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

Prepared by SHEP PLUS
MOALF/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:
1. Introduction: Background, Common Varieties and Optimal Ecological Requirements
2. Pre-Cultivation Preparation 1–5
3. Cultural Practices 1–8
4. Harvest
5. Post-Harvest Handling
6. Cost & Income Analysis
7. Post-Training Evaluation Exercise

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1. Introduction:
1.1 Background

Cowpea (Kunde)

Photo: © Victor Omari, HCD 2019
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.

Cowpea (Kunde)
1.2 Common Varieties

“Machakos 66 (M 66)”

“Katumani 80 (K 80)”

Photos: (CC BY-NC-SA 3.0) http://www.infonet-biovision.org/PlantHealth/Crops/Cowpea
© A.A. Seif, icipe
1.2 Some Common Varieties

“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 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

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude</td>
<td>0 – 1,500 meter above sea level</td>
</tr>
<tr>
<td>Rainfall</td>
<td>200 – 700 mm annually</td>
</tr>
<tr>
<td>Growing Temperature</td>
<td>20 – 35 °C</td>
</tr>
<tr>
<td>Soils</td>
<td>• Well drained sandy loams or sandy soils</td>
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**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 °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
2. G20 technologies

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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
2. G20 technologies

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[G20 Technologies]
Make sure to support farmers carry out G20 techniques for any crop
2.1 Crop Planting Calendar

A Sample of a Cowpea Planting Calendar

<table>
<thead>
<tr>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land prep</td>
<td>Sowing</td>
<td>Harvesting</td>
<td>Peak demand</td>
</tr>
<tr>
<td></td>
<td>8 – 10 kg of</td>
<td>starts 30</td>
<td>for Cowpea</td>
</tr>
<tr>
<td></td>
<td>seed/acre</td>
<td>days after</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spacing</td>
<td>sowing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60 cm x 20</td>
<td>Sorting &amp;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cm (35,000</td>
<td>grading</td>
<td></td>
</tr>
<tr>
<td></td>
<td>plants/acre)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fertilizer</td>
<td>Yields</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Application</td>
<td>2,400kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8 – 10 kg</td>
<td>Per acre</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TSP/acre</td>
<td>Marketing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Weeding</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A Sample of a Cowpea Planting Calendar: Targeting a peak market demand beginning just after November
2.2 Composting

Well composted manure ready for use

Photo: SHEP PLUS
2.2 Composting

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.

Well composted manure ready for use.
3.1 Basal Application

Manure incorporation as a basal application
3.1 Basal Application

- 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

Photo: © IITA (CC BY-NC 2.0) https://www.flickr.com/photos/iita-media-library/6938018228/
3.2 Planting

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

• 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.

**Triple Super Phosphate (TSP)**
3.4 Water Requirement

Drip irrigation

Photo: © Victor Omari HCD 2019
3.4 Water Requirement

- 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)

Drip irrigation

Photo: © Victor Omari HCD 2019
3.5 Managing of Weeds

Weed-free field of Cowpea
3.5 Managing of weeds

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

Weed-free field of Cowpea
3.6.1 Major Pests

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

B: Photo: © IITA (CC BY-NC 2.0) https://www.flickr.com/photos/iita-media-library/7176562229

C: Photo: By Katja Schulz from Washington, D.C., USA - Thrips, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=40573207

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

E: 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

Aphid infestation on cowpeas

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

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

Blister beetle feeding on Cowpea flower

Photo: © IITA (CC BY-NC 2.0) https://www.flickr.com/photos/iita-media-library/7176562229
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

Photo: By Katja Schulz from Washington, D. C., USA - Thrips, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=40573207
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

Legume Pod Borer Feeding inside the Pod

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

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

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

Photo: © A. M. Varela, icipe (CC BY-NC-SA 3.0)
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Photo: © A.A. Seif & A.M. Varela, icipe (CC BY-NC-SA 3.0)
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Photo: Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org (CC BY 3.0 US)
3.6.2 Major Diseases

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

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

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

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Fusarium Wilt on a Legume Crop

Photo: © A.M. Varela, icipe (CC BY-NC-SA 3.0) http://www.infonet-biovision.org/PlantHealth/Crops/Cowpea
3.6.2.b: Powdery Mildew

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

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)

Photo: IITA (CC BY-NC 2.0) https://www.flickr.com/photos/iita-media-library/5863604320
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)

Cowpea Mosaic Virus (CpMV)
3.6.2.d: Damping-off

Young seedlings symptoms of Damping Off

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

Young seedlings symptoms of Damping Off
3.6.2.e: Leaf Spot

Cercospora Leaf Spot

Photo: Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org (CC BY 3.0 US)
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)

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Cercospora Leaf Spot
4. Harvest

Farmers harvesting cowpea leaves

Photo: SHEP PLUS
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

**Farmers harvesting Cowpea leaves**