



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””

# AMARANTH 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

1-1



1-2



## Amaranth (Mchicha)

# 1. Introduction:

## 1.1 Background

- Amaranth is a member of the *Amaranthaceae* family
- It is also known as **Pigweed/African Spinach**
- Amaranth have green or red leaves, and branched flower stalks (heads) bearing small seeds, variable in colour from cream to gold and pink to shiny black
- There are about 60 species of Amaranth but only a limited number are of the cultivated types

# 1. Introduction:

## 1.1 Background Cont'

- Amaranth can be used as a leafy vegetable or as a high-protein grain
- The leaves are cooked alone or combined with other local vegetables, such as spider plant or pumpkin
- The leaves are rich in Calcium, Iron, Vitamins A, B and C
- There is no distinct separation between the vegetable and grain type since the leaves of young grain type plants can be eaten as greens

# 1.2 Common Varieties Cont'



Photo: By Pinus - Own work, CC BY-SA 3.0,  
<https://commons.wikimedia.org/w/index.php?curid=15830611>

***A. tricolor***

# 1.2 Common Varieties

## ***“A. tricolor”***

- It is used as a cooked leafy vegetable.
- It is fast-growing, albeit less so than the more commonly cultivated *A. cruentus* and *A. dubius*.
- *A. Tricolor* is much more susceptible to drought than other vegetable amaranths. Water shortage causes early flowering, which reduces the yield and the market quality. (Grubben & Denton, 2004)



# 1.2 Common Varieties



Source:  
<http://www.prota4u.org/protav8.asp?g=pe&p=Amaranthus%20dubius%20Mart.%20ex%20The%20II>

***A. dubius***



Source:  
<https://www.prota4u.org/protav8.asp?g=pe&p=Amaranthus+blitum+L.>

***A. blitum***

# 1.2 Common Varieties Cont'

## ***“Amaranthus dubius”:***

- In Kenya, it is grown on a commercial scale and sold in city markets
- The plant is up to 150 cm tall
- Stems: slender to stout, branched, glabrous or upwards, especially in the inflorescence, with short to rather long hairs
- Maturity Period: 3 – 4 weeks after sowing
- Yield: 7.5 – 12.5 tons/acre (uprooted crop)
- It is often cooked with bitter leaf vegetables, such as Black Night Shades



# 1.2 Common Varieties Cont'

## “*Amaranthus blitum*”:

- The economic value as a market vegetable is limited, since “*A. dubius*” is more productive
- The plant is small and stunted to rather tall and erect, up to 100 cm tall
- Stems: simple or branched, glabrous
- Leaves: green or more or less purple in colour
- Maturity Period: 4 weeks after sowing
- Yield: 5.0 tons/acre (uprooted crop)

# 1.2 Common Varieties Cont'

## “*Amaranthus hybridus*”:

- Stems: erect, green or sometimes reddish purple, leaves are alternate with long stalks
- Yield: Up to 12 to 24 tons/acre
- Leaves are eaten cooked alone or with ugali



Photo: By Bouba at French Wikipedia - photo by Bouba,  
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<https://commons.wikimedia.org/w/index.php?curid=1644576>

***A. hybridus***

# 1.3 Optimal Ecological Requirements

<b>Altitude</b>	<b>0 – 2,400 meter above sea level</b>
<b>Rainfall</b>	<b>At least 500 mm</b>
<b>Growing Temperature</b>	<b>22 – 30 °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 4.5 – 8.0</b></li></ul>

# 2. Pre-cultivation Preparation:

## 2.1 Market Survey



## Conduct Market Survey

# 2.2 Crop Planting Calendar

CROP PLANTING CALENDER

Aug	Sep	Oct	Nov	Dec	Jan
<div>Land Preparation</div> <div>Manure Application 5 – 8 tons/acre</div> <div>Sowing in nursery bed: 0.5 – 1.0g/m<sup>2</sup> of bed</div>	<div>Transplant 30 days after seed germination</div> <div>Spacing 30 cm x 15 cm</div> <div>Fertilizer application NPK 10-10-20 160 kg/acre</div> <div>Weed, pest &amp; disease control</div>	<div>Harvesting starts 6 weeks after transplanting</div> <div>Sorting, cleaning &amp; grading</div> <div>Yield: 12 tons/acre</div> <div>Marketing</div>	<div>Peak demand for Amaranth</div>		

A Sample of Amaranth Planting Calendar



# **Pre-Cultivation Preparation Techniques**

2.3 Soil sampling & analysis

2.4 Composting

2.5 Quality seed/planting materials

# **3.0 Cultural Practices**

3.1 Land preparation

3.2 Incorporation of crops residues

3.3 Basal application

# 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 500 g per acre
- Amaranth is planted either by direct seeding or transplanting

