MINISTRY OF
FOOD & AGRICULTURE
REPUBLIC OF GHANA

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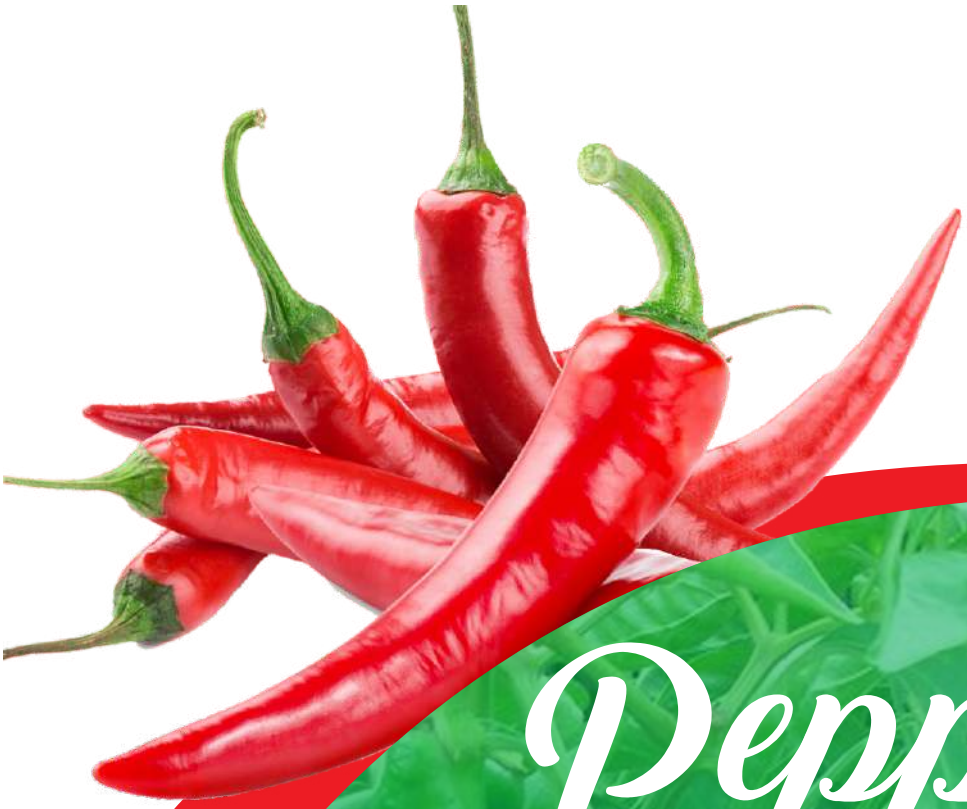

Pepper
PRODUCTION GUIDE

PEPPER PRODUCTION GUIDE

This production guide was developed to complement existing Information, Education and Communication (IEC) materials available on the Agronomy of selected commodities under the “Planting forFood and Jobs” campaign.It is designed for use by Agricultural Extension Agents and other farmers who can equally use to train their colleague farmers.

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TABLE OF CONTENT

1.0 INTRODUCTION

Botanical name: *Capsicum annuum (sweet)* and *Capsicum frutescens (hot)*

Alongside tomato and onion, peppers chilli ranks as one of Ghana's three most important vegetable crops in terms of hectares and crop value with significant potential for generating income, creating jobs, and contributing to foreign exchange through exportsPepper can be produced in the field and under greenhouse farming using conventional organic procedures.

Typical Pepper farm

2.0 GROWING REQUIREMENTS

Select well drained soil on a gentle slope with a pH of 5.0-7.0 (slightly acidic to neutral)peppers require sunny, semi-tropic or tropical conditions and annual rainfall of between 600mm to 1,250mm. Low humidity will result in bad fruit set due to dropping of flower buds. The ideal temperature for good growth is between 18-32ºC.

