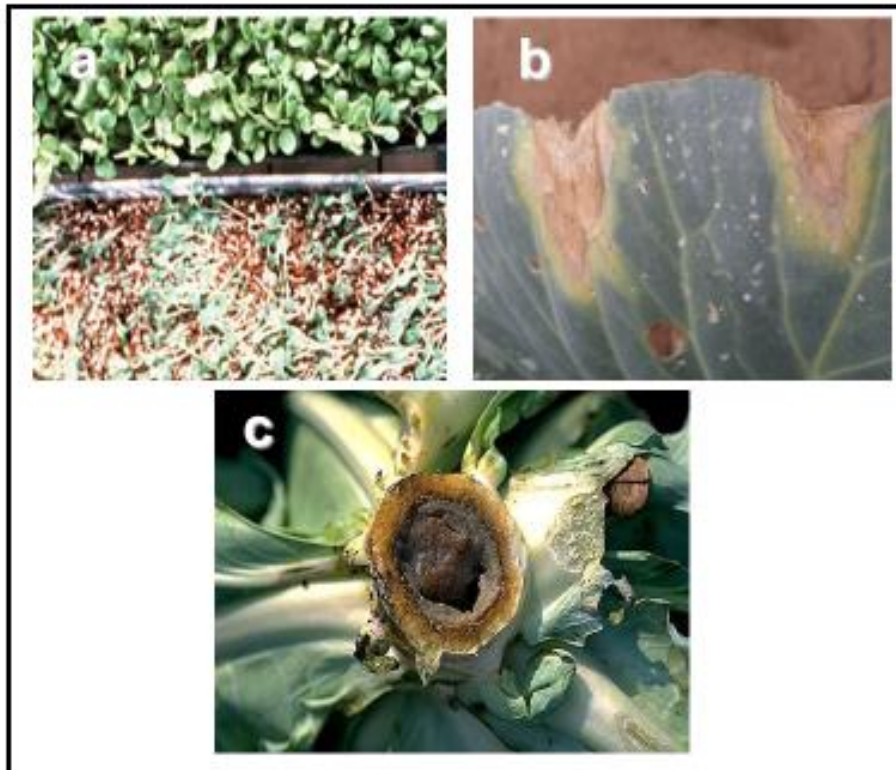
#### Control:

- **Hand removal** since the pest is easily found near the damaged plant, especially at the beginning of infestation
- **Early weeding** destroys sites for egg laying
- Destroying crop residues
- **Dry season Ploughing** exposes the pest to its predators and desiccation
- Maintain crop rotation cycle
- Use of appropriate insecticides such as dimethoate, malathion, or trichlorophon

# 3.9.4 Major Disease pests



## 3.9.4 Major Diseases



### 3.9.4 Major Diseases

- Disease infestation leads to reduction in quality and quantity of produce
- The following are the major diseases of Cabbage in Ethiopia:
  - a. **Damping-off**
  - b. **Bacterial Black Rot**
  - c. **Bacterial Soft Rot**

# 3.9.4.a: Damping-off



Information Source: <http://www.yates.co.nz>

## Symptom of “Damping-off”

# 3.9.4.a: Damping-off



Symptom of “Damping-off”

## 3.9.4.a: Damping-off

### General Descriptions:

- The disease is caused by the **fungi**
- Common problem at the **nursery stage**
- More likely prevalent during **rainy season**
- **Too much moisture** will dispose the crop to the disease

