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

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’

A. tricolor

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

A. dubius

[Image: Photo: G.J.H. Grubbens]


A. blitum

[Image: Photo: R.R. Schippers]

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

*Amaranthus hybridus*

Photo: By Bouba at French Wikipedia - photo by Bouba, CC BY-SA 3.0, [https://commons.wikimedia.org/w/index.php?curid=1644576](https://commons.wikimedia.org/w/index.php?curid=1644576)
## 1.3 Optimal Ecological Requirements

<table>
<thead>
<tr>
<th>Altitude</th>
<th>0 – 2,400 meter above sea level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall</td>
<td>At least 500 mm</td>
</tr>
<tr>
<td>Growing</td>
<td>22 – 30 °C</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
</tr>
<tr>
<td>Soils</td>
<td>• Well drained sandy or silty loam soils</td>
</tr>
<tr>
<td></td>
<td>• High organic matter content</td>
</tr>
<tr>
<td></td>
<td>• pH range 4.5 – 8.0</td>
</tr>
</tbody>
</table>
2. Pre-cultivation Preparation:

2.1 Market Survey

Conduct Market Survey

Source: SHEP PLUS
## 2.2 Crop Planting Calendar

### A Sample of Amaranth Planting Calendar

<table>
<thead>
<tr>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Preparation</td>
<td>Transplant 30 days after seed germination</td>
<td>Harvesting starts 6 weeks after transplanting</td>
<td>Peak demand for Amaranth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manure Application</td>
<td>Spacing 30 cm x 15 cm</td>
<td>Sorting, cleaning &amp; grading</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 – 8 tons/acre</td>
<td>Fertilizer application NPK 10-10-20 160 kg/acre</td>
<td>Yield: 12 tons/acre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sowing in nursery bed: 0.5 – 1.0g/m² of bed</td>
<td>Weed, pest &amp; disease control</td>
<td>Marketing</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 m² 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

Recently Transplanted Amaranth seedling

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

Amaranth Healthy plants

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

A leaf being attacked by Spider Mites

Source: 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
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

Photo: © A. M. Varela, icipe, Infonet Biovision (CC BY-NC-SA 3.0)
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

Photo: © Magnus Gammelgaard, Infonet Biovision (CC BY-NC-SA 3.0)
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

A larva and an adult of leaf caterpillars

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)
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 3 days)
  – Spinosad (TRACER 480 SC ® PHI 1 day)
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

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

Photo: R.K. Jones, North Carolina State University, Bugwood.org (CC BY 3.0 US)
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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  (https://extension.umd.edu/growit/choanephora-rot)
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  (http://www.shambashapeup.com/news)
Reference

- 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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DOMO ARIGATO

GOZAIMASU

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