3.0 SITE SELECTION

- Select sites easily accessible by vehicles and other farm machines.
- Select sites located close to a reliable source of quality water.
- Select an open site with a deep, well-drained sandy loam soil or clay loam soil.
- Choose soils with a pH range of 5 –7.0
- Choose sites with annual rainfall of between 300-600mm well distributed throughout

the year.

- Choose sites with annual rainfall of between 300-600mm well distributed throughout the year.
- Site should have gentle slope, ideally land with1- 2% inclination
- Site must have a temperature range from 24-32°C.
- Avoid sandy and heavy clay soils. (Clay soils have poor drainage capacity and hence prone to water-logging.)
- Avoid sites previously cropped with plants in the same family asPepper e.g. tomato, garden eggs etc.

4.0 SEED/VARIETALSELECTION

Use certified, high-yielding pepper seeds from recommended Agro-Input dealers.
Decision on which variety to cultivate must be based on target market.

Good quality pepper seeds must have the following characteristics:

- Virus and disease resistant
- High germination percentage i.e. between 95- 100%
- No pest or mechanical damage.
- No foreign matter e.g. weeds seeds, dead insects, stones etc.
- Well packaged and properly labelled**.** The labels should provide the following information:
- Variety
- Date of packaging
- Percentage germination
- Percentage purity
- Seed treatment
- Net weight
- Producer's name

Some Suitable varieties

I. (Hot)- Legon 18, Long Red Cayenne, Bird's eye (improved variety is called Demon which is good for export), M12, Scotch Bonnet, KpakpoShito, Jalapeno, Habanero, Fresno.

Long red cayenne

KpakpoShito (bomb/cherry pepper)

Scotch bonnet (Red)

Scotch bonnet (green)

Birds eye

Habanero

i. (Sweet)- King Arthur, Florida Giant, California Wonder, Red Knight, Early Carl Wonder, Chinese Wonder, Yolo Giant.

Florida giant

4.1Nursery Establishment

Determining a good nursery site:

- Nursery must be located near a good permanent source of water.
- The nursery should be located about 20 meters away from pepper, tomato and garden egg plants to prevent transmission of diseases to the seedlings.
- The site should be well drained and free from troublesome weeds like (nut-grass and spear grass).
- Good sanitation must be practiced at the nursery. (All trash must be burnt between each production cycle.)
- The nursery must be located close to the farm.

Seedbed Preparation

Steps in preparing a proper seedbed:

- Prepare seed bed by digging 15 cm deep and breaking up the lumps into fine tilth.
- Raise the bed for about 15-20cm above the ground level to allow good drainage.
- Make sure the surface of the bed is smooth and remove all stones, roots, and weeds.
- Bed size should be 1m wide by any convenient length.
- Sterilize the soil by heaping dry grass on it and spot burn to control most soil borne diseases and pests.
- If the area has been continuously cropped spread one bucket of well-decomposed animal manure (poultry manure or cow dung) on a bed of size 1m×10m.
- Mix soil and manure, then water thoroughly and leave for one week before nursing.
- For one hectare plot an area of 71.5square meters may be needed for the nursery. This area should be divided into four beds 1m×10m each. Leave an alley of 0.5m wide between beds and at the ends of the beds to allow for easy movement within and around beds.

5.0 LAND PREPARATION

Process for Preparing the Land

- Plough across the slope to a depth of 20-30cm and harrow to a fine tilth (double plough if necessary).
- Incorporate well decomposed poultry manure at the rate of 20-30ton/ha at land preparation preferably between the first and second ploughing. In the absence of poultry manure, apply cow dung or other animal droppings at a rate of 30-40ton/ha. This should be ploughed in 4-5weeks before planting (NB: spot or row application can also be done).
- In low lying areas plant peppers on ridges. Create ridges of 100 cm width and 15 cm height. Distant between ridges should be 60 cm apart.

5.1 Nursery Management

Seed rate: 100-150g (approximately 30,000 seeds) is required to plant 1 ha depending on variety, seed viability and spacing.
Before sowing/nursing seeds perform a germination test to know the viability level of the seed.For commercial production reject any seed below 70 %. For a demonstration where quantities needed are low such seed may be accepted if that is the only one available. However, in real terms, i.e. commercial productions do not go below germination percentage of 85%.