### Symptoms:

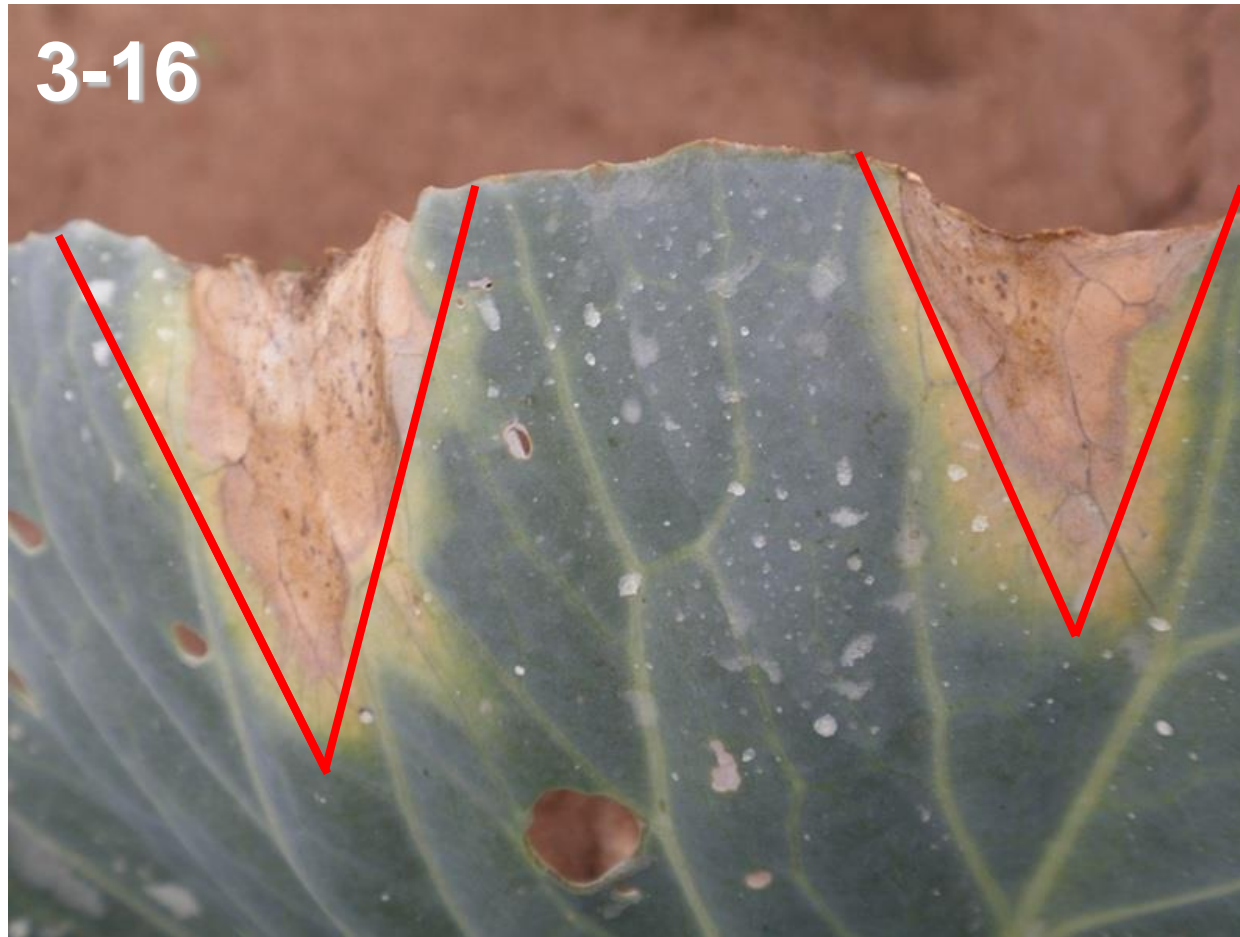
- **Seedlings rot** at the base of the stem thus falling over to the ground

### Control:

- Avoid **dense sowing** which cause damp conditions
- Avoid **excessive watering** and **fertilization**, particularly with nitrates
- Avoid fields with a history of the disease
- Practice **crop rotation**
- Use **certified disease-free seed**
- **Solarization of seedbed** where feasible
- Use of appropriate fungicide such as
  - AMIDIL 68WG (a.i. Metalaxyl-M+Mancozeb)

