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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""

COWPEA LEAVES PRODUCTION

Photo: © Victor Omari, HCD 2019

Photo: SHEP PLUS

Prepared by SHEP PLUS

Training Title: **Cow Pea Production**

Objective: **To provide a guideline on production of Cow Pea**

Specific Objective:

- **To provide basic information on production, post-harvest handling, and marketing of Cow Pea leaves**

Contents:

Contacts:

- **Ministry of Agriculture, Livestock & Fisheries (MOALF):**
  Kilimo House, Cathedral Road, P.O. Box 34188-00100, Nairobi, KENYA, Tel: 020-2718870
- **Agriculture and Food Authority (AFA), Horticultural Crops Directorate (HCD):**
  Airport Road, Opp. JKIA, P.O. Box 42601-00100, Nairobi, KENYA, Tel: 020-2131560/3597356
- **Japan International Cooperation Agency (JICA) Kenya Office:**
  BRITAM Tower, 22nd & 23rd, Hospital Road,
  P.O. Box 50572-00200, Nairobi, KENYA, Tel: 020-2775000
- **Smallholder Horticulture Empowerment and Promotion Project for Local and Up-Scaling (SHEP PLUS):**
  N.H.I.F. Building, 4th Floor, Ngong Road/Haile Selassie Avenue, Upper Hill
  P.O. Box 19024-00100, Nairobi, KENYA
  Tel: 0712-504095 /0737-293867, E-mail: info.shepunit@gmail.com

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 Unit Project (SHEP UP) 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 the cases. But where applicable, it is recommended that the instructions issued be given due consideration.

Disclaimer

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Editors: James Arim, Stephen Kioko, Collins Otieno, Calistus Efukho, Grace Mbuthia, Florence Mangoli, Zablon Oirere, Elizabeth Mbuthia, Fransisca Malenge, Jiro Aikawa, Kiyoshi Kita, Harue Kitajima, Yasuhiro Takashina, Taku Seo

Contributors: Grays Kiplagat, Thomas Mumu, Sarah Ndegwa, Antonina Luta, Peter Orangi, Florence Wambua, Raymond Chelule, Murage Henry, Omari Victor, Jacob Keror, Musah Samuel, Carolyne Mwenze

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The cited agrochemicals are in accordance with “Pest Control Product Registered for Use in Kenya 11th Edition, 2018”. The registered agrochemicals are subject to change. Please refer to the latest registered agrochemicals by Pest Control Product Board.

1. Introduction:
1.1 Background

Cowpea (Kunde)

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1.1 Background

Photo: © Victor Omari, HCD 2019

Cowpea (Kunde)

1. Introduction:
1.1 Background

- **Cowpea** is one of **the most important crops** in the dry lands of Kenya, but it is gaining popularity across the country
- It is grown as pure stand or **intercropped with Maize and Sorghum**
- It's **drought tolerant**, performs well in a wide variety of soils, and being a legume, replenishes low fertility soils when the roots are left to decay
- Grown both as a **leafy vegetable** and for its **grain**
- Plant types can be classified as **erect**, **semi-erect** or **trailing types**
- **Rich in calcium, iron, zinc, and vitamin B complex**

1.2 Common Varieties

“Machakos 66 (M 66)”

“Katumani 80 (K 80)”

1.2 Common Varieties

“Machakos 66 (M 66)”

“Katumani 80 (K 80)”

1.2 Some Common Varieties

- The following are the common varieties grown in Kenya

“Machakos 66 (M66)”:

- A dual purpose bushy **semi-spreading variety**
- Flowers **55 – 60 days** after germination
- Grown in higher altitude of **1,200 – 1,500 m.a.s.l.**
- Tolerant to yellow mottle virus and scab and partly to aphid and thrips damage
- Moderately tolerant to **Septoria Leaf Spot** and **Powdery Mildew**

“Katumani 80 (K80)”:

- A dual purpose variety (vegetable & grain) with **sprawling growth habit**
- Flowers **50 days** after emergence
- Tolerant to **Aphids**, **Thrips**, **Pod borers** and **Leafhoppers**
- Susceptible to **Cowpea Yellow Mosaic Virus (CYMV)**

1.2 Common Varieties Cont’

“KVU 27-1”

1.2 Common Varieties Cont'

"KVU 27-1"

1.2 Some Common Varieties Cont'

"KVU 27-1":

- A dual purpose variety with **a semi-spreading habit**
- Moderately tolerant to **Aphids**, **Thrips**, **Pod borers** and **Leafhoppers**
- Moderately resistant to **fungal diseases** and **mosaic virus**