5.1.1Germination test.

- Sow fifty (50) Pepper seeds in a germination tray or a small nursery bed
- Place the tray in a warm area and keep it moist.
- Between 5- 8 days count all seeds that germinate for cayenne and 8 -12 days for scotch bonnet and cherry pepper seeds,
- Late germinators are weak seeds, reject them.
- Determine the viability rate (germination percentage) by dividing the number of seeds that germinated by number of seeds sown (50) and multiply by 100.
- Do it in triplicate and take the average.

- The germination percentage is good if test results show 85% and above. Alternatively conduct a floating test to isolate good seeds from bad seeds.
- Pour seeds into a basin half-full of water
- Discard seeds that float on the surface of water. They are considered bad seed. Seeds that remain under water are considered good seed and can be nursed

5.1.2 Nursery activities:

- Soak seeds in clean water for two hours and dry before seeding to improve germination.
- Raise seedlings in the nursery to ensure maximum seed germination and quality planting materials.
- For farmer saved seeds, treat with recommended seed dressing or hot water at 50^{o}C for 25mins in a water bath before sowing. (NB: seeds from certified sources are pre-treated).
- Raise seedlings in seed trays, boxes or on seed beds. Seedlings raised in trays normally have a minimum 95% establishment rate in the field since they are transplanted with the block. It is suitable under unfavourable weather conditions such as rainy seasons and dry spells.
- It is highly recommended to raise all seedlings under protected structures such as net houses or tunnels (inset image of a tunnel to illustrate what a nursery tunnel is)before they reach the hardening stage.

5.1.3 Raising seedlings

Sowing seeds on nursery bed

- Make rows of 15cm apart and 0.5cm deep on seed bed
- Drill seeds ensuring that no seed rests on another
- Cover thinly with sterilized soil
- Water carefully with a watering can or hose fitted with a fine rose
- Treat seed bed with recommended insecticide to prevent removal of seed by ants and other pests
- Mulch bed thinly with dry grass, straw or plastic film until seeds emerge
- Ensure seed bed is kept moist by watering lightly as and when necessary, preferably in the morning and evening

Sowing seeds in Nursery Trays

a) Use 50-90-hole seed tray.
b) Fill the seedling tray holes with a sterilized and well-drained fertile medium such as potting mix, cocopeat or carbonated rice husk, compost.
c) Place a seed in each cell at about 0.5 cm deep and cover with media
d) Cover the holes with a thin layer of the medium.
e) Water immediately and every morning or as needed using a fine sprinkler (overhead misting systems, watering can, well calibrated Knapsack to give shower etc)
f) After seeding, cover seed tray with cocopeat, or vermiculite or newsprints to enhance germination.
g) Place the trays on raised areas such as benches in a sheltered place
h) Seeds should emerge within 5-7 days depending on the variety

Post-emergence care of seedlings

- Seedlings emerge 5-6 days after sowing. But in the scotch bonnets, emergence can be delayed for up to 9 days.
- Remove mulch as soon as seedlings begin to emerge
- Erect a light shade over the seedlings using palm fronds, dry unseeded grass, dark saran cloth, mosquito net or floating row cover (Lutracil) over a wooden, metal or other frame.
- Spray appropriate pesticides to prevent pest and disease damage where necessary
- Keep soil moist but not wet. Water preferably in the morning.
- prick out seedlings 10-12 days after emergence, if overcrowded.
- Hand pick weeds as and when necessary
- Rogue out slow growing, etiolated, diseased and malformed seedlings

Pepper Nursery

5.1.4 Hardening-off

Harden-off seedlings 5-9 days before transplanting by withholding water and increasing exposure to sunlight (partial removal of shade).