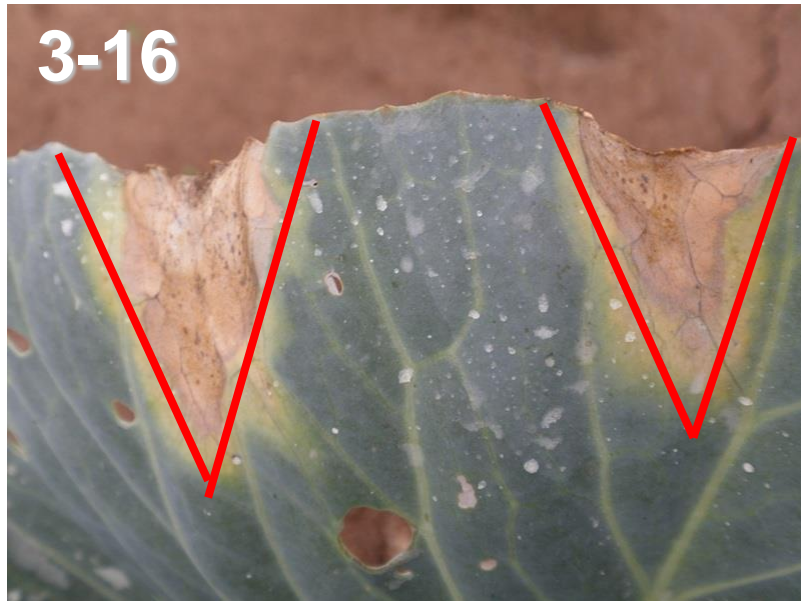


## 3.9.4.b: Black Rot



**Early symptom of “Black Rot” on the edge of a Cabbage leaf**

## 3.9.4.b: Black Rot



**Early symptom of “Black Rot” on the edge of a Cabbage leaf**

### 3.9.4.b: Black Rot

#### General Descriptions:

- This is a **seed-borne bacterial disease**, spread through **soil + Infected debris**
- Black rot infection and spread is favored by **wet conditions** and **high temperatures (26 – 30 °C)**
- Crowded plants provide conditions that are ideal for bacterial spread to nearby plants

#### Symptoms:

- Yellow **V-shaped lesions** on the leaf margins which later turn **brown** as the leaf veins in the affected area become **black**
- A cross sectional cut of infected stem reveal a characteristic **black ring**
- In later stages, affected heads turn **black** and soft
- The rotten heads give a characteristic **offensive odour**

#### Control:

- Use certified seeds
- Field sanitation (burn crop residues)
- Use of resistant/tolerant varieties, e.g.) **Rotanda**
- Crop rotation (at least 3 years)

# 3.9.4.c: Bacterial Soft Rot



Information Source: <http://www.semena.org>

**Symptom of the “Bacterial Soft Rot”  
on a Cabbage stem**

## 3.9.4.c: Bacterial Soft Rot



**Symptom of the “Bacterial Soft Rot” on a Cabbage stem**

### 3.9.4.c: Bacterial Soft Rot

#### General Descriptions:

- It is a **soil borne disease**
- **High temperature (32 – 33 °C)** favour disease development
- The disease is spread rapidly by **rain splash** on lower leaves
- It is mainly a **post-harvest problem**

#### Symptoms:

- The head becomes **soft** and has **watery rot** which develops an **offensive smell**
- When the stem of the affected plant is cut, a **very bad smell** is generated

#### Control:

- **Crop rotation** with legumes, cereals
- Foliar sprays with **copper based fungicides**
- **Avoid harvesting when it is wet**
- Remove from the field or plough crops deeply immediately after harvesting so that the residues decompose as quickly as possible
- Application wooden ash around root zone
- Handle produce carefully and store in a **cool, well-ventilated area**
- **Use of fungicide such as ENRICH BM (a.i. Bronopol)**

# 4. Harvest



4-1

**Cabbage crops ready for harvest**

# 4. Harvest



**Cabbage crops ready for harvest**

## 4. Harvest

### 4.1 Harvesting Indices (GHCP&PHHT20: Q17)

- **Maturity Period: 2.5 – 4 months** depending on variety and location after transplanting
- **Maturity:** When the **head becomes firm**
- Harvest the heads **before** they **pass the prime stage** and **crack** or **split**
- Cut heads at the base and leave 3 – 4 wrapper leaves to protect the head and keep it fresh
- Avoid bruising the head as it encourages rotting
- **Yields: 300-750 qt/ha** (depending on the variety and crop husbandry)
- **Varieties with firm solid heads** have good storability

