Smallholder Horticulture Empowerment & Promotion Project for Local and Up-Scaling (SHEP PLUS)

“Changing Farmers’ Mindset from “Grow and Sell” to ”Grow to Sell””

WATERMELON 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

- Watermelon is a **warm season crop**
- Popular fruit for **fresh consumption** and **agro-processing**, such as juice making
- It contains about **6% sugar** and **92% water** by weight
- It is a source of **Potassium, Vitamin A, Vitamin C, Folate and Amino acid**. It contains some of the most important **antioxidants in nature**—e.g. **Lycopene**
1.2 Some Common Varieties

“Sugar Baby”
- Round dark green to black fruit with deep red flesh
- Very sweet and juicy
- Maturity Period: 120 days
- Average fruit weight: 4 kg
- Yield potential: 20 – 30 tons/acre

“Sukari F1”
- Early to medium
- Good fruit setting ability
- Fruits are oblong in shape
- Rind color: light green with dark green stripes
- Maturity Period: 90 days
- Average fruit weight: 7 – 8 kg
- Yield Potential: 25 – 35 tons/acre
- Has good transport and keeping qualities
1.3 Other varieties

• **Zuri F1**: has strong rind; resistant to *Fusarium* wilt.

• **Sweet Rose F1**: maturity 80-90 days, nearly round & good keeper

• **Charleston Grey**: light green strips & hard rind. It is *drought* resistant

• **Crimson Sweet**: resistant to root-knot nematode
1.4 Optimal Ecological Requirements

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<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Altitude</strong></td>
<td>0 – 1,500 metres above sea level</td>
</tr>
<tr>
<td><strong>Rainfall</strong></td>
<td>400 – 600 mm of rainfall annually</td>
</tr>
<tr>
<td><strong>Growing</strong></td>
<td>22 – 28 °C (day)</td>
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<td><strong>Temperature</strong></td>
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<tr>
<td><strong>Soils</strong></td>
<td>• Sandy loam</td>
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<td></td>
<td>• Well drained and slightly acidic</td>
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<td>• pH range 6.0 – 6.8</td>
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2. Pre-Cultivation Preparation:
2.1 Market Survey

Conducting a market survey on Watermelon
## 2.2 Crop Planting Calendar

### A Sample of a Watermelon Planting Calendar

<table>
<thead>
<tr>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
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</thead>
<tbody>
<tr>
<td>Land preparation</td>
<td>Sowing in field: 0.6 – 1.2 kg of seed/acre</td>
<td>Spacing 90 – 100 cm x 100 – 150 cm</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; top-dress 40 kg CAN per acre (10 g/hole = 2 bottle tops/hole)</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; top-dress 80 kg CAN per acre (20 g/hole = 4 bottle tops/hole)</td>
<td>Harvesting starts 80-120 days after sowing</td>
<td>Sorting &amp; grading</td>
<td>Peak demand for Watermelon</td>
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<td></td>
<td></td>
<td>Fertilizer (DSP) application 80 kg/acre (20 g/hole = 4 bottle tops/hole)</td>
<td>Weed, pests &amp; diseases control</td>
<td>Weed, pests &amp; diseases control</td>
<td>Yields 25,000 – 50,000kg Per acre</td>
<td>Marketing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manure application 8 tons/acre</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Weed, pest &amp; disease control</td>
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</tr>
</tbody>
</table>
Other 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 Planting

Seed Rate:
- About 0.6 – 1.2 kg per acre depending on variety and spacing
- Soak seeds overnight to hasten germination

3.4.1 Recommended Spacing (GHCP&PHHT20: Q10):
- 100 – 150 cm between rows
- 90 – 100 cm between plants
- Plant population: 2,666-4,444 plants per acre

3.4.2 Fertilizer Application Rates (GHCP&PHHT20: Q11):
- 80 kg per acre of TSP or DSP

Young watermelon plants
3.5 Water Requirement

(GHCP&PHHT20: Q12)

- Water deficit during flowering and fruit development causes serious yield reduction
- Irrigation is important to ensure consistent moisture availability e.g. 4-day interval
- Excessive irrigation causes splitting / cracking, tasteless and watery fruits