5.1.5 Transplanting

a. Transplant early in the morning, on a cloudy day or late afternoon.
b. If it is done in the hot afternoon, then heavy irrigation is recommended just after transplanting.
c. Adopt the recommended spacing depending on variety. See table 1 above for planting spacing for some varieties.
d. Water seedlings very well 2 to 3 hours prior to transplanting.
e. Set seedlings in the transplanting hole to the seedlings' soil level and firm the base.
f. Irrigate immediately after transplanting (even if it has just rain before the transplanting begins) in order to establish good root soil contact. Thereafter, irrigate frequently until seedlings are established

Table 1: Spacing for some pepper varieties

	Spacing(between plants and between rows)
Cayenne(Legon 18)	60cm x 60cm
CSIR-CRI MakoNtoose	60cm x30cm
CSIR-CRI ShitoAdope	60cm x30cm
KpakpoShito (local landrace) Cherry Pepper	70cm x30cm
MakoHwaun (local Scotch bonnet types)	70cm x 50cm
Jalapeno	60cm x 30cm

Fresno	70cm x 50cm
Demon Asian Bird's eye	60cm x 30cm
Sweet Pepper	60cm x 60cm

6.0 FERTILIZER APPLICATION

Conduct soil test to determine fertility status and adjust fertilizer recommendations rates to meet the crop's nutrients requirements. Water the plants after the fertilizer application to ensure that the nutrients are made available to the plants.

At flowering, side dress with 0.003kg(one crown cap) of NPK per plant of Potassium nitrate.

6.1 Inorganic fertilizers (Option 1)

a. At transplanting, apply/water seedlings with a starter solution of 5g/L NPK 15-15-15 or 3g/L mono ammonium phosphate (MAP) or any commercial fertilizer rich in Phosphorus and Nitrogen.

b. 2 weeks after transplanting (WAT), apply of 6g of NPK 15-15-15.

c. At 4 WAT apply 3 grams of urea per plant. (Burry urea in soil)

d. Side dress crop with 3g Potassium Nitrate/plant at flowering and repeat at 2 weeks intervals.

e. Apply high Calcium foliar fertilizers containing Boron bi-every 2 weeks following manufacturer's instructions.

f. After each harvest, apply 3g KNO3/ plant and irrigate to prolong harvesting period.

6.2 Top dressing

a. For waterlogged or alkalinesoils apply foliar feed sprays during vegetative growth and flowering to supply macro and micronutrients.

b. At flowering plants may show increased demand for potassium, boron and phosphorus

6.3 Inorganic fertilizers (Option 2)

Type of Fertilizer	Time of application	Rate	Mode of application	Placement point
NPK 15-15-15 (solution-1 milk tin to 15liters of water)	At transplanting	1 milk tin/ plant	Starter solution	Base of plant
NPK 15-15-15	10-14 days after trans-planting	6g/plant (2 crown caps)	Side dressing	5cm from plant
Sulphate of Ammonia	Flowering stage	3g/plant (1 crown cap)	Side dressing	5cm from plant
Potassium nitrate	3 weeks after flowering	1.5g/plant (1/2 crown cap)	Side dressing	5cm from plant
Foliar fertilizers	1, 3 and 5 weeks after flowering	As recom-mended by the manufacturer	Sprayon foliage	On leaves

6.4 Organic fertilizers:

6.4.1 Farmyard manure

- Apply poultry manure at 20 t ha^{-1} or cattle manure at 40t ha^{-1} before planting or as side dressing.
- Depending on the availability of resources half rate of NPK and farmyard manure can be used.

6.5 Cropping System

Peppers can be cultivated as a sole crop or intercropped with other crops Peppers can withstand some level of shade however ensure plants obtain ample sunlight when inter cropped with others

7.0 IRRIGATION

Provide supplementary irrigation to maintain a good moisture level throughout the growth period especially during flowering and fruit development.

- Water plants the day after transplanting using furrow, drips sprinkler or spot irrigation.
- Irrigate when the soil is half wet or when plants start to show signs of wilt.