- The 3 varieties above are for arid and semi-arid areas

Other varieties grown in Kenya:

"Kenkunde":

- A reddish brown pea which is drought tolerant but is bitter

Others:

- **KVU 419**, **Kunde 1**, **KCP 022**, **Ngombe**
- **Local Varieties:** these differ from one area to another and is defined by among other aspects, seed colour **e.g.)** white seed, black seed, growth habit or whether it's drought tolerant or does well in wet season

1.3 Optimal Ecological Requirements

Altitude	**0 – 1,500 meter above sea level**
Rainfall	**200 – 700 mm annually**
Growing Temperature	**20 – 35 ^{0}C**
Soils	**•Well drained sandy loams or sandy soils** **• pH range 5.5 – 6.5**

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Soils	• **Well drained sandy loams or sandy soils** • **pH range 5.5 – 6.5**

1.3 Optimal Ecological Requirements

- **Altitude:** Cowpea can be cultivated up to **1,500 m** above sea level
- **Rainfall:** Minimum rainfall of **200 mm per growing season** is required for most varieties. The crop does well in rainfall up to 700 mm. Rainfall should be well distributed throughout the growing period.
- **Temperature:** The optimum temperature for growth and development is **20 – 35 ^{0}C**. It tolerates heat and dry conditions. Colder temperatures slow down germination
- **Soil:** Cowpea performs well in a wide variety of soils and soil conditions. Well drained sandy loams or sandy soils are suitable. Soil pH range is **5.5 – 6.5**

2. G20 technologies

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

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[G20 Technologies]
Make sure to support farmers carry out G20 techniques for any crop

