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""

CAPSICUM 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

Capsicum

(Pili Pili Hoho/ Pili Pili Mboga)

- Capsicum belongs to ***solanaceae*** family.
- It has **a mild flavor, not hot**
- It is rich in **Vitamin A** and **C**
- It also has **nutritive elements** such as **Potassium** and **Phosphorus**
- Its fruits are consumed **fresh**, **dried** or in **processed** form as table vegetable or spice
- Is eaten raw in salads or cooked in food seasonings

1.2 Some Common Varieties

There are two main types: determinate (open field) and Indeterminate (greenhouse) varieties.

- **Determinate** varieties: are bushy with defined growth and development period. Examples include **Yolo** Wonder and **California** Wonder
- **Indeterminate** varieties: achieve growth through single apical stem with few secondary branches. Examples **Commandant F1**, **Admiral F1**, **Nemalite F1**, **Green Bell F1**

1.2 Some Common Varieties Cont'

"California Wonder"

Photo: http://www.burpee.com/vegetables/peppers/pepper-sweet-california-wonder-prod000825.html

- The following are the common varieties grown in Kenya

"California Wonder":

- Suitable for home and market gardening
- Fruits are **thick walled**, **4 lobed**, **blocky** and **compact**
- **Yield: 6,000kg per acre**

"Yolo Wonder"

Photo: http://www.neseed.com/Pepper-Seeds-Yolo-Wonder-p/32400.htm

"Yolo Wonder":

- A popular variety for **export** and **local market**
- Fruits are **shiny dark green**, **3 – 4 lobed**, **firm** and **blocky**
- It is **vigorous**, **compact** and **high yielding**
- **Yield: 6,000kg per acre**

1.2 Some Common Varieties Cont'

"Commandant F1":

- Can be grown in **open field** and **greenhouse**
- Has **resistance** to Potato virus, Tomato mosaic and Tobacco mosaic, pepper mild mottle and bacterial spot
- Has long harvesting period: **10 weeks** and **4-6 months** for open field & greenhouse, respectively
- Fruits can be harvested green (75 days) or red (90 days)
- Yield: **25,000kg-30,000kg** per acre (open field), **50,000-60,000kg** per acre (green house)

"Admiral F1":

- Can be grown in **open field** and **greenhouse**
- Has **similar** characteristics to **Commandant F1**
- Fruits can be harvested green (75 days) or yellow (90 days)
- Yield: **25,000-30,000kg** per acre (**open field**), **50,000-60,000kg** per acre (**green house**)

1.3 Optimal Ecological Requirements

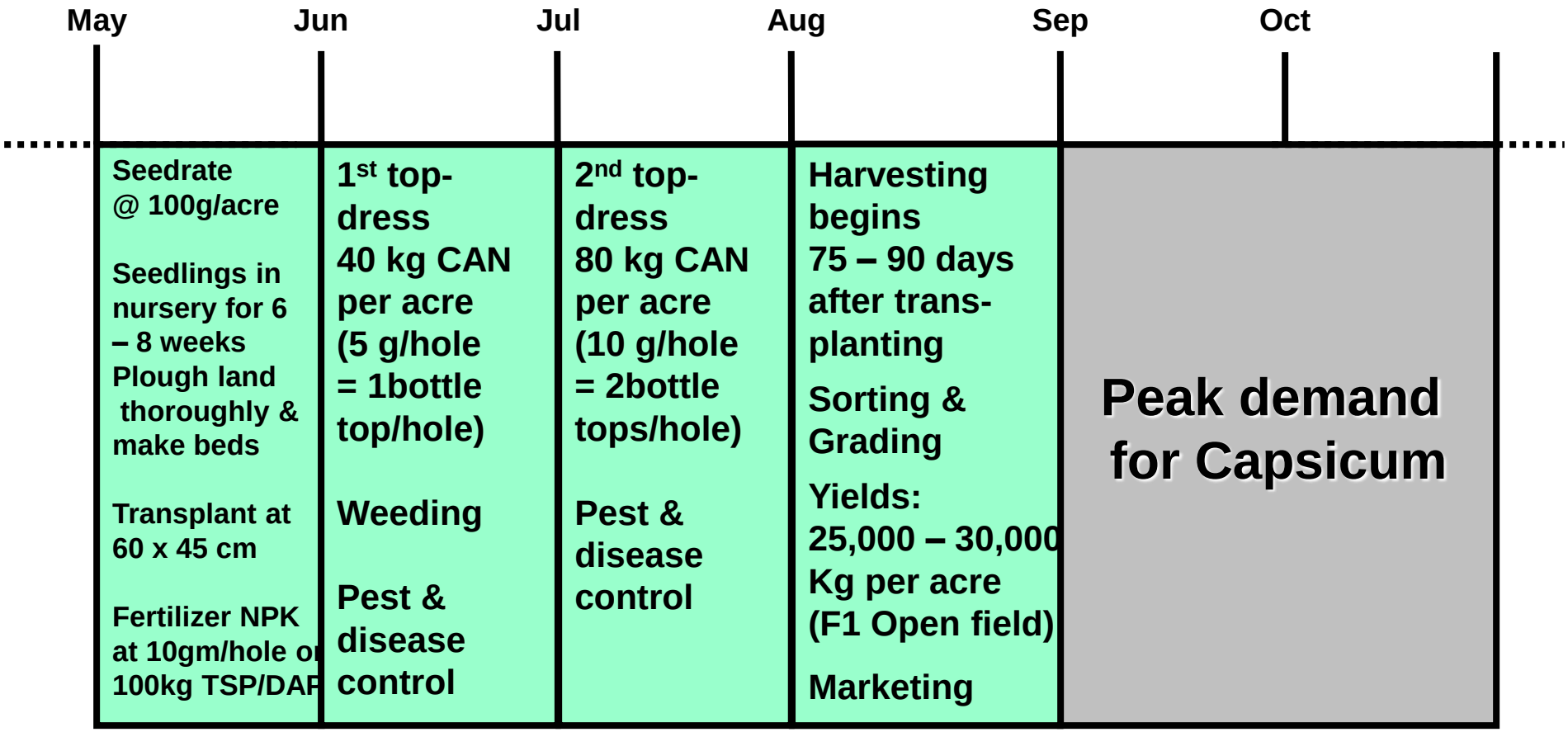
Altitude	**0 – 2,000 metres above sea level**
Rainfall	**600 – 1,200 mm of rainfall annually**
Growing Temperature	**18 – 30 ^{0}C**
Soils	**•Well-drained loamy soils** **•pH 5.5 – 6.8** **•High organic matter**