8.0 WEED CONTROL/MANAGEMENT'

- Control weeds by hoeing before plants are one month old in the field.
- Weed 2-3 weeks after transplanting.
- At each weeding, earth-up around the stems to make plants strong to withstand lodging.
- Repeat weeding every 3 weeks or weed when necessary.
- Mulching can be done to control weeds.
- Weed timely to avoid drastic yield reduction as a result of weed competition.

9.0 STAKING

Plants may be staked to prevent lodging, particularly when they have a heavy load of fruits.

10.0 PESTS & DISEASES MANAGEMENT

(a) Insect Pest of Pepper

(i) Aphids (*Myzuspersicae)*

Aphids cause both direct and indirect damage on the field and greenhouses. The indirect damage caused by aphids is associated with the excretion of honeydew during feeding. Aphids cause direct damage by removing plant fluids with their piercing-sucking mouth part. Aphids are also vectors and transmit viruses.

Signs and Symptoms

- Presence of immobile aphids on the underside of leaves, shoots and stems
- Curled, wrinkled or cupped leaves
- Honeydew on infested crop

Aphids on pepper

Wrinkled and curled pepper leaves

Aphids and its natural enemy

Management

Prevention

- Avoid too much nitrogen which makes plant to be very succulent and attractive to aphids
- Grow repellent plants like onions, garlic and marigold with the crop in alternating rows to prevent aphids
- Conserve natural enemies (e.g. ladybird beetles, hoverflies and *Aphidius* sp.) by avoiding spraying broad spectrum insecticides

Monitoring

- Start monitoring from seedling stage, look at lower leaves, stems or growing points for soft bodied insects found in clusters
- Keenly check underside of leaves, shoots and stems for immobile aphids
- Monitor (at least three times in a week) for aphids early in the morning or later in the day especially during dry spells

Control

- Remove and burn infected/infested plants to help reduce aphid populations
- Spray soap solution (Potassium soaps e.gAlatasamina) (add 10-15 tablespoons of liquid soap in 15L and spray on foliage
- Spray with botanical extracts e.g. garlic, neem, red chilli pepper or soap (take 50g mix in 2 L of water. Boil for 15 minutes, allow to cool and spray 3 times at 2 weeks' interval)

(ii)Fruit flies (*Ceratitis* spp., *Bactrocera* spp., *Dacus*spp.)

Fruit fly females lay eggs under the epidermis of the pepper fruit. An infested fruit usually has a small dimple where the female fly has deposited an egg. After emerging from their eggs, maggots generally move to the core to feed, but they may also feed on the walls of the fruit. Maggots remain in peppers until fully grown (2 to 3 weeks). The maggot exits the pepper and drops to the soil to pupate.. One maggot can destroy an entire fruit.

Signs and Symptoms

- Dot-like scars on fruit
- Eggs of fruit fly inside the skin of the fruit
- Larvae (maggots) feeding inside the fruit when cut open
- Check for rotten and fallen fruits
- Presence of adult flies on the field

Fruit fly female laying eggs

Maggots of fruit fly

Management

Prevention

- Synchronize planting timing with other farmers in the area to avoid heavy infestation of field
- Avoid planting pepper near alternate hosts (mango, citrus, watermelons, tomatoes, eggplants, avocadoes to reduce pest populations
- Conserve natural enemies like ants, rove beetles, birds and parasitic wasps by practicing mixed/intercropping to enhance biodiversity, and avoid the use of broad spectrum insecticdes
- Prune regularly to improve aeration

- Remove non-harvested pepper and wild melon pumpkins as they will host larvae and bury 15 to 30 cm deep
- Till the fields top soil (5 to 10cm deep) before planting to expose pupae to the sun, birds, poultry and parasites

Monitoring

- Start monitoring as soon as fruit begins to develop. Inspect plants weekly to look for brownish or yellowish wasp-like flies on plants
- Use food baits e.g. waste brewers' yeast 45ml/L of water or ripe fruits as baits to monitor presence of fruit flies
- For early detection, use commercial pheromone traps with trimedlure, cuelure, or methyl eugenol (3 traps/50m^2)