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

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[G20 Technologies]
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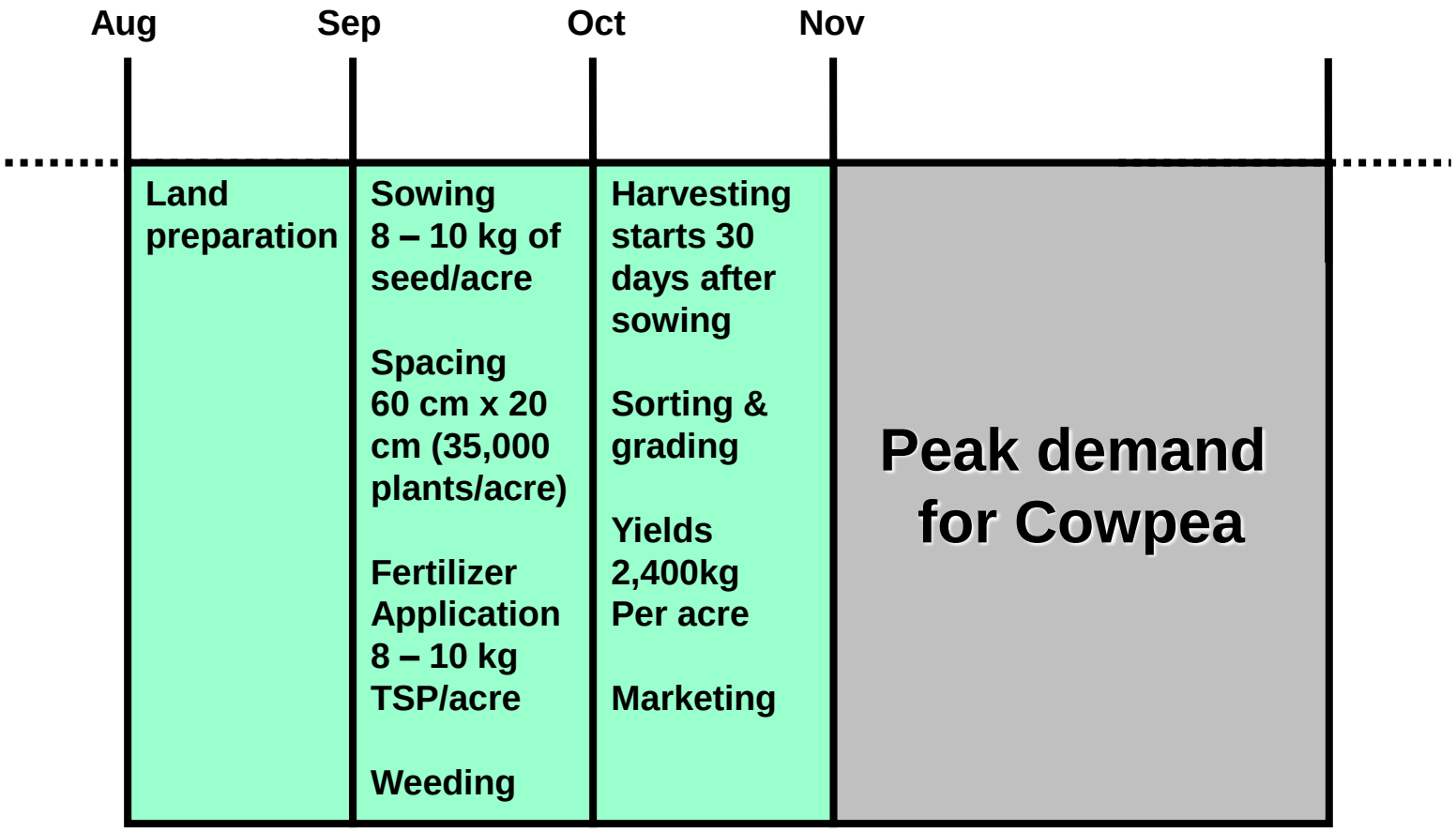
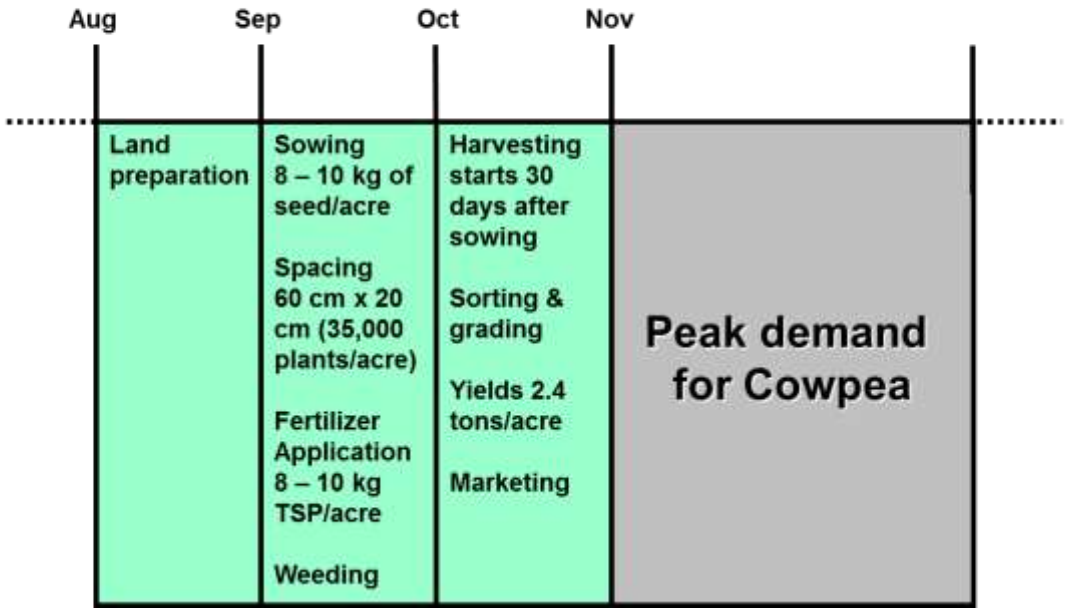
2.1 Crop Planting Calendar

A Sample of a Cowpea Planting Calendar



2.1 Crop Planting Calendar

A Sample of a Cowpea Planting Calendar



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

2.1 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:

1. Determine from the market survey results (2.1) when there is peak demand for Cowpea
2. Work backwards from the month when there is peak demand to prepare a monthly farm activities preceding the peak period
3. 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 for supplemental irrigation

2.2 Composting

Photo: SHEP PLUS

Well composted manure ready for use

2.2 Composting

Photo: SHEP PLUS

Well composted manure ready for use

2.2 Composting (GHCP&PHHT20: Q4)

- During compost making, the organic matter needs to be covered to prevent leaching of nutrients
- Based on the results of the soil analysis, prepare adequate compost for application
- Where soils are highly eroded, an application of **2 tons per acre** of dry compost or manure is beneficial
- Generally, Cowpea is more tolerant to infertile soils than many other crops