### **Direct Seeding:**

- It is appropriate when plenty of seed is available, labour is limited and during the dry season
- Seeds are either broadcasted or sown in rows at 0.5 to 1.0 g per m<sup>2</sup> of bed

## 3.4 Raising Seedlings Cont'

### Direct Seeding Cont':

- Since Amaranth seeds are very small, seeds are mixed with sand at a ratio of 1g seed to 100g sand for easy sowing & uniform stand
- For drilling, make furrows 0.5 to 1.0 cm deep & space rows 10 cm apart on the bed
- Drill the seeds in the furrows and cover with soil mixed with compost

# 3.4 Raising Seedlings Cont'

## **Nursery Site Selection:**

- Avoid setting up the nursery in fields previously having an Amaranth crop

## **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 frequency of watering and the shade over the nursery



# 3.5 Transplanting



Photo: Steve Dewey, Utah State University, Bugwood.org (CC BY 3.0 US)

## Recently Transplanted Amaranth seedling

# 3.5 Transplanting

## 3.5.1 Appropriate Time:

- Seedlings are transplanted 30 days after seed germination
- It is recommended that transplanting should be done either early in the morning or late in the evening
- Thoroughly water the nursery before transplanting

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

- The recommended spacing is 10 cm between rows, 5 cm within rows for dense stands (for uprooting young plants) and 30 cm x 15 cm for less dense stands (for plucking)

# 3.5 Transplanting Cont'

## 3.5.3 Fertilizer Application Rates

**(GHCP&PHHT20: Q11):**

- 5 – 8 tons/acre of farm yard manure
- 160 kg/acre of NPK 10–10–20 is recommended

### **Note:**

- Only thoroughly decomposed manure should be used to avoid possible introduction of cutworms in the field
- The DAP fertilizer should be mixed thoroughly with the soil to avoid possible scorching of the seedlings

# 3.6 Water Requirement

## (GHCP&PHHT20: Q12)

- The optimal amount of rainfall required for Amaranth during the growing period is 500 mm
- Avoid over-irrigation since it may enhance disease development & nutrient leaching
- It is drought tolerant because it has deep roots that can go up to 2 meters in search of water

### Irrigation Methods:

- Irrigation can be overhead, drip or furrow



## 3.7 Managing of Weeds



**Amaranth field kept weed free**



## 3.8 Top-dressing



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

## Amaranth Healthy plants

## 3.8 Top-dressing

### (GHCP&PHHT20: Q14)

- The crop should be top dressed to promote better re-growth with CAN at monthly intervals
- Apply N at 20kg/acre as top-dressing 15 days after transplanting
- Foliar spray of 1% Urea (10g per litre) after every harvest
- Placement method is preferred over broadcasting as it is more effective and economical

# **3.9 Pests & Diseases Control:**

## **(GHCP&PHHT20: Q15 & 16)**

### **3.9.1 Major Pests**

- The following are the major pests of Amaranth in Kenya:
  - A. Spider Mites**
  - B. Weevils**
  - C. Aphids**
  - D. Leaf Caterpillars**

## 3.9.1.A: Spider Mites



Source: [https://commons.wikimedia.org/wiki/File%3ACSIRO\\_ScienceImage\\_23\\_Adult\\_and\\_Egg\\_Two\\_Spotted\\_Spider\\_Mites.jpg](https://commons.wikimedia.org/wiki/File%3ACSIRO_ScienceImage_23_Adult_and_Egg_Two_Spotted_Spider_Mites.jpg)  
CSIRO [CC BY 3.0 (<http://creativecommons.org/licenses/by/3.0/>)], via Wikimedia Commons

**A leaf being attacked by  
Spider Mites**

# 3.9.1.A: Spider Mites

## Identification:

- Spider Mites are tiny sap sucking plant pests
- They attack the underside of leaves
- Leaves may have yellow blotches and silvery look or streaks of bronze on leaf surface
- Other signs include distortion, deformation, wilting, spotting, streaking or discoloration on leaf surface
- Infestations are normally serious in drier months
- Extreme infestation leads to leaf drop



## 3.9.1.A: Spider Mites Cont'

### Control:

- Avoid planting next to infested fields
- Maintain field hygiene
- Avoid frequent use of broad-spectrum pesticides, in particular pyrethroids, this may lead to spider mite outbreaks
- Use overhead irrigation or wash plants with a strong jet of water to knock off mites and destroy their webs
- Use of natural enemies such as PHYTOTECH® (*Phytoseilus persimilis* (Predatory mite))

# 3.9.1.B: Weevils



**Weevil larvae in Amaranth stem & canker/hollowed stem due to Weevil larvae feeding**

## 3.9.1.B: Weevils

### Identification:

- Adult feeds on leaves & lays eggs in branch crotches
- The larvae bore through stems to the root collar hollowing the stems & causing rotting
- The stem boring weevil causes plants to wither & lodge
- Feeding of larvae result in stems that are more susceptible to wind breakage increasing crop losses
- The larvae pupate in the stem