Control

- Collect dropped fruits and bury them outside the field at a depth of 60cm with plastic bags
- Spray Success Appat (food bait Spinosad (0.24g/l) The spray should contain ½ cup (150ml) of the bait mixed with 5L water. Protection lasts 8 days

(iii) False Codling Moth (*Thaumatotibialeucotreta*)

False Codling Moth (FCM) is a highly polyphagous and economically damaging pest. FCM caterpillars can cause significant internal damage with little or no evidence of infestation that can be seen from the outside. The only external evidence may be a small oxidised mark on the skin of the fruit where the first instar caterpillars originally penetrate, but this can be very difficult to detect. With time this can become a distinctive but not always obvious, sunken brown spot on the skin

Signs and Symptoms

- Green brown with rows of dark bristled tubercles along the back of the larvae
- Presence of larvae at the base of developing fruits and flowers
- Check for larvae on fruits or floral buds that have fallen to the ground and rosette flowers and check for larvae

Adult FCM

False codling moth damage on pepper

FCM larvae in pepper

Management
Prevention

- Avoid growing pepper in proximity to alternate host crops, e.g cotton, tomatoes, okro, egg plants, pigeon pea and sweet potato
- Use trap count information to determine if the moth will be a serious pest in the growing area, if numbers are high consider planting elsewhere or planting an alternative crop
- Plough before transplanting during dry spell to expose the larvae/pupae to the natural enemies and extremes of heat
- Minimize use of pesticides to conserve natural enemies like spiders, parasitic wasps, praying mantis, ants and birds
- Gather and burn pepper sticks, stubbles and remaining fruits after harvest

Monitoring

- Begin monitoring for FCM moths at the seedling stage, scout weekly on plants for eggs and adults of moths
- Open fallen fruits to detect the presence of the larvae.
- Monitor adults with traps baited with a pheromone attractant and inspect the traps each week. If any moths are detected once the fruits are developing, take control measures immediately

Control

- Hand pick and crush caterpillars at initial infestation, check early in the morning or late in the evening before they return into the fruit
- Destroy fruits that are infested and have fallen to the ground to reduce the build-up cycle and avoid carrying over the pest to the next season. Put the fruits in plastic bags and expose them to the sunlight or burn and bury to a depth of 60-90cm

(iv) Thrips (*Thriptabaci*)

Signs and Symptoms

- Look for tiny, slim, elongated, shiny, black insects on flowers
- Silvery leaf spots and slivery streaks on fruits
- Thrips excreta are visible as small black dots on leaves

Thrips damage **Thrips**

Management

Prevention

- Prior to planting, plough and harrow the field to destroy diapausing nymphs by exposing them to sunlight
- Intercrop with maize or sorghum to reduce population of thrips
- Remove alternative host (Centrossema, *Musa* spp.) from production fields

Monitoring

- Thrips start infesting the plant before the flowers open. This causes the flowers to die and become brown. Begin monitoring at flower bud initiation.
- Pick and open the flower buds to assess for larvae or adult thrips. Alternatively shake the flowers unto a piece of white paper to determine the presence of thrips

Control

- Spray with neem extracts (Nimacol, Nimbicidine) at a rate of 1 match box/L of water or pawpaw leaf extract at a rate of 12 large matured leaves / 16L knapsack and spray at 80L/ha at 10-day interval during flowering
- Spray with Deltamethrin product at 75-100mls/L
- Spray with Lambda Cyhalothrin product at 35-40mls/ 15L of water

(v)Mites

Mites are tiny and cannot be seen with the naked eyeand are difficult to detect with a hand lens. An attack by the broad mites can be detected by the symptoms of damage. They live on the underside of leaves, tender stems, fruits, flower peduncles and flowers.Symptoms remain for a long period of time after control. They cause damage by sucking the cell content from leaves.