3.1 Basal Application

Photo: SHEP PLUS

Manure incorporation as a basal application

3.1 Basal Application

Manure incorporation as a basal application

3.1 Basal Application (GHCP&PHHT20: Q8)

- Pre-plant phosphorus (**P**) can be applied in form of fertilizer (**TSP**) at the rate of **8 – 10 kg** (17-22kg TSP) **per acre**
- Manure/compost should be applied **1 – 2 weeks before** planting and incorporated into the soil
- The manure/compost should be broadcasted (**2 tons per acre**) then worked into the soil (incorporated) preferably using a hoe

3.2 Planting

Young cowpea seedlings

3.2 Planting

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Young cowpea seedlings

3.2 Raising Seedlings
(GHCP&PHHT20: Q9)

- Cowpea is directly grown from seed
- The seed can be inoculated with *Rhizobium* (e.g. Biofix) which boosts the positive effects of nitrogen fixation

3.2.1 Appropriate Time

- Early planting after **30 mm** of rainfall is received
- **Seed rate: 8 – 10 kg per acre** and **3 – 4 seeds per hill**
- Seed should be planted at **4 – 5 cm deep**
- Seedlings are thinned to one **after 2 weeks**

3.2.2 Recommended Spacing (GHCP&PHHT20: Q10)

- The seeds are planted at a spacing of **60 cm** between rows and **30 cm** between plants for both **vegetable** and **grain production**
- Plant Population: **22,222 per acre**

OR

- **30 – 40 cm** between rows and **8 – 10 cm** between plants purely for **vegetable production** (uprooting at **3 – 5 true-leaf stage**)
- Plant Population: **166,666-100,000** per acre

3.3 Fertilizer Application

Triple Super Phosphate (TSP)

3.3 Fertilizer Application

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Triple Super Phosphate (TSP)

3.3 Fertilizer Application

- Cowpea does not require too much nitrogen fertilizer because it fixes its own nitrogen from the air using the nodules in its roots
- Cowpea requires more phosphorus than nitrogen to help the plant nodulate well and fix its own nitrogen from the air
- Single or **Triple Super Phosphate** fertilizer should be applied at a rate of **17-22kg per acre**

3.4 Water Requirement

Photo: © Victor Omari HCD 2019

Drip irrigation

3.4 Water Requirement

Photo: © Victor Omari HCD 2019

Drip irrigation

3.4 Water Requirement
(GHCP&PHHT20: Q12)

- Cowpea is a more drought-tolerant crop compared to many other crops. It grows under rainfall ranging from **200 – 700 mm** per annum
- Cowpeas utilize soil moisture efficiently than other crops
- It reacts to serious moisture stress by limiting growth (especially leaf growth) and reducing leaf area by changing leaf orientation and closing stomata
- Cowpeas are usually grown **under dryland** rather than irrigated conditions (For continuous production, irrigation is required)

3.5 Managing of Weeds

Photo: SHEP PLUS

Weed-free field of Cowpea

3.5 Managing of weeds

Weed-free field of Cowpea

3.7 Managing of Weeds (GHCP&PHHT20: Q13)

- Cowpea has a deep root system.
- Weeding is done once or **twice in the growing season**
  - **First Weeding:** 2 weeks after emergence
  - **Second Weeding:** as need arises
- This can be done through use of appropriate weeding tools
- Cowpeas may also be affected by the parasitic weed ***Striga* spp**. This is controlled by hand weeding before it sets seeds
- Where this weed is a problem, soil fertility improvement is important
- Use of manure and/or small quantities of fertilizer may reduce infestation, when combined with weeding of plants before seed setting

3.6.1 Major Pests

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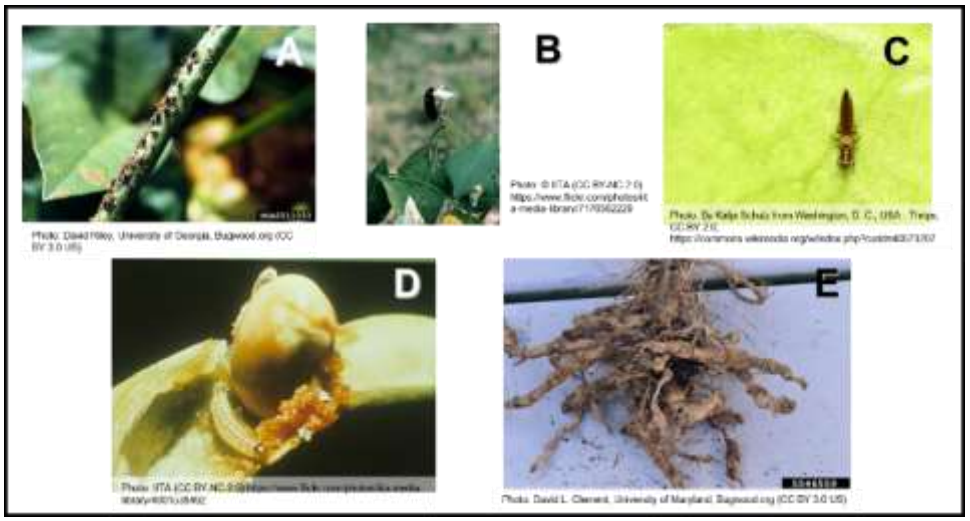
Photo: David L. Clement, University of Maryland, Bugwood.org (CC BY 3.0 US)