Drip Irrigation
3.6 Management of Weeds

A watermelon field with good weed management (left) and field with weeds (right)

Photos: SHEP PLUS
3.7 Top-dressing

(GHCP&PHHT20: Q14)

- CAN top dressing fertilizer is applied in 2 splits:
  - 1st split application: when the plants start to run (40 kg per acre)
  - 2nd split application: when plants are about to flower (80 kg per acre)

Top-dressing using the placement method
3.8 Crop Management:
3.8.1 Mulching

Mulching underneath fruit using organic materials

Photo: © Victor Omari, HCD 2019
3.8 Crop Management:
3.8.1 Mulching

- Mulching could be done using straw or dry leaves
- Its advantages include:
  - Moisture conservation
  - Weeds suppression
  - Prevents fruits from being in contact with soil and hence pest & disease attack
  - The fruits need to be turned regularly to ensure uniform fruit color development

Mulching underneath fruit using organic materials

Photo: © Victor Omari, HCD 2019
3.8.2 Pruning

- Remove any **dead**, **diseased**, **yellowing**, **infested** leaves or shoots at the joint where they are connect to the main stem
- Remove **deformed** and **blossom-end rot fruits**
- Maintain 2-3 vines and remove extra vines
- If market demands larger melons leave 3-4 well shaped melons per plant
- **Do not** prune when vines are wet

Control the number of fruits per plant if market demands larger fruits

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

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

  A. Melon Flies
  B. Aphids
  C. Spider Mites
  D. White Flies
  E. Epilachna Beetles
  F. Root-knot Nematodes
3.9.3.A: Melon Flies

Identification:

- Adult has a yellow stripe in the middle of the thorax between the wings
- A black (often incomplete) T-shaped marking on the abdomen (the rear body section)
- Additional dark patches towards the outer edge of the wings
- Head yellowish with black spots

Photo: SHEP PLUS
3.9.3.A: Melon Flies (1/2)

Damages:

- Larvae usually tunnel into the fruit causing a watery ooze to form on the surface that can later turn brown and resinous.
- Exit holes by the larvae (2 – 3 holes) are visible on fruit surface.
- Affected fruit will rot and often fall from the plant prematurely.
- Larvae can also feed on flowers and plant stems.

Photo: SHEP PLUS
3.9.3.A: Melon Flies (2/2)

Control:

• **Field Monitoring/ Biological control:**
  – Use of pheromone traps e.g.) **cue lure** baited traps, and **Bactrolure L®** (a.i. **Methyl Eugenol**) used together with Malathion

• **Cultural Control:**
  – Wrap fruits with a eco-bags
  – Remove fruits with dimples and oozing clear sap
  – Kill the maggots by burning, burying or tying collected fruits in black plastic bags

• **Chemical Control:**
  – Difficult since larvae feed inside the fruit
  – **Use of pesticides**, such as
    • Deltamethrin (Decis 2.5 EC®)
    • Trichlofon (Dipterex 95 SP®)
3.9.3.B: Aphids

Identification:
- Colonies of green to blackish aphids are found on tender shoots
- Excretion of honeydew

Damages:
- Attacked leaves are curled and twisted
- Sooty mould

Control:
- Ensure plants are not water stressed
- **Use of pesticides**, such as
  - Azadirachtin (Nimbecidine®)
  - Deltamethrin (Decis 2.5EC®)
  - Abamectine + Diomethosam (Summit®)
3.9.3.C: Spider Mites

**Identification:**
- Mites are tiny spider-like pests which spin silk threads for anchoring to the plant.
- Their bodies are yellow-green to reddish brown color.
- They flourish at **low humidity** and **high temperature** (hot dry conditions).
3.9.3.C: Spider Mites Cont’

Damage:
• Attacked leaves show white to yellow speckling
• Where there is high infestation, plant is covered with orange cloud of mites and webs

Control:
• Adequate irrigation
• Mulching to conserve water
• Predatory mite (Phytotech®)
• Spray with miticides, such as: Bifenthrin (Brigade 25EC®)
3.9.3.D: White Flies