Signs and Symptoms

- Feeding produces discolouration, necrosis of tissues and deformation.
- Initial attack occurs on the stems of terminal shoots and the lower surface of young leaves.
- Young leaves turn narrow, twisted or crumpled, fail to elongate and finally may wilt and drygiving the plant a scorched appearance.
- Older leaves are generally cupped with corky brown areas between the main veins on the lower side of the leaves.
- The succulent part of the stem of young plants may become slightly swollen,

roughened or russeted. The foliage becomes rigid.

- Attacked fruits become deformed with a cork-like surface or fail to develop. Severely infested fruits falland yield is significantly reduced.
- The damage shows up as a stippling of light dots on the leaves and sometimes the leaves take on a bronze color.

Management

Prevention

- Adequate watering especially during periods of drought as mite damage will often be worse on drought stressed plants first
- Avoid movement of mite infested seedlings from one field to the other
- Use high pressured water to wash off mites

Monitoring

- Mites are tiny and difficult to detect, when monitoring, look for damage symptoms such as stippled or yellow leaves
- Check the undersides of leaves for mites, their eggs, and webbing. Mites can be detected with the aid of a hand lens
- To observe mites more closely, shake a few of the leaf surface onto a white sheet of paper.Once disturbed, they will move around rapidly

Control

- Spray with Sulphur 80 WP at a rate of 70mls/ 15L of water

(b) DISEASES:

(I) **Anthracnose (ripe fruit rot):** Anthracnose caused by*Colletotrichum* spp. Itis amajor problem of ripened fruitswhich occurs when there is localized waterlogging within the farm and it results in thick black spots on the fruits, rendering them unmarketable. Lesions colour varies from brown, orange then black.

Signs and Symptoms

- Circular dark sunken lesions with concentric rings on the immature and mature fruit
- Lesions can also be seen on the stems and leaves as irregularly shapedbrown spots with dark edges

Management
Prevention

- When planting use certified seeds or disease-free seedlings
- The seeds can be treated to reduce the chance of the disease by soaking in hot water (50°C) for30 minutes before planting
- Transplant only healthy seedlings from nursery
- Pepper should be rotated every 2 years with other non-host crops (e.g. maize, sorghum or groundnuts)
- Ensure good drainage on the fields
- Control weeds effectively because of wide host range of pathogens

Monitoring

- Monitor fields after transplanting and look for early leaf spot lesions (dark brown to black spots.
- Scout the field once a week and check for symptoms on the leaves and fruits
- Remove any diseased plants and fruits from the field and either bury or burn them

Control

- Rogue and destroy early plants that show disease symptoms and burn to destroy
- Apply Mancozeb as protectant fungicide at a rate of 75g/ 15L knapsack sprayer
- Apply Folpet at 45g/15L of water
- Apply Maneb at a rate of 30-45g/15L

(ii) Fusarium wilt: The fungus lives indefinitely in the soil and is spread in irrigation water. It is very susceptible to changes in temperature and soil moisture. The optimum temperature for disease development is 24 to 27°C. The wilt does not occur in dry soil,

but it is serious in poorly drained fields.

Signs and Symptom

- Yellowing and wilting of leaves and stems often affects one side of the plant
- Wilted leaves which dry up and turn brown
- When stem is uprooted and cut

Internal dark brown discolouration of stem

Yellowing and wilting of pepper

Brown discolouration of vascular tissues

Management

Prevention

- Plant local varieties (e.g. Mesiwa) which are tolerant to wilt in high relative humidity areas
- Avoid planting on land with history of wilt disease
- Rotate nursery site each season and maintain good drainage
- Destroy plant debris immediately after harvest by burning
- Solarise soil using plastic sheets 6-8 weeks before planting
- Practice long crop rotation, 6 years with non-solanaceous plants (e.g. cereals and grains –maize, millet) after 3 seasons