2. Pre-Cultivation Preparation:
2.1 Market Survey

Carrying out a market survey on Capsicum

2.2 Crop Planting Calendar

A Sample of a Capsicum 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

Photo: SHEP PLUS

Raising seedlings in nursery beds

3.4 Raising Seedlings

- Capsicum is normally raised in nursery & transplanted but it can also be directly sown
- It can also be raised on seed trays for improved germination
- Seed Rate: **100g per acre**

Nursery Site Selection:

- The nursery should be sited in a plot that has not been planted with a member of ***Solanaceae*** **family** for the last **3 years**
- The nursery site should be well drained

Nursery Establishment:

- Prepare a nursery bed of **1 m width** and of a convenient length
- Make drills on the seedbed at a spacing of **10 – 20 cm apart**
- Thinly sow the seeds in the drills and cover lightly with soil
- Water the nursery regularly
- Prepare shade and cover with organic materials such as dry grass
- The shade protects young seedlings from exposure to sun

3.4 Raising Seedlings

Management of Nursery:

- Water the nursery regularly
- Harden the seedlings **1 – 2 weeks before transplanting** by reducing the frequency of watering and gradually exposing the seedlings to direct sunlight
- Control of whiteflies is important since they transmit viruses to young Capsicum plants
- These insects can be blocked from reaching the seedlings by using **an insect proof net**

3.5 Transplanting

Photo: SHEP PLUS

Transplanted Capsicum plants in the field

3.5 Transplanting

3.5.1 Appropriate Time

- Seedlings are transplanted out in the field **at the 4 – 6 true leaf stage**, usually **6 – 8 weeks after sowing**
- Hardy transplants can be produced by restricting water and removing shade protection **1 week before transplanting**
- It is recommended that transplanting should be done either **early in the morning** or **late in the evening**

3.5.2 Recommended Spacing (GHCP&PHHT20: Q10)

- **Plant Spacing: 60 cm × 45 cm** or **70 cm × 30 cm** depending on the variety
- **Plant Population per Acre:** range from **14,814** to **19,047**
- Appropriate spacing produces short sturdy plants with good root system

3.5.3 Fertilizer Application Rates (GHCP&PHHT20: Q11)

- The type of fertilizer and amount needed depend on **soil analysis** results
- Apply **100 kg per acre** of DSP/TSP during transplanting
- The fertilizer should be mixed thoroughly with the soil

3.6 Water Requirement

Photo: SHEP PLUS

Drip Irrigation

3.7 Managing Weeds

Photo: SHEP PLUS

Mulching done to control weeds

3.8 Top-dressing

(GHCP&PHHT20: Q14)

- Capsicum crop should be top-dressed with organic and inorganic/chemical fertilizers to produce high yields
- The type and quantity of fertilizer depend on soil analysis

[General recommendation]

- **1st top-dressing** is done with **40 kg per acre** of **CAN 2 – 3 weeks** after transplanting
- **2nd top-dressing** is done with **80 kg per acre** of **CAN 4 – 6 weeks** after transplanting
- During flowering high amounts of nitrogenous fertilizer should be avoided

3.9 Crop Management
3.9.1 Training & Staking

Photo: Darbie Granberry, University of Georgia, Bugwood.org (CC BY 3.0 US)