# 5. Post-Harvest Handling



## Practice of Post-Harvest Handling of produce

# 5. Post-Harvest Handling



5-1

**Practice of Post-Harvest Handling of produce**

## 5. Post-Harvest Handling

### 5.1 Containers & Packaging Materials (GHCP&PHHT20: Q18)

- Packed in **clean well ventilated containers/crates** and transported in covered vehicles

### 5.2 Value Addition Techniques: Sorting, Cleaning & Grading (GHCP&PHHT20: Q19)

- **Sorting:** Damaged and diseased heads are discarded
- **Grading:** Cabbages are graded depending on the head size
- Generally, most fresh markets prefer heads medium sized one.



# 6. Cost & Income Analysis

Item	Quantity	Unit Price	Total (ETB)
<b>Marketable Yield</b>			
<b>Variable Costs</b>			
Land Preparation			
Manure/Compost			
Seeds			
Fertilizers			
Fungicides			
Insecticides			
Others e.g.) selective Herbicides			
<b>Labour</b>			
Planting			
Spraying/Weeding/Harvesting/Grading			
Transportation/Packaging			

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Planting			
Spraying/Weeding/Harvesting/Grading			
Transportation/Packaging			

**A sample sheet of items and activities to be considered for determining an enterprise's gross margin**

## 6. Cost & Income Analysis

- Farmers are encouraged to keep accurate records of all enterprise activities **(GHCP&PHHT20: Q20)**
- This is vital in determining the enterprise profitability
- Record keeping is very important for farmers practicing commercial agriculture

### There are 2 types of records:

#### •Individual Records:

- Kept by individual farmers and include the cost of production and sales
- Useful in analyzing whether the farmer is making profit or losses in his farming enterprise
- Records are very important for traceability of produce

#### •Group Records:

- Include activities such as group purchase of inputs, selling of produce etc.

# 7. Post-Training Evaluation Exercise

QUESTION	TRUE	FALSE
1. “Copenhagen Market” is one of the common improved variety in Ethiopia.		
2. In choosing a variety, farmers should consider yield levels and disease resistance/tolerance among other things.		
3. Market survey enables buyers to understand the market situation.		
4. Cabbage planting calendar is a tool used by farmers to plan for production.		
5. Regular watering ensures uniform head formation.		
6. While forming head, plant require more potassium, so applying ash could increase yields		
7. Crop rotation does <b>NOT</b> prevent pest and disease build up nor replenish soil nutritional status.		
8. “Diamond Back Moth (DBM)” infestation is normally serious in wet months.		
9. “Damping-off” is a common disease of seedlings at the nursery stage.		
10. Maturity of the Cabbage is achieved when the head is soft.		

# 7. Post-Training Evaluation Exercise

\* Please ask the farmers to appropriately indicate answers to each of the following questions.

PAGE NUMBER	QUESTION	TRUE	FALSE
2/32	1. “Copenhagen Market” is one of the common improved variety in Ethiopia.	✓	
2/32	2. In choosing a variety, farmers should consider yield levels and disease resistance/tolerance among other things.	✓	
5/32	3. Market survey enables buyers to understand the market situation.		✓
6/32	4. Cabbage planting calendar is a tool used by farmers to plan for production.	✓	
15/32	5. Regular watering ensures uniform head formation.		✓
17/32	6. While forming head, plant require more potassium, so applying ash could increase yields	✓	
19/32	7. Crop rotation does <b>NOT</b> prevent pest and disease build up nor replenish soil nutritional status.		✓
21/32	8. “Diamond Back Moth (DBM)” infestation is normally serious in wet months.		✓
26/32	9. “Damping-off” is a common disease of seedlings at the nursery stage.	✓	
29/32	10. Maturity of the Cabbage is achieved when the head is soft.		✓

## [Note]

- If there is any question which half of the participants gave the wrong answer, you need to repeat the specific area regarding to question