Management

Prevention

- Plant local varieties (e.g. Mesiwa) which are tolerant to wilt in high relative humidity areas
- Avoid planting on land with history of wilt disease
- Rotate nursery site each season and maintain good drainage
- Destroy plant debris immediately after harvest by burning
- Solarise soil using plastic sheets 6-8 weeks before planting
- Practice long crop rotation, 6 years with non-solanaceous plants (e.g. cereals and grains –maize, millet) after 3 seasons
  Disinfect farm tools with 10% bleach solution after working in infested areas
- Rogue out and destroy plants that show early symptoms of the disease and destroy by burning
- There is an interaction between nematodes (especially root-knot nematodes) and Fusarium wilt so avoid planting in sites where nematodes damage has occurred

Monitoring

- Monitor field weekly for symptoms of wilt soon after transplanting

Control

- Rogue out and destroy plants that show early symptoms of the disease and destroy by burning
- There are No effective chemicals for the management of fusarium wilt

(iii) Nematodes (Root-Knot Nematodes)

Signs and Symptoms

- Wilted and yellowing of plants
- Stunted growth and zones of poor growth on the farm soon after transplanting
- Uproot affected plants to examine the root system and check for galls and swellings

Galls on roots

Management

Prevention

- Do not transfer nematodes into a clean area when transplanting by reducing movement of soil particles after use
- Expose ploughed land 2-3 weeks before transplanting, this may help to reduce nematode numbers
- Farm tools (e.g. cutlasses) should be washed of soil particles after use

- Control weeds and volunteer crops or solanaceous plants
- Rotate for 2 years with non-host crops: sorghum, millet. Broccoli or cauliflower
- Plant marigolds (e.g. Target patula) on fields for two months after harvest, plough into soil before transplanting seedlings

Monitoring

Fields should be monitored regularly for symptoms of the disease

Control

- Rogue and burn affected plants with typical nematode symptoms at early stages of plant growth
- Applications of poultry manure or cow dung at a rate of 5t/ha can boost crop vigour and reduce nematode infestations on the crop
- Nematicides (chemicals) used in controlling nematodes are generally poisonous and expensive. Nematicides should generally not be recommended to smallholder farmers

(iv) Damping off: It is a rot that occurs at soil level of the young crop (seedling stage) and it is caused by fungi.

Signs and Symptoms

- Wilting, collapse and death of seedlings
- Dark shriveled stems around the base and brown rotten roots

Damping off damage

Management
Prevention

- Solarize the soil of nursery beds before planting using clear plastic to sterilize. If the problem persists, consider changing nursery sites
- Clean or disinfect tools (tillers, cutlasses and hoes) using 10% bleach solution or fire to heat
- Sow seeds thinly to ensure aeration. Plant in raised beds to maintain good drainage and avoid over watering

Monitoring

- Monitor nursery daily for symptoms such as wilting, collapse and death of seedlings

Direct control

- Remove infected plants as soon as symptoms appear and destroy away from nursery
- Avoid excessive fertilization at nursery to reduce damping off
- Treat seed with Mancozeb 800g/kg, Folpet 500g/l at 3-4g/kg

11.0 HARVESTING

- Peppers are ready for harvesting 6-8 weeks after transplanting. Harvest red ripe or green depending on market demand.
- To harvest, snap the fruit stalk from the stems by hand.
- Second harvesting is done after 10 to 14 days. From then on, harvest once every week even though the yield can drop after the 11th week.
- Depending on the condition of the pepper, harvesting can even continue beyond 6 months if there is no outbreak of diseases.

NB: the plants must still be provided with nutrients especially more of K and less of N even after harvesting for more yield and crop quality.

Pepper ready for harvesting

11.1 Storage

If the local market is the target however, the peppers are left to ripen and could take 8-9 weeks before harvesting. They are then parboiled and dried before selling.Harvested peppers should be placed in the shade immediately after harvest and cooled as soon as possible.

Solar drying of pepper

11.2 Marketing

Pepper can be produced for both local and export markets. Growing pepper for local and export markets are prone to variations in market conditions. Producers should therefore identify potential buyers who will give them an assurance of buying their pepper before commencing production activities.