Well trained & staked Capsicum field

3.9 Crop Management
3.9.1 Training & Staking

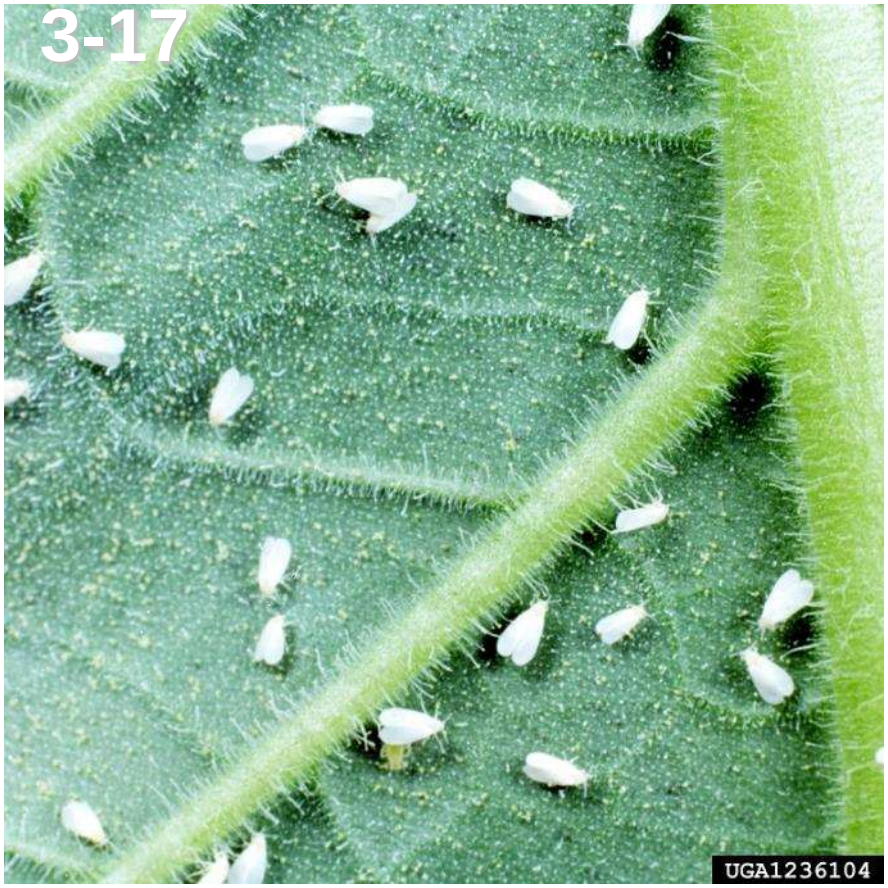
- **Staking** keeps the plants upright and also keep the fruit away from the soil
- Staking materials: **Wood stakes**, **bamboo** or any **sturdy material**
- **Strings, plastic strips** or other material can be used for **training** the plant to the stake
- It keeps the canopy intact, thus preventing sunscald on the fruit
- It also prevents the plant from splitting during a heavy fruit load
- Staking can help minimize lodging

3.10.3 Major Pests

- Pest damages cause a reduction in quality and quantity of produce
- The following are the major pests of Capsicum in Kenya:

A. White Fly
B. Root-Knot Nematode
C. Aphid
D. Cutworm
E. Spider Mite
F. Fruit Borer
G. Leaf Miner
H. Thrips

3.10.3.A: White Fly



White Flies on a leaf

3.10.3.A: White Fly

Identification :

- Whiteflies are **soft-bodied**, **winged insects** closely related to aphids
- They can be as small as 1/12 of an inch, and are often found in **clusters on the undersides of leaves**
- They are **active during daytime**
- Whiteflies are **capable of overwintering** and reproducing throughout the year **in warmer climates**

Damages:

- Whitefly immature stages (nymphs) and adults suck sap from leaves producing **chlorotic spots on infested leaves**
- Nymphs excrete **a clear sugary liquid** known as **honeydew**, which proliferates the growth of a **black sooty mould** affecting photosynthesis
- Whiteflies are **vectors of important viral diseases**, such as **Chili Leaf Curl**

3.10.3.A: White Fly

Control:

- Keep the seedlings protected under **a fine meshed insect netting** until they are ready for transplanting
- Make sure the netting is always properly closed
- **Use of traps:** Yellow sticky traps
- **Conserve natural enemies:** Parasitic Wasps, Predatory Mites, Ladybird & Lacewings
- **Spray with insecticides**, such as:
  - Lambdacyhalothrin 106g/L + Thiamethoxam 141g/L (**LEXUS 247 SC**)

3.10.3.A: Root-knot Nematode

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

Symptom of “Root-knot Nematode” on roots

3.10.3.A: Root-knot Nematode

- Nematodes are **soil inhabitants** easily spread by infested seedlings, soil washed down the slopes or by implements
- Root–knot Nematodes are most serious on **light sandy soils**

Identification:

- **Small lumps** or **galls** develop on the infested roots
- The galls on Capsicum are much smaller than those on cucurbits or Tomato

Damages:

- **Wilting** of plants
- The plant roots can be seen to be **distorted**, **swollen** and bearing **galls** (**knots**)
- The infested roots eventually **rot** and **affected plants die**

Control:

- **Crop rotation**
- Mixed cropping with **African Marigold**
- Maintaining **high levels of organic matter** in the soil
- Use some bio products e.g.) **Neem extracts (Nimbecidine®, Achook EC®)**

3.10.3.B: Aphid

Photo: Whitney Cranshaw, Colorado State University, Bugwood.org (CC BY 3.0 US)

Aphids on a leaf

3.10.3.B: Aphid

Identification:

- Aphids occur in **colonies** initially around tender plant parts and on the lower leaf surface
- When numerous, they can be found on all above ground parts of the plant

Damages:

- Aphids damage plants by sucking their sap, excreting **a sticky substance** (**honeydew**) that coats the plants, or/and by **transmitting viral diseases**
- **Curling**, **wrinkling**, or **cupping** of young leaves, **chlorotic spotting**, **mottling of older leaves**, **stunting** and **wilting** of plants
- Growth of sooty mould on honeydew excreted by aphids reduces photosynthesis and **affects fruit quality**