3.6.1 Major Pests



3.8.3 Major Pests

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

A. Aphid
B. Blister Beetle
C. Thrips
D. Pod Borer
E. Root-knot Nematodes

3.6.1.A: Aphids

Photo: David Riley, University of Georgia, Bugwood.org (CC BY 3.0 US)

Aphid infestation on cowpeas

3.6.1.A: Aphids

Photo: David Riley, University of Georgia, Bugwood.org (CC BY 3.0 US)

Aphid infestation on cowpeas

3.6.1.A: Aphids

Identification:

- These are small soft-bodied insects which pierce the plant tissue and suck sap from the attacked plants
- They feed on undersurface of young leaves, young shoots and pods of mature plants

Damages:

- They excrete large quantities of honeydew which support growth of sooty mould
- Heavy attack causes death of young seedlings, delayed flowering and stunted growth
- Cowpea aphids transmit mosaic virus

Control:

- Biological control using predators, such as **Lady Bird Beetle**
- Spray with Lambda Cyhalothrin (KARATE 2.5 WG® PHI: 3days), Deltamethrin (DECIS 2.5 EC® PHI: 1day)

3.6.1.B: Blister Beetle

Blister beetle feeding on Cowpea flower

3.6.1.B: Blister Beetle

Blister beetle feeding on Cowpea flower

3.6.1.B: Blister Beetle

Identification:

- Adults are medium to large sized beetles (**2 – 5 cm long**) usually black and yellow or black and red in colour

Damages:

- The adults feed on flowers and cause reduced pod set
- Adult beetles are attracted to maize pollen

Control:

- In rare occasion when large numbers of beetles are found on flowering crops, control measures can be applied
- Hand picking is commonly done. However, care should be taken because when disturbed, the beetles release a liquid that burn the skin. Wear gloves to protect the hands.

3.6.1.C: Thrips

Adult thrips on a leaf

3.6.1.C: Thrips

Adult thrips on a leaf

3.6.1.C: Thrips

Identification:

- Adult thrips are shiny black minute insects with a short life cycle that takes **14 – 28 days**
- Eggs are laid on flower buds and on hatching, nymphs feed on the flower buds. They pupate in the soil or debris close to the host plants

Damage:

- During pre-flowering stage, the nymphs and adults feed on and damage the terminal buds. However, the main damage is on the flower buds and flowers. Attacked flower buds turn brown and eventually fall off, leaving behind dark red scars
- Damaged flowers are distorted and malformed, show discoloration and may fall off
- Infested pods are malformed

Control:

- Intercropping cowpea with maize or sorghum
- Plant resistant/tolerant varieties e.g. **K80** & **KVU 27-1**
- Eliminate **alternative host** plants
- Maintain **field hygiene**
- Use of **pesticides**, such as
  - Lambda Cyhalothrin (**KARATE 2.5** WG 25g/Kg. PHI: 3days)

3.6.1.D: Pod Borer

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Legume Pod Borer Feeding inside the Pod

3.6.1.D: Pod Borer

Photo: IITA (CC BY-NC 2.0) https://www.flickr.com/photos/iita-media-library/4901538492

Legume Pod Borer Feeding inside the Pod

3.6.1.D: Pod Borer

Identification:

- Adult moth has whitish markings on its forewings
- Larva are dull to yellow white & reach a length of **1.8 cm**
- Each segment has dark spots that form a distinct series along the length of the body
- Head is dark brown to black
- The moths lay eggs on leaf and flower buds, flowers and terminal shoots

Damages:

- Young caterpillars feed on any part of the flower or foliage
- Older caterpillars are highly mobile and feed continuously on flowers and newly formed pods, causing severe damage to the crop

Control:

- **Use of pesticides**, such as
  - **Lambda-cyhalothrin (Karate 2.5WG®. PHI: 3days)**

