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Pests and Diseases of Pepper in Guyana

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SYMPTOMS

Nymphs and adult flies feed on leaves causing discoloration. Areas near the mid-vein are brown and dried up. The major damage occurs on the undersides of new or old leaves. Fruits are also discoloured, distorted and hardened. Leaves are distorted and curl upwards like the shell of a boat. The lower surface of the leaves develops a silvery sheen that later turn bronze. Damaged terminal growth may be discolored, stunted, and deformed.

Figure 26 : Distortion of leaf

Figure 27: Nymph of thrip

CONDITIONS FOR DEVELOPMENT

Outbreaks often occur when the natural biological control is disrupted. Management is difficult. Thrips develop rapidly in warm weather, and populations can build up quickly in situations where natural enemies are destroyed and weather is favorable.

Thrips, have a wide host range that includes many weeds and crops, they breed all year, moving from one host to another as plants are harvested or dry up.

MANAGEMENT STRATEGY

Early detection of infestation is critical to an effective response. This is difficult because thrips are small and can easily be missed except by an experienced observer.

Thanks to a combination of innate resistance and patterns of behavior, thrips are difficult to control by insecticide spraying and there is no general agreement on useful insecticides or treatment practices. Cultural practices are also relatively ineffective. Heavy rainfall is thought to decrease thrips number whilst plastic mulch is reported to limit population growth.

However the following measures are recommended:

1. Adequate and timely irrigation regimes,

2. Crop rotation with cabbage, or

3. Use of recommended insecticides such as Vydate L. (2.5 ml/L) and Admiral (1 ml/L).

Whiteflies, have a wide host range that includes many weeds and crops, they breed all year, moving from one host to another as plants are harvested or dry up.

Figure 24: Crinkling of Leaf

Figure 25: Adult White Fly

MANAGEMENT STRATEGY

Management of heavy whitefly infestations is very difficult. Whiteflies are not well controlled with any available insecticides. The best strategy is to prevent problems from developing in your farm to the extent possible. In many situations, natural enemies will provide adequate control of whiteflies; outbreaks may occur if natural enemies that provide biological control of whiteflies are disrupted by insecticide applications, dusty conditions, or interference by ants. Avoid or remove plants that repeatedly host high populations of whiteflies. Do not plant a new crop next to one which is mature. In gardens, whitefly populations in the early stages of population development can be held down by a vigilant programme of removing infested leaves, vacuuming adults, or hosing down (syringing) with water sprays. Aluminum foil or reflective mulches can repel whiteflies from vegetable gardens and sticky traps can be used to monitor or, at high levels, reduce whitefly numbers. If you choose to use insecticides, insecticidal soaps or oils such as neem oil may reduce but not eliminate populations. Caprid, Admire, Pegasus, Basudin, Vydate L at 10 mls to 4500 mls water applied early in the morning or late in the evening may be used in a rotational manner.

THRIPS - Thrips palmi

Thrips palmi, commonly known as thrips, are small yellow coloured elongated insects less than 1 mm in length found mostly on the upper and lower leaf surfaces. They affect the vegetative stages of the crop basically affecting leaves and fruits. Thrips are known to act as vectors for the transmittal of viruses in Solanaceous crops.

PEST AND DISEASES OF PEPPER IN GUYANA

CONDITIONS FOR DEVELOPMENT
Weedy fields and continuous cropping favours the buildup of cutworms. Preferred laying site is moist soil or low growing weeds. Warm conditions favour more generations of cutworms.

MANAGEMENT STRATEGY
The management strategies for cutworm control include:

1. Plant seedlings that have been hardened or at least 4-5 weeks; or

2. Ploughing fields 3 – 6 weeks prior to planting;

3. Maintaining weed-free fields following crop emergence;

4. Natural predators – wasps, grasshoppers - should be encouraged by avoiding unnecessary spraying;

5. Under severe cutworm infestation (3 – 10 % crop damage), insecticides may need to be used. Insecticide treatment for cutworms should be made in late afternoon or evening to minimise insecticide degradation prior to larvae emerging to feed. Any approved soil insecticide at the recommended rate may be applied, such as Basudin 60% E.C (Diazinon) or Vydate L 40% E.C at the rate of 10 mls to 4500 mls water, to seed beds and cultivated cropping areas.

WHITEFLIES - Bemisia tabaci (Homoptera: Aleyrodidae)

Bemisia tabaci commonly known as whiteflies, are tiny, sap-sucking insects that are frequently abundant in vegetable crops. They derive their name from the mealy, white wax covering the adult's wings and body. They affect the vegetative and reproductive stages of the crop basically affecting the leaves. Whiteflies are known to transmit viruses to pepper plants.

SYMPTOMS
Whiteflies suck phloem sap and tend to fly upwards when the plant is disturbed. Large populations can cause leaves to turn yellow, appear dry, or fall off plants. Plants can be distorted and discoloured. Like aphids, whiteflies excrete honeydew, so leaves may be sticky or covered with black sooty mold. The honeydew attracts ants, which interfere with the activities of natural enemies that may control whiteflies and other pests.