### Control:

- Uproot and destroy attacked plants to reduce number of Weevils and prevent damage to healthy plants

# 3.9.1.C: Aphids



**A leaf infested by Aphids**

# 3.9.1.C: Aphids

## Identification :

- 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

## Symptoms:

- Aphids cause leaves to curl and become unattractive to customers
- Heavily infested plants usually have wrinkled leaves, stunted growth & deformed seeds
- Young plants may dry out & die under heavy aphid attack
- Heavy attack on older plants may cause crop loss by decreasing flower & seed production
- Damage may also reduce seed viability

## 3.9.1.C: Aphids Cont'

### Control:

- Field hygiene & constant scouting through removal and destruction of crop residue
- Use of insecticides; Lambda Cyhalothrin (KARATE 2.5 WG® PHI 3days), spot spraying is recommended
- Natural enemies (Parasitic Wasps)

# 3.9.1.D: Leaf Caterpillar



Photo: Alton N. Sparks, Jr., University of Georgia, Bugwood.org (CC BY-NC 3.0 US)



Photo: Mark Dreiling, Bugwood.org (CC BY-NC 3.0 US)

**A larva and an adult of leaf caterpillars**



## 3.9.1.D: Leaf Caterpillar

### Identification:

- Larva is greenish with white lines & black crescents on thorax
- Adult is small, black coloured, moth with slender body
- Wings are dark brown in colour with white wavy markings

### Symptoms:

- They web the leaves with silken threads & feed within
- Webbed leaves become devoid of chlorophyll & dry up



## 3.9.1.D: Leaf Caterpillar Cont'

### Control:

- Collect & destroy affected plant parts with caterpillars
- Spray with insecticides such as:
  - Lambda Cyhalothrin (KARATE 2.5 WG® PHI 3days)
  - Spinosad (TRACER 480 SC ® PHI 1day)

## 3.9.2 Major Diseases

- The following are the major diseases of Amaranth in Kenya:
  - a. Damping-off**
  - b. Choanephora Rot**

## 3.9.2.a: Damping-off



Photo: R.K. Jones, North Carolina State University, Bugwood.org  
(CC BY 3.0 US)

### Symptom of “Damping-off”

#### General Descriptions:

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

## 3.9.2.a: Damping-off

### Symptoms:

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

### Control:

- Avoid overwatering of seedlings in the nursery and dense sowing which cause damp conditions
- Use disease free seeds
- Keep nursery weed free
- Apply a drench of a fungicide to the nursery plants such as Metalaxyl-M-+ Mancozeb (AMIDIL 68WG® PHI 5days)

## 3.9.2.b: Choanephora Rot



Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org (CC BY 3.0 US)

## Choanephora Rot disease

## 3.9.2.b: Choanephora Rot

### General Descriptions:

- It is caused by fungus
- Infection is predisposed by injuries
- The disease is spread by air currents and infected seeds
- Warm, moist conditions favour disease development

### Symptoms:

- It causes wet rot of stems and leaves
- Affected plant parts have hairy appearance (silk-like threads) consisting of fungal spores
- During rainy season, it can cause heavy defoliation



## **3.9.2.b: Choanephora Rot Cont'**

### **Control:**

- Plant clean/certified, disease-free seeds
- Avoid dense planting to allow sufficient aeration
- Practice good field sanitation

# 4. Harvest

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

- **Maturity Period:** 6 weeks after transplanting, first harvest is at a plant height of 30 cm
- **Harvesting Methods:**
  - Plants may be harvested at once or leaves & tender shoots harvested several times
  - A single harvest is for short maturing & quick growing varieties like “***A. tricolor***”
  - Whole plants are pulled from soil with roots
  - With multiple harvests, young leaves & tender shoots are picked at 2 to 3 week interval
  - Frequent harvest prolongs the harvest period and delays onset of flowering
  - Harvest during cooler time of the day
- **Yields:** 12 tons per acre of fresh leaves

# 5. Post-Harvest Handling



**Amaranthus in a market**

# 5. Post-Harvest Handling

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

- Packed in clean well ventilated containers and transported in covered vehicles

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

- **Sorting:** Amaranthus are sorted to remove insects & yellow or damaged leaves
- Airing of the harvested leaves is done to remove field heat
- **Cleaning:** leaves should be thoroughly washed with portable water
- **Grading:** leaves are graded by size, bunched in the same size then tied in small bundles

# Reference

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# Reference

- Pest Control Product Registered for Use in Kenya 10th Edition, 2016
- The proposed agrochemicals are in accordance with “Products Registered for Use on Crops Version 1\_2018” by Pest Control Products Board. The registered agrochemicals are subject to change. Please refer to the latest registered agrochemicals by Pest Control Product Board.



*THANK YOU*  
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