Control:

- **Naturally controlled by predators**, such as ladybird beetles, hoverflies, anthocorid bugs, spiders, lacewings and fungal diseases
- Indigenous natural enemy
  - Parasitic wasp (Aphitech®)
- **Spray with insecticides**, such as **Acetamiprid (Presento 200SP®)**

3.10.3.C: Cutworm

Photo: John C. French Sr., Retired, Universities:Auburn, GA, Clemson and U of MO, Bugwood.org (CC BY 3.0 US)

A Cutworm larva

3.10.3.C: Cutworm

- Cutworms are **the caterpillars of various moths**
- They drop to the soil where they live until pupation
- They hide during the day in the soil around the base of the plants and climb into plants **at night**

Damages:

- Young caterpillars feed on leaves making **small holes**
- **Cutting stems of young seedlings** at the level of the soil

Control:

- **Eliminate weeds early** well before transplanting
- **Plough and harrow the field** to expose Cutworms to natural enemies and desiccation **3 – 4 weeks** before transplanting is done
- Dig near damaged seedlings and destroy them
- **Conserve natural enemies: Parasitic wasps** and **ants** are important in natural control of Cutworms
- Application of **Azadirachtin 0.03% (NIMBECIDINE EC)** and **Imidacloprid 17.8% (TATA MIDA 200SL)**

3.10.3.E: Spider Mite

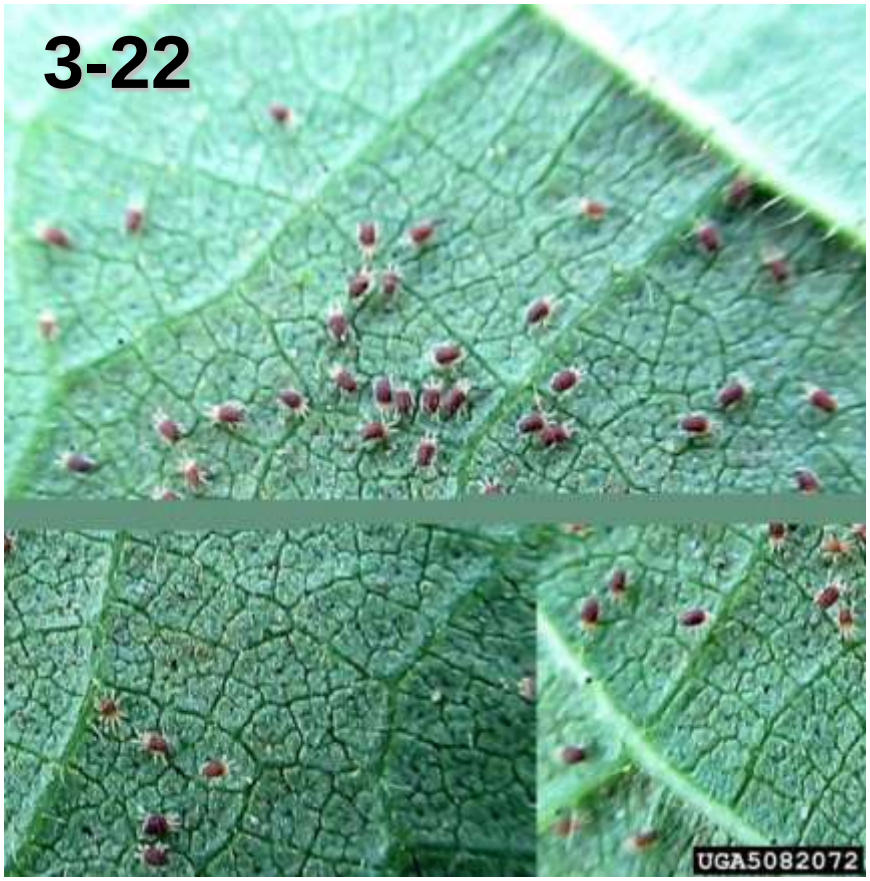


Photo: O.P. Sharma, Bugwood.org (CC BY 3.0 US)

Spider mites on a leaf

3.10.3.E: Spider Mite

Identification:

- Adults are **oval** and have **eight legs**
- They are **very tiny** (0.5 mm) resembling **tiny moving dots**
- They **vary in colour** depending on the species
- Many of the species are bright red in colour, others are yellowish, greenish, pinkish, orangish or reddish
- The Two-spotted Spider Mite has **a large dark blotch** on each side of the body

Damages:

- Spider Mites suck the sap of the plants, **causing mottling of the upper leaf surface**
- Infested leaves first show **a white to yellowing speckling**, and then eventually **turn bronze** and **fall off** as the infestation becomes heavy
- Spider Mites prefer **the lower surface of the leaves**, but in severe infestations occur on both leaf surfaces as well as on stems and fruits
- High infestations cause **defoliation**

3.10.3.E: Spider Mite

Control:

- **Field hygiene** is important for the management of Spider Mites
- **Conserve natural enemies**, such as **Predatory Mites**
- Chemical sprays using **miticides**, such as
  - **Oxydemeton-Methyl (Hattrick EC®)**
  - **Predatory mite (AMBLYTECH®, PHYTOTECH®)**