CONDITIONS FOR DEVELOPMENT
Outbreaks often occur when the natural biological control is disrupted. Management is difficult. Whiteflies develop rapidly in warm weather, and populations can build up quickly in situations where natural enemies are destroyed and weather is favorable.

4. Maintain strict weed control in and around the farm;

5. Remove and destroy punctured or mined leaves;

6. Heavily infested plants should be removed completely and destroyed;

7. Use appropriate chemicals when infestation is critical. (more than 20% mining on lower leaves)

8. Avoid the use of early season applications of broad-spectrum insecticides for control of other pests in order to conserve natural enemies of the leaf miner.

CUTWORMS - Agrostis sp. (Lepidoptera: Noctuidae)

Cutworms are larvae of the moth, Agrostis spp., that chew and cut through plant parts (as the name suggests). Generally, the seedling stage of the crop is affected with young stems and leaves of the plant affected. Moths vary in colour from dull brown to black with wing spans ranging from 30-50 mm. Cutworms are dull grey, brown or black, and may be striped or spotted, up to 25 - 50 mm in length, soft bodied and smooth. They hide under the soil or litter by day. They can often be located by scratching the surface near damaged plants; when disturbed they curl-up and remain stiff as a defensive response. They feed in late afternoon and at night, spending the days hidden in the soil, except under very overcast conditions.

SYMPTOMS

Cutworms cut leaves and young stems damaging seedlings and transplants above, at or just below the soil surface. Older cutworms consume foliar material and burrow into the stem resulting in wilting and lodging of older plants. Evidence of cutworm presence is greenish-black excreta pellets below the seedlings.

Figure 22: Cutting of Young Seedling

Figure 23: Larvae of Cutworms

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LEAF MINERS - Agromyza spp.

Leaf Miners are larvae of Agromyza spp., which are small flies about 3 – 5 mm long. The females feed by puncturing leaves along the veins. The eggs are deposited between the two epidermis of the leaves, and the larvae tunnel or mine (deriving the name leaf miner) the mesophyll. The larvae or leaf miners are small yellow maggot-like creatures about 3 mm long and live in the mid-tissue layer of plant leaves. They "mine" out the nutrients in a rapidly-widening path that skeletonizes plant leaves often referred to as "chinee writing".

SYMPTOMS

The first sign of leaf miner damage is the presence of the adult feeding punctures (whitish spots) in the upper leaf surfaces. This is followed by winding whitish irregular tunnels that are initially narrow, but then widen as the larvae grows. Infected leaves are blotchy. Heavy infestations can result in yellowing and premature leaf abscission and consequent loss in yield.

Figure 20: Tunneling on Leaves

Figure 21: Tunneling on Fruit

CONDITIONS FOR DEVELOPMENT

Warm conditions favour leaf miner development. Spraying with a broad spectrum insecticide early in the crop destroys the natural enemy of the leaf miners allowing heavy infestation later in the crop. Aphid control has an incidental effect on Agromyza spp..

MANAGEMENT STRATEGY

The management strategies for leaf miner control include:

1. Do not use cuttings from infested mother trees;

2. Where a previous crop has been infested, use a thorough clean-up programme to minimize carry-over of the pest to the following crop;

3. Practice crop rotation;

PESTS

INTRODUCTION

Hot peppers are cultivated in all the regions of Guyana. There is tremendous scope for the expansion of hot pepper production locally. It is one of the commodities targeted for expansion under the Agricultural Diversification Project because of the market (both local and export) demands that exist.

Pepper Varieties

Several cultivars, grown locally are suitable for fresh consumption or processing. They include Wiri Wiri, Miwiri, Bird Pepper, Ball O' Fire, 'Bullnose' Scotch Bonnet, Tiger Teeth, West Indian Red, Caribbean Red and Habanero. Varieties identified for the export market include the West Indian Red, Caribbean Red, Habanero and 'Bullnose' Scotch Bonnet.

PEPPER MOTTLE VIRUS

Pepper Mottle Virus (PMV) affects the leaves and fruits at both vegetative and reproductive stages.

SYMPTOMS

Symptoms produced by this virus are reminiscent of 2,4-D herbicide injury with plants exhibiting misshapen leaves, which become puckered, and light and dark patches on the foliage giving the plant a mottled appearance (hence the name). Additionally the fruits are
small, malformed, mottled and may have necrotic depressions. The overall effect of the disease is stunted plants with reduced yields.

Figure 18: Mosaic and Dark Green Vein Banding

Figure 19: Crinkling of Leaves and Fruit Distortion

CONDITIONS FOR DEVELOPMENT

PMV is an aphid transmitted disease. The virus is not transmitted through seed. The virus persists and survives because aphids carry the virus from infected peppers to native perennial solanaceous weed species. The incidence of PMV is dependent on the population of aphids and susceptible weed hosts. Infected crops are within range of infected weeds.

MANAGEMENT STRATEGY

Control of PMV is difficult once plants become infected.
Management strategies include:

1. Removing and destroying diseased plants;
2. Crop rotation with non-host plants;
3. The virus is spread by aphids, hence this vector should be controlled using recommended insecticides; and
4. Control all weeds within and around the farm.