Identification:
- Small soft bodied insects with wings covered with white powdery wax
- Presence of honeydew and sooty mould

Damage:
- Sucking sap
- Vector of viral diseases (Cucurbit Yellow Stunting Disorder)

Control:
- Use of pesticides such as:
  - Lamba-Cyhalothrin (Karate 2.5WG®)
  - Thiamethoxam (Actara 25WG®)
3.9.3.E: Epilachna Beetles

Identification:
- Adults resemble lady bird beetles

Damages:
- Feed on leaves leaving fine net of leaves
- Damaged leaves shrivel and dry up

Control:
- Spray with insecticides, such as
  - Deltamethrin (Decis 2.5EC®)
  - Lambda-cyhalothrin (Duduthrin Super EC®)

An Epilachna Beetle

Photo: © A. M. Varela, icipe (CC BY-NC-SA 3.0)
3.9.3.F: Root-knot Nematode

General Description:
- Most cucurbits are extremely susceptible to Root-knot Nematodes

Symptoms:
- Stunting, weak/unhealthy, premature wilting, and slow recovery to improved soil moisture conditions

Root-knot Nematode (Meloidogyne sp.) induced galling of Watermelon roots
3.9.3.F: Root-knot Nematode Cont’

Symptoms Cont’:

• Root symptoms cause swollen areas (galls) on the roots of infected plants which result from exposure to multiple and repeated infections

• Leaf chlorosis (yellowing)

Control:

• Cultural Control:
  – Crop rotation of less susceptible crops or resistant varieties
  – Use of adequate amount of manure
  – Use of resistant varieties e.g.) Crimson Sweet
  – Use of Ethoprophos (MOCAP GR10®), Azadirachtin (NIMBECIDINE EC®)
3.9.4 Major Diseases

- The following are the major diseases of Watermelon in Kenya:
  a. Powdery Mildew
  b. Anthracnose
  c. Downy Mildew
  d. Fusarium Wilt
  e. Gummy Stem Blight (Black Rot)
  f. Watermelon Mosaic Virus (WMV)
3.9.4.a: Powdery Mildew

General Descriptions:
- It is a fungal disease which is favoured by dry condition

Symptoms:
- White powdery growth start on lower leaf surface and later on the upper surface
- At advanced stage necrotic areas develop on the leaves

Control:
- **Use of fungicides**, such as
  - Sulphur (COSAVET DF®)
  - Famoxadime+Cymoxanil (EQUATION PRO®)
  - Azoxystrobin + Difenoconazole (AZOXY TOP 325 SC®)

Symptom of “Powdery Mildew”

Photo: Jason Brock, University of Georgia, Bugwood.org (CC BY 3.0 US)
3.9.4.b: Anthracnose

General Descriptions:
• This disease is caused by fungus and affects leaves, vines and fruits
• Plants can be infected at any stage

Symptoms:
• Round to angular reddish brown spots on older leaves
• Spots may dry, turn black and tear out
• Sunken spots on the rind of fruits which may produce pinkish colored ooze

Photo: Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org (CC BY 3.0 US)
Photo: Jason Brock, University of Georgia, Bugwood.org (CC BY 3.0 US)
3.9.4.b: Anthracnose Cont’

Control:
• Cultural Control:
  – Crop rotation
  – Plant clean seeds
• Chemical Control:
  – Use of fungicides, such as
    • Copper Oxychloride (Samaya Kop 50WP®) when vines start to run
    • Mancozeb (Dithane M45®)
    • Azoxystrobin + Difenoconazole (AZOXY TOP 325 SC®)
3.9.4.c: Downy Mildew

General Descriptions:

- Fungal disease which attacks leaves of Watermelon
- The pathogen is air borne

Downy Mildew on upper leaf surface
3.9.4.c: Downy Mildew Cont’

Symptoms:
- Small, irregular, chlorotic spots on upper leaf surface becoming brown and necrotic; entire leaf may become blighted
- Infected leaves tend to curl upward from the margins
- Gray to purple downy growth may be visible on underside

Control:
- **Cultural Control:**
  - Reduce canopy density
- **Chemical Control:**
  - Mancozeb (Mithane Super®, Penncozeb WP®)
  - Propineb + Cymoxanil (Milraz WP®)
  - Dimethomorph + Mancozeb (MILLIONAIRE 69% WDG®)
3.9.4.d: Fusarium Wilt

General Descriptions:
- It is a fungal disease which can infect crop at any stage of growth
- Pathogen can be spread by seed, soil or drainage water

Symptoms:
- Wilt symptoms develop from one or few runners
- Vascular tissue of lower stem and roots show brown coloration

Photo: Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org (CC BY 3.0 US)
3.9.4.d: Fusarium Wilt Cont’

Control:

- **Crop rotation**
- **Rouging/removal and destruction of diseased plants**
- **Plant in well drained soils and avoid water logging**
- **Use of certified seed**
- **Use of well decomposed manure and compost**

Stems and leaves affected by Fusarium Wilt

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org (CC BY 3.0 US)
3.9.4.e: Gummy Stem Blight (Black Rot)

General Description:
• The disease affects leaves, stem and fruits

Symptoms:
• Brown round or irregular lesions on leaves
• Lesions on stem are brown and later turn white
• Gum oozes from stem cracks
• Affected fruits are soft and discolored

Control:
Use of chemical, such as Copper Oxychloride (SAMAYA KOP 50WP®, COBOX 50WP®, ISACOP®)
3.9.4.f: Watermelon Mosaic Virus (WMV)

General Descriptions:
• This disease is transmitted by **aphids**
• It infects **only cucurbit crops**

Symptoms:
• **Mottling of leaves**
• Stunted growth, shortened internodes with bushy erect growth for some runner tips
• **Mottled appearance** on fruit surface

Control:
• **Field sanitation**: removal of weeds (they are potential hosts)
• Control aphids
4. Harvest

A farmer and his harvested watermelon

Photo: SHEP PLUS
4. Harvest

4.1 Harvesting Indices (GHCP&PHHT20: Q17)

- **Tendrils** near **fruit stem** have changed color from green to brown
- **Ground spot** on the **belly** of the melon has changed from white to **yellow**
- The fruits when thumped with the hand produce muffled **dull tone** (immature fruits produce clear metallic ringing tone)
- Cut and leave the stalk attached to the fruit
- Mature fruits have sweet taste, flavor, crisp texture and deep red color
- **Sugar content** (measured as soluble solids by use of hand held refractometer) of **10 %** or more in the flesh near the center of the melon

**Main harvesting stages:**

- Mature but before full ripeness for distant markets
- Mature and ripe for nearby markets
4. Harvest Cont’

Notes:

• Watermelons don’t ripen after they are picked so harvest time is important (non climacteric)
• If harvested immature, red color will develop but sugar content does not increase after harvest
• Harvesting should be done by cutting the vine and NOT pulling, twisting or breaking off the vines

Yields: 25,000 – 50,000kg per acre (Depending on varieties)
Choose appropriate post harvest handling methods
5. Post-Harvest Handling Cont’

Sorting and Grading

- Watermelons are sorted to remove insect-damaged, **blossom-end rot**, cracked, discolored, without stalk
- Watermelons are graded according to size (small, medium & large) for each variety
5. Post-Harvest Handling Cont’
Packaging, Storage & Transportation

• Graded watermelons are packed in large containers or cartons
• Watermelon can be stored for two (2) weeks.
• But prolonged storage leads to lose of crispness and color
• Vehicles for transportation should be straw or paper-padded to reduce damage through bruising
Reference

• The proposed agrochemicals are in accordance with “Products Registered for Use on Crops Version 1_2018”. The registered agrochemicals are subject to change. Please refer to the latest registered agrochemicals by Pest Control Product Board.

• Infonet Biovision

• http://www.infonet-biovision.org/PlantHealth/Crops/Watermelon

• http://www.greenlife.co.ke
THANK YOU

ASANTE SANA

DOMO ARIGATO

GOZAIMASU

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