3.10.3.F: Fruit Borer

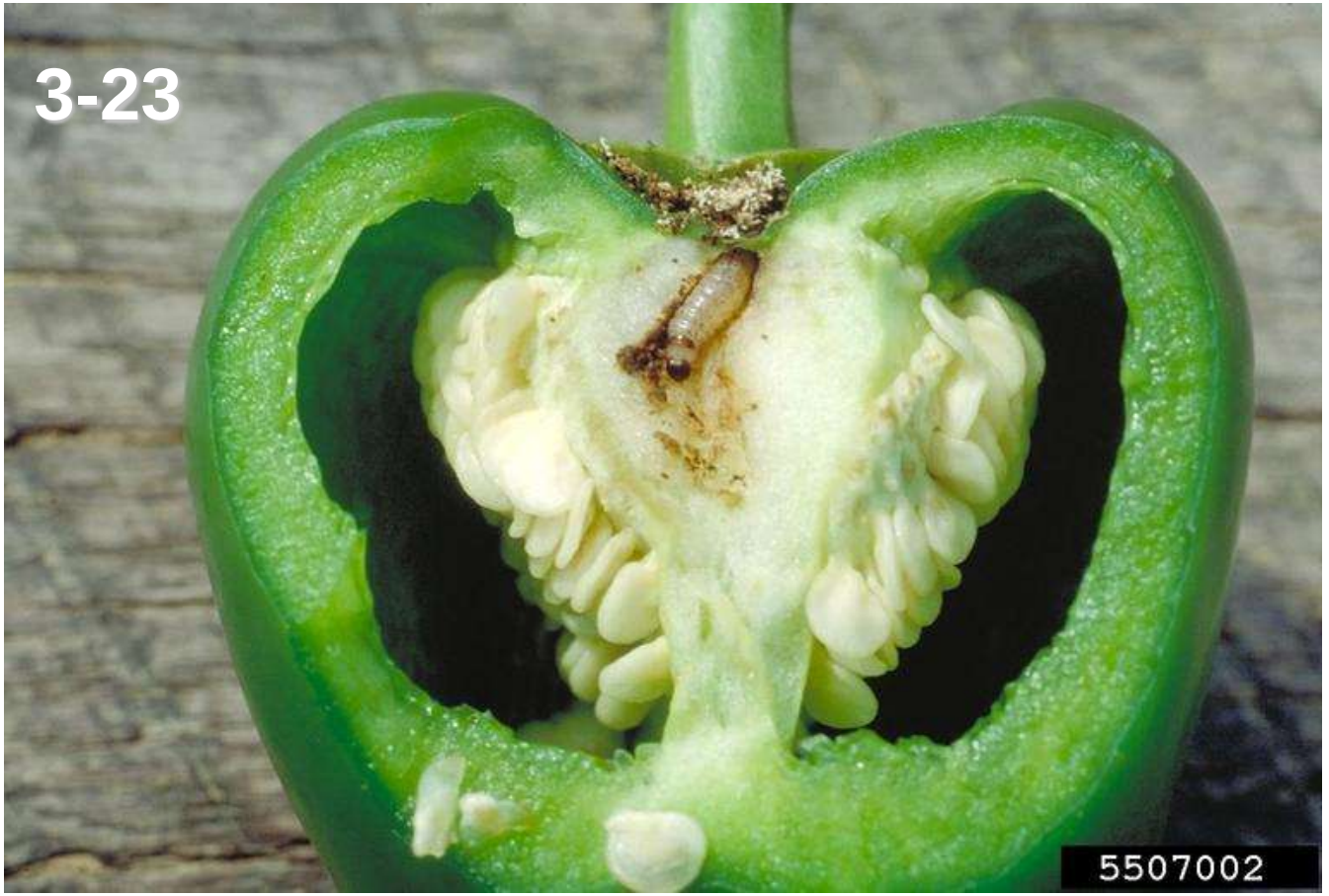


Photo: Phil Sloderbeck, Kansas State University, Bugwood.org (CC BY 3.0 US)

Fruit Borer larvae in a capsicum fruit

3.10.3.F: Fruit Borer

Identification:

- Fruits Borers (Bollworms) are **about 2 – 3.5 cm long**
- Moths are active at dusk and at night
- Moths of Fruit Borers, **feed on nectar** and **lay eggs on leaves**

Damages:

- Some species feed on leaves causing **defoliation** and **slow plant growth**
- Attack on flower buds results in **flower abortion**
- Caterpillars usually bore holes in fruits, causing **extensive damage** and **promoting decay** from secondary infection by diseases

3.10.3.F: Fruit Borer

Control:

- Check the crop regularly (**scouting**)
- **Plough the soil before planting**
- Handpick and destroy damaged fruits, eggs and caterpillars
- **Conserve natural enemies:** Parasitic wasps, ants, pirate bugs etc.
- Scouting the crop in order to detect eggs or larvae before they bore into the fruit
- **Use trap crops**, such as tasseling maize for oviposition by adult females
- Use bio-pesticides, such as **Bacillus thuringinesis (Bt)**, **neem products** or other plant extracts
- Spray **insecticides**, such as
  - **Lambda Cyhalothrin (Karate 2.5 WG®)**

3.10.3.G: Leaf Miner

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

Leaves infested by Leaf Miner

3.10.3.G: Leaf Miner

Identification :

- Female flies make **numerous small**, **whitish tunnels (mines)** on the foliage when feeding and depositing eggs
- Full-grown maggots come out of the mines to pupate in the soil beneath the plants or on the foliage, and maggots are **the most destructive stage**

Damages:

- The females lay eggs that hatch into **tiny yellow maggots** which feed on leaf tissues leaving **a wandering track** (**whitish tunnels**) known as **mines**
- The mines may **reduce photosynthetic activity**, affecting development of flowers and fruits
- These tunnels can serve as **entry points** for disease-causing organisms
- Completely mined leaves might **dry up** and **fall off prematurely**
- Wilting of plants leading to **fruit sunscald**, **death of the young plants** and **yield loss**

3.10.3.G: Leaf Miner

Control:

- **Ploughing and solarization** can help in exposing pupae to desiccation and natural enemies
- Conserve **natural enemies**
- **Neem products** are effective for controlling Leafminers
- Use of Systemic chemicals and observe PHI
- **Spray insecticides**, such as:
  - **Thiocyclam (EVISECT S®)**
  - **Spinosad (TRACER 480SC®)**

3.10.3.H: Thrips

Photo: Andrew Derksen, USDA-APHIS, Bugwood.org (CC BY 3.0 US)

Photo: Bruce Watt, University of Maine, Bugwood.org (CC BY 3.0 US)

Thrips and damage on Capsicum leaves

3.10.3.H: Thrips

Identification:

- Often concealed **under the calyx**
- Thrips usually feed on all above ground parts of plants preferring **the underside of young leaves**, **flowers** and **fruits**

Damages:

- Thrips puncture leaves and suck the exuding sap
- At the initial stage of infestation, leaves have a **silvery sheen** and show **small**, **dark spots of faecal material** on the underside
- Later leaves **curl upward**, **wrinkle** and finally **dry up** leading to fruit sunscald
- Damaged leaves, buds and fruits turn **rusty in colour**
- **Wilting**, **retardation of leaf development** and **distortion of young shoots** resulting in stunted plants
- Attack on fruits causes **deformation** and **scarring** of the fruits
- Thrips transmit the **Tomato Spotted Wilt virus** and **Leaf Curl disease**

3.10.3.H: Thrips

Control:

- **Conserve natural enemies**, such as **Anthocorid Bugs**, **Predatory Mites** and **Spiders**
- **Spray insecticides**, such as
  - **Spinosad (Tracer 480 SC®)**
  - **Thiocyclam (EVISECT S®)**

3.10.4 Major Diseases

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

a. Damping-off
b. Anthracnose
c. Leaf Spot
d. Fusarium Wilt
e. Powdery Mildew
f. Viral Diseases
g. Bacterial Soft Rot
h. Bacterial Wilt
i. Blossom End Rot

3.10.4.a: Damping-off

Photo: © A. A. Seif & B. Nyambo, icipe (CC BY-NC-SA 3.0)
http://www.infonet-biovision.org/PlantHealth/Pests/Damping-diseases

Capsicum seedlings showing symptoms of Damping-off

3.10.4.a: Damping-off

General Descriptions:

- This disease is **soil borne** caused by fungi
- There are **2 two types** of Damping-off:
  - Seedlings fail to emerge (**Pre-emergence Damping-off**)
  - Small seedlings collapse (**Post-emergence Damping-off**)

Symptoms:

- Seedlings are **stunted** through **root rot** and/or **collar rot**
- Nursery beds show **irregular patches**
- **Leaves:** lesions, abnormal colours, abnormal forms, wilting, fungal growth
- **Roots:** lesions
- **Seeds:** rot, discolorations
- **Stems:** external discoloration, canker, abnormal growth, mycelium visible
- **Whole plant:** plant death, dieback, damping-off

3.10.4.a: Damping-off

Control:

- Growing certified disease-free seed
- Nursery beds be located on **well drained sites**, not previously under vegetable production
- **Proper watering regime**
- Use of **appropriate fungicides** as spray or soil drench, such as **Metalaxyl + Mancozeb (AMIDIL 68WG®)**

3.10.4.b: Anthracnose

Capsicum fruit affected by Anthracnose

3.10.4.b: Anthracnose

General Descriptions:

- **Anthracnose** is caused by *Colletotrichum spp*.
- Spores dispersed by **water-splash**, **air currents**, **insects** or **other forms of contact**
- **Transmitted through seed**, but also through **infected plant parts**
- Persists on and in the **seed**, **crop residues**, and **weed hosts**

Symptoms:

- **Dark**, **sunken spots** up to **2.5 cm** across on Capsicum
- The **spots** on green and ripe fruit surface may be covered with s**almon-pink** mass of spores in moist weather

Control:

- Use **certified** disease-free seeds
- **Practice field sanitation** (removal of crop debris after harvest)
- Application of **registered fungicides**, such as
  - **Propineb (ANTRACOL WP 70®)**

3.10.4.c: Leaf Spot

Cercospora Leaf Spot symptoms on a leaf

3.10.4.c: Leaf Spot

General Descriptions:

- The fungus survives **on seeds** and **in crop debris**
- The disease is favoured by **prolonged periods of wetness**

Symptoms:

- **Spots on leaves** are **brown** and **circular** with small to large light grey centres and **dark brown margins**
- **Spots on stems**, **petioles** and **peduncles** are typically elliptical with same characteristic colour

Control:

- Use **certified seeds**
- **Maintain adequate soil moisture**, especially **at fruit development stages**
- **Carry out soil liming** in calcium deficient soils
- **Top-dress with Calcium Nitrate (CN)** and ensure adequate soil moisture
- Practice **field sanitation**
- **Spray the crop with calcium chloride, Mancozeb (Dithane M45WP®)**

3.10.4.d: Fusarium Wilt

Fusarium Wilt on plants in the field

3.10.4.d: Fusarium Wilt

General Descriptions:

- The fungus lives **indefinitely in the soil**
- It is spread by **irrigation water**
- It is very susceptible to changes in temperature and soil moisture
- It is serious **in poorly drained fields**

Symptoms:

- **Dropping** and **yellowing** of lower leaves followed by **wilting** of the entire plant
- Leaves on infected plants remain attached and the vascular system of the plant is discoloured, particularly in the lower stem and roots

Control:

- Crop rotation
- **Lime the soil** (soil pH 7.0 – 7.5 reduces Fusarium wilt disease)
- Ensure the soil has **a good drainage**

3.10.4.e: Powdery Mildew

Leaves showing the initial sporulation

3.10.4.e: Powdery Mildew

General Descriptions:

- The disease is caused by **a fungus**
- It is favoured by **warm**, **humid** and **dry weather**

Symptoms:

- **Yellowish blotches or spots** appear on the lower leaf surface, and **a white to grey powdery fungal** growth on **underside of the leaves**
- The disease progresses **from the older to younger leaves** shedding the foliage
- Leaf defoliation leads to **reduction in size and number of fruits**

Control:

- **Remove and destroy crop debris** after harvest
- Apply **preventive fungicides**, such as
  - **Sulphur (Cosavet DF®)**

3.10.4.f: Viral Diseases

Photo: Florida Division of Plant Industry , Florida Department of Agriculture and Consumer Services, Bugwood.org (CC BY 3.0 US)

Cucumber Mosaic Virus infection

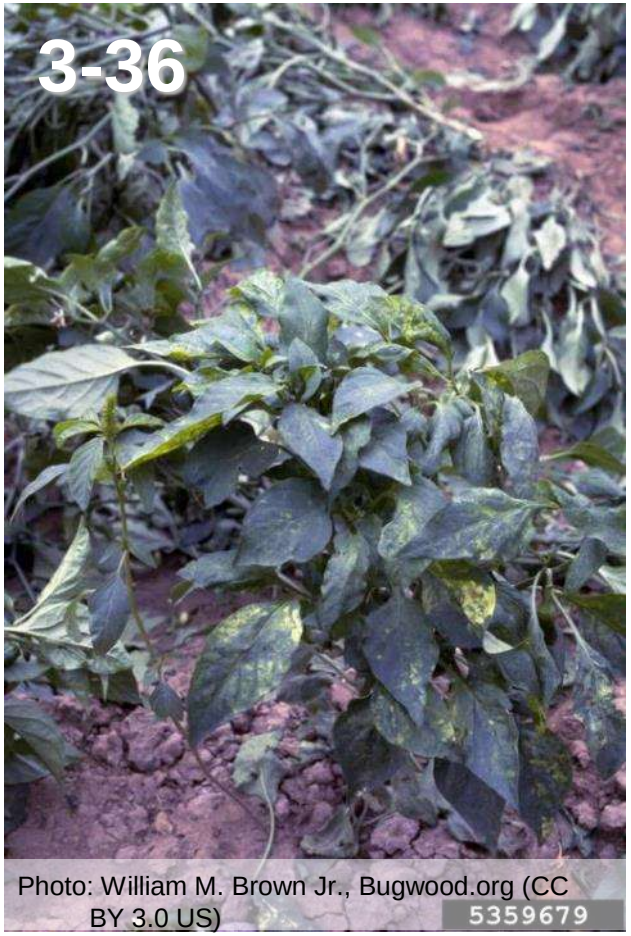


Photo: William M. Brown Jr., Bugwood.org (CC BY 3.0 US)

Alfalfa Mosaic virus infection

3.10.4.f: Viral Diseases

General Descriptions:

- **Cucumber Mosaic Virus (CMV)** is the most important world wide
- Other viral diseases include **Alfalfa Mosaic Virus (AMV)**, **Tobacco Mosaic Virus (TMV)**, **Tomato Spotted Wilt Virus (TSWV)**, **Pepper Mottle Virus (PeMV)**, **Potato Virus Y (PVY)**, **Tobacco Etch Virus (TEV)**
- Most of these viruses are **transmitted by insects such as aphids**, **infected seed** and **a few mechanically**

Symptoms:

- Difficult to firmly diagnose by symptoms as they can be altered by factors like **cultivar**, **age of host plant**, **environmental conditions**, **host plant nutrition** and **viral strains**, not to mention the occurrence of virus mixtures
- Some symptoms are; **mosaic patterns on leaves**, **yellowing**, **ring spots**, **leaf deformation** or **distortion**, **curling of leaves**, and/or **stunting of plants**
- Also, **reduction of fruit size**, **distortion**, and/or **ring patterns** could be seen

3.10.4.f: Viral Diseases

Control:

- **Rogue out and burn affected plant (including alternative hosts) immediately**
- **Use barrier crops** to minimize virus spread
- **Use oil sprays** to reduce virus transmission by **Aphids**
- **Use reflective mulches (silver colored)** to repel **Aphids** and **Thrips**
- **Field hygiene** & **Crop rotation**
- **Control** the insect **vectors**
- Use certified seeds

3.10.4.g: Bacterial Soft Rot

Photo: © Marita Cantwell, UC Davis vegetable Produce facts English. Bell Pepper : Recommendations for Maintaining Postharvest Quality. http://postharvest.ucdavis.edu/Commodity_Resources/Fact_Sheets/Datastores/Vegetables_English/?uid=5&ds=799 (Accessed on March 20, 2019)

Bacterial Soft Rot on a Capsicum fruits

3.10.4.g: Bacterial Soft Rot

General Descriptions:

- The bacteria are **soil-borne**
- Soft Rot is primarily **a post-harvest problem**
- The disease is **serious during rainy periods** because the bacteria are splashed from the soil onto the fruit, which are more susceptible due to their high moisture content
- The disease begins in the **peduncle** and **calyx tissues** of harvested fruit

Symptoms:

- Fruit infected on the plant **collapses** and **hangs on the plant** like **a water-filled bag**
- When the contents leak out, a dry shell of the fruit remains

Control:

- **Crop rotation** with pulses and cereals
- **Control of insects** that cause injury to fruits
- **Post-harvest decay** can be reduced by harvesting fruits when dry
- **Minimize injury** during handling
- **Store** at **cool** temperatures

3.10.4.h: Bacterial Wilt

Photo: © (c) A.M. Varela, icipehttp://www.infonet-biovision.org/PlantHealth/Crops/Peppers#simple-table-of-contents-3

Bacterial Wilt symptoms on Capsicum plants

3.10.4.h: Bacterial Wilt

General Descriptions:

- The bacteria attack **a wide range of crops,** solanaceous weeds and **can survive in the soil for long periods**
- It is favoured by **wet**, **warm conditions**
- Cross sectional cut from roots and lower stems of diseased plants exude **milky streams of bacteria** from the vascular system when suspended in water

Symptoms:

- **Wilting of the entire plant** with no leaf yellowing

Control:

- **Rogueing of infected plants**
- **Control Root-knot Nematodes** since they could facilitate infection and spread of **Bacterial Wilt**
- **Soil amendments** (organic manures)
- **Crop rotation** to avoid continuous planting of Solanaceous crops
- **Proper irrigation management**

3.10.4.i: Blossom End Rot

Photo: Paul Bachi, University of Kentucky Research and Education Center, Bugwood.org (CC BY 3.0 US)

Advanced Blossom End Rot symptoms on Capsicum fruits

3.10.4.i: Blossom End Rot

Symptoms:

- The end of the fruit becomes **off-whitish** to **brown in colour** and takes on a **“sunken” appearance**
- As the fruit matures, these symptoms become **more pronounced** and the colour of the rot becomes **dark brown** to almost black

Control:

- Boost the soil with calcium by adding **lime**, **Calcium Nitrate**, **dolomite**, **gypsum** or **composted animal manures** before planting the seedlings
- **Water regularly:** Capsicums continue to flower and bear fruit for prolonged periods of time, so ensure the soil around their roots is kept moist
- **Avoid fertilizers with a high nitrogen content:** Nitrogen fertilizers will promote leaf growth at the expense of fruit, allocating calcium to the leaves instead of to the fruit

4. Harvest

4.1 Harvesting Indices (GHCP&PHHT20: Q17)

- Maturity period ranges between **2 – 3 months** after transplanting
- Capsicum fruits can be harvested when they are **harvestable-green or when they have developed full color**
- Green fruits are incapable of ripening after removal from the plant
- The right stage for coloured fruit is when they have reached **full colour**, **filled out**, **still firm**, **sticky** and **thick walled**

Harvesting Method:

- Since Capsicums have soft pliable thin flesh, **care should be taken during harvesting**
- Use clean **knife** or **scissors** to harvest the fruits
- Fruits should be harvested **early in the morning** when it is cool since the fruit temperature is low
- Harvested fruits should be kept in a **cool**, **shaded** and **ventilated area** in order to minimize heat gain
- **Yield: 6,000kg peracre** (OPV), **25,000–30,000kg per acre** (F1) open field and **50,000–60,000 per acre** (F1) greenhouse depending on the variety and crop husbandry

5. Post-Harvest Handling

Photo: SHEP PLUS

Harvested Capsicums

5. Post-Harvest Handling

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

- Harvested Capsicum peppers are packed into plastic crates then transported to markets
- Peppers are sensitive to ethylene and should not be stored with fruits that produce ethylene such as bananas and avocados

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

Sorting:

- Eliminate all fruits harvested with defects

Grading:

- Grade Capsicum based on its **uniform colour**, **maturity**, **shape** and **size**

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 CD
- Sweet and Hot Peepers Production Guideline by Starke Ayres
- Fruits and vegetables technical handbook, 2003, Ministry of Agriculture and Rural Development
- CROPS EXTENSION POCKET HANDBOOK Vol. 1 - FIELD CROPS, 2012 Ministry of Agriculture

THANK YOU

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