GEMINI VIRUS

Geminivirus is caused by the agent Geminivirus and affects all stages of plant growth and affects leaves and fruits.

SYMPTOMS
The common symptoms are stunting, curling or twisting of leaves, bright yellow mosaic, distorting of leaves and fruits and reduced yield.

Figure 17: Distortion of Pepper Leaves

CONDITIONS FOR DEVELOPMENT
The Gemini viruses are transmitted by the whitefly, Bemisia tabaci, and are not known to be transmitted either mechanically or by seed in nature.

MANAGEMENT STRATEGY
Control of geminivirus is difficult once plants become infected. Management strategies include:

1. Removing and destroying diseased plants;

2. Crop rotation with non-host plants;

3. The virus is spread by whiteflies (Bemisia tabaci), hence this vector should be controlled using recommended insecticides; and

4. Destroy all perennial weeds which harbour the whiteflies.

DISEASES

MANAGEMENT STRATEGY

The control measures recommended are:

1. Use clean seed;

2. Removing and destroying infected crop debris;

3. Perform proper weed control;

4. Crop rotation;
5. Seed treatment (0.2% a.i. thiram at 30 °C for 24 hours);

6. Wet seed treatments most effective e.g. Ceresan 0.1% for 15 minutes;

7. Proper irrigation to prevent drought stress of aging plants.

8. Alternate Manzate, Control and Benlate with Mankocide to prevent the spread of the disease at the recommended rates. The effectiveness of these sprays depends on early detection and thorough application coverage including the lower leaf surface. When conditions are highly favourable for the fungus, these sprays may provide only partial control.

   Benlate – systemic foliar, seed and post-harvest treatments - 1-2 tsp/3.8 l (5-10 g/3.8 l)

   Control – contact, foliar applied - 1-2 tbsp/3.8 l (15-30g/3.8 l)

   Saprol – systemic, foliar applied - 1-2 tsp/3.8 l (5-10 ml/3.8 l)

   Tri-Miltox Forte 410 WP applied at 1.9 to 3.8 kg per hectare at 7-14 days interval

   Sulphur dust and spray is effective;

   Neem treatments and bicarbonate were found to be effective.

POWDERY MILDEW

Powdery Mildew is a common disease on many types of crops and is caused by the fungus Leveillula taurica (although the asexual stage of the fungus Oidiopsis taurica, typically found). The typical parts of the plant affected are the leaves, stem and growing points.

SYMPTOMS

The primary disease sign is the presence of a white, powdery, fungal growth that covers the lower leaf surface. The upper leaf surface of infected leaves may show a yellow or brownish discolouration and, in some cases, the fungus may actually sporulate on the upper leaf surface. The edges of infected leaves eventually roll upward, exposing the fungus. Infected leaves will drop prematurely from the plant, exposing the fruit to the sun, perhaps causing sunscald on the fruit.

Figure 16: White, Powdery Fungal Growth on the Lower Leaf Surface

CONDITIONS FOR DEVELOPMENT

The disease is favoured by warm temperatures (20-35 °C). Although high humidity favours germination of spores, infection can occur during periods of high or low humidity. The fungus reproduces rapidly under favourable conditions. Wind-disseminated spores cause secondary infections, which help spread the disease. The fungus predominately infects leaves, but it can occasionally be found attacking fruit. The disease is most severe on older leaves just prior to fruit set, but can occur at any time throughout the crop if environmental conditions are favourable.

DAMPING OFF

Damping off is caused by the fungi Rhizoctonia solani, Phytophthora spp., Pythium spp., and Fusarium spp. The fungi affect seeds, seedlings and transplants with the affected part of the plants being chiefly the root.

SYMPTOMS

The symptoms vary with the age and stage of development of the plant affected. Seeds may fail to germinate, become soft and mushy, then turn brown, shrink and finally disintegrate.

Seedlings may be infected before or after emergence. If infected before emergence, the germinating plants become soft, brown, and decompose. If infected after emergence, water-soaked lesions form about 1 cm above or below the soil line. The stem softens and cannot support the seedling, which collapses and dies. Stunting of plants due to root rot may also occur. In this case, the root system rots, becomes brown and develops few if any secondary roots.

Figure 1: Stem Softening

Figure 2: Stem Rots

CONDITIONS FOR DEVELOPMENT

Seedlings during the first three weeks after sowing are particularly susceptible. Factors which favor the disease are sowing seeds in disease-infested soils or growth medium, overwatering, poor drainage, inadequate light, overcrowding, poor ventilation, and applying excess levels of nitrogen to soil. The presence of nematodes may exacerbate disease development.

Spores of these fungi are resistant to desiccation and can survive in soil for long periods. The different fungi that cause damping off have different environmental requirements for disease development (e.g. Pythium ultimum prefers low temperature while Pythium aphanidermatum prefers high temperature).

Pythium and Phytophthora can cause damping-off in cool, wet soils while Fusarium