3.6.1.E: Root-Knot Nematode

Roots showing severe damage by Root-Knot Nematodes

3.6.1.E: Root-Knot Nematode

Photo: David L. Clement, University of Maryland, Bugwood.org (CC BY 3.0 US)

Roots showing severe damage by Root-Knot Nematodes

3.6.1.E: Root-Knot Nematode

Identification:

- Roots of affected plants have knots or galls
- The root galls formed by nematodes can be distinguished from the nodules containing *Rhizobium*, which are **small, spherical and pink inside**

Damages:

- Affected plants appear nutrient deficient, wilting and have stunted growth
- Can cause premature death of plants as a result of damage to the roots
- Attack by **Root-knot Nematodes** make plants susceptible to **Fusarium Wilt**

Control:

- Crop rotation with nematode resistant or tolerant crops e.g.) **Cereals**, **Onions**
- After harvest, uproot entire plants and destroy crop debris
- Tops can be composted but any infested roots should be burned since nematodes may survive the relatively low heat of compost heap

3.6.2 Major Diseases

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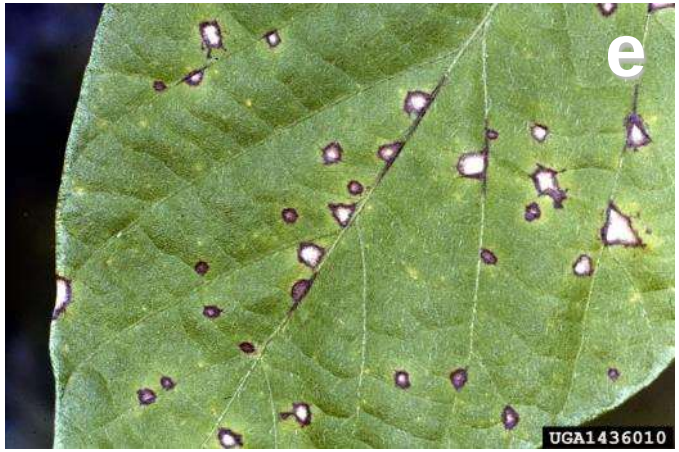

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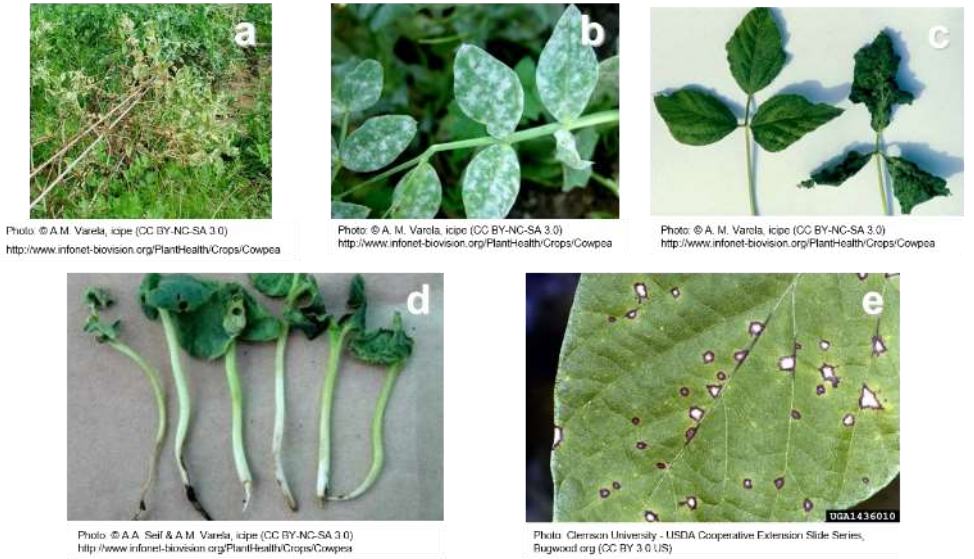
3.6.2 Major Diseases



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http://www.infonet-biovision.org/PlantHealth/Crops/Cowpea

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3.8.4 Major Diseases

- Disease infestation leads to reduction in quality and quantity of produce
- The following are the major diseases of Cowpea in Kenya:

a. Fusarium Wilt
b. Powdery Mildew
c. Cowpea Mosaic Virus
d. Damping-off
e. Cercospora Leaf Spot

3.6.2.a: Fusarium Wilt

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Fusarium Wilt on a Legume Crop

3.6.2.a: Fusarium Wilt

Fusarium Wilt on a Legume Crop

3.6.2.a: Fusarium Wilt

General Descriptions:

- The disease is caused by **a fungus**
- It attacks water and nutrient conducting tissues of the plants

Symptoms:

- Wilting of lower leaves, or whole plant
- Browning of stem tissues
- Stunted growth

Control:

- Control root-knot nematodes since nematodes increase plants susceptibility to **Fusarium Wilt**

3.6.2.b: Powdery Mildew

Powdery Mildew on a legume crop

3.6.2.b: Powdery Mildew

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Powdery Mildew on a legume crop

3.6.2.b: Powdery Mildew

General Descriptions:

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

Symptoms:

- A light grayish and powdery growth on the leaves and pods
- It causes yellowing and defoliation of infected plants
- Heavy application of nitrogen-based fertilizer tend to increase disease severity

Control:

- Field hygiene
- Avoid very close spacing
- Use tolerant varieties e.g.) **M66**
- Use recommended fungicides, such as
  - **Azoxystrobin (Ortiva SC®. PHI: 3days), Sulphur (a.i. Cosavet DF ® PHI: 3days)**

3.6.2.c: Cowpea Mosaic Virus

Cowpea Mosaic Virus (CpMV)

3.6.2.c: Cowpea Mosaic Virus

Cowpea Mosaic Virus (CpMV)

3.6.2.c: Cowpea Mosaic Virus

General Descriptions:

- The disease is caused by **a virus** which is transmitted by aphids

Symptoms:

- Curling of leaves
- Infected leaves are smaller than healthy ones
- Infected plants may be dwarf and become bushy with reduced yields

Control:

- Control **aphids**
- Plant clean/**certified seeds**
- Crop rotation with none-legumes such as cereals
- Remove **alternative hosts** of virus diseases (legumes)

3.6.2.d: Damping-off

Young seedlings symptoms of Damping Off

3.6.2.d: Damping-off

Young seedlings symptoms of Damping Off

3.6.2.d: Damping-off

General Descriptions:

- The disease is caused by a fungi and causes high seedling mortality
- It is favoured by **cool**, **wet** or **water logged soils conditions**

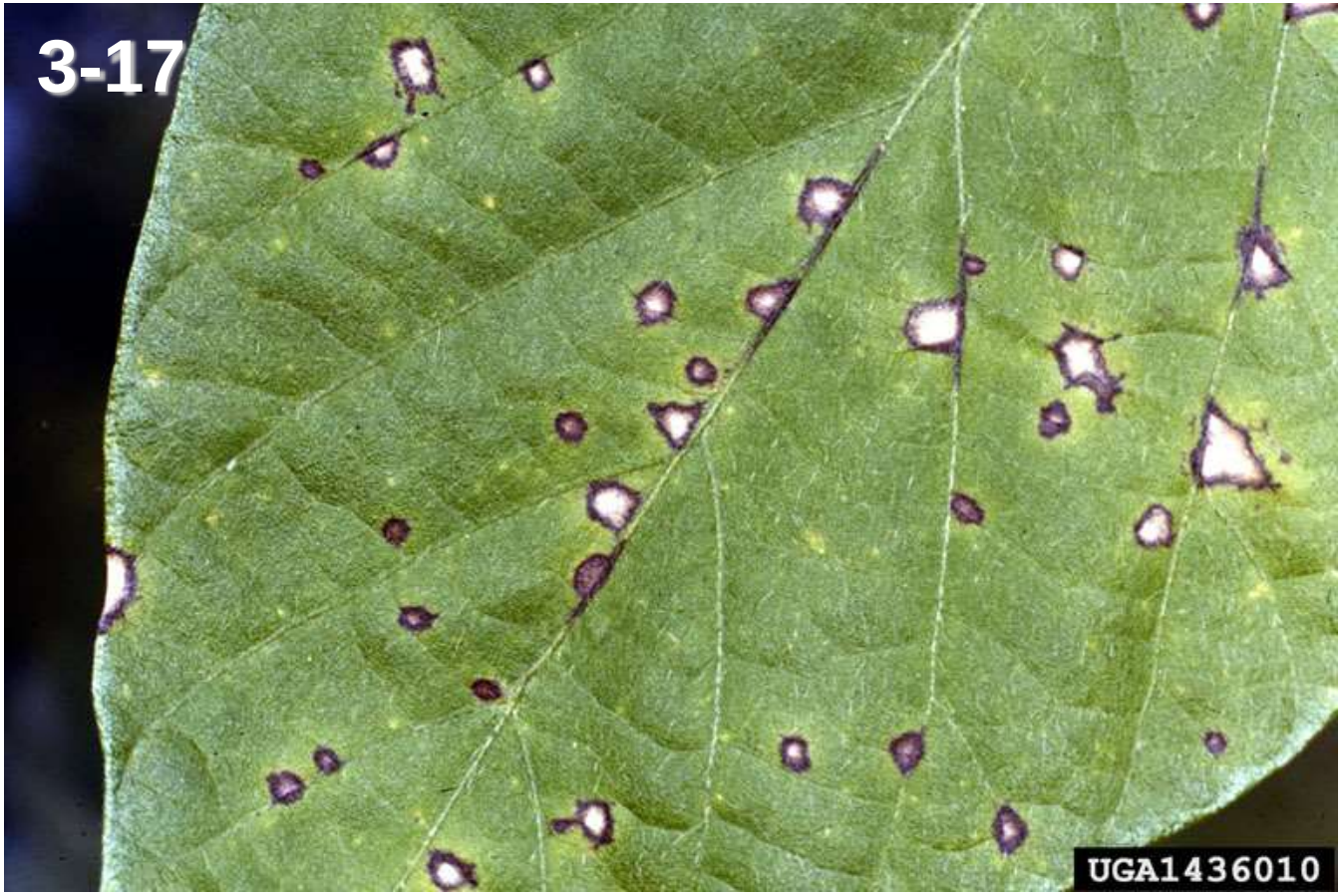
Symptoms:

- The emerging seedling collapses, often submerged in a mass of white fungal growth **3 weeks** after sowing

Control:

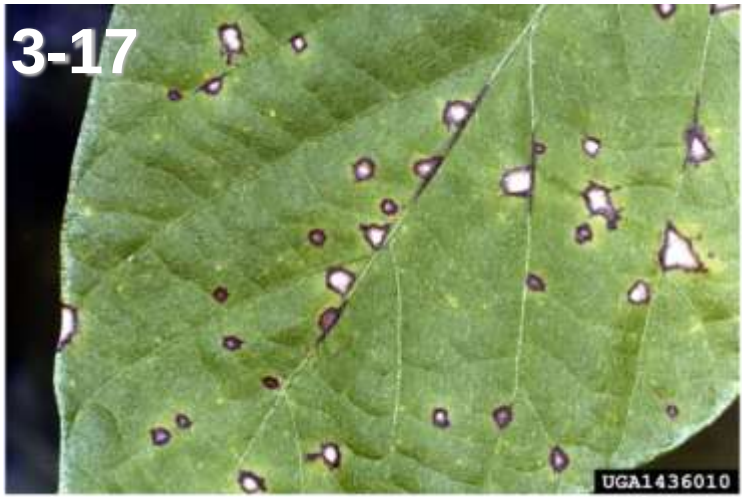
- Crop **rotation**
- **Avoid** water **logging**
- Use recommended fungicides such as Metalaxyl-M+Moncozeb (**AMIDIL 68WG®. PHI: 5days)**

3.6.2.e: Leaf Spot



Cercospora Leaf Spot

3.6.2.e: Leaf Spot



Cercospora Leaf Spot

3.6.2.e: Leaf Spot

General Descriptions:

- Leaf spots vary in size and are often yellowish, brown or purple in colour
- The disease is most serious during periods of prolonged moist weather and on late plantings

Symptoms:

- The spots normally first develop on the lower leaves
- Cercospora leaf spot appears as dark mouldy growth and develops on the lower surface of the leaf corresponding to the spot
- Severe leaf spotting results in defoliation with subsequent yield reduction

Control:

- Practice crop rotation with non-leguminous plants
- Avoid cultivation when foliage is wet
- **Use of fungicides**, such as
  - **Azoxystrobin (Ortiva SC® PHI:3days**)

4. Harvest

Photo: SHEP PLUS

Farmers harvesting cowpea leaves

4. Harvest

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Farmers harvesting Cowpea leaves

4. Harvest

4.1 Harvesting Indices (GHCP&PHHT20: Q17)

- Maturity period for leaf harvesting is **3 – 4 weeks** after planting

Harvesting Methods:

- **Leaf harvesting**
  - Leaves are picked when they are young and tender
  - In other cases, whole plants are harvested by uprooting
- **Leaf and grain harvesting**
  - The leaf vegetable yields are significantly affected by leaf harvesting frequency
  - When harvesting frequency is shorter, higher yields are realized but yield of grain decreases
  - **Leaf Yields: 2,400kg per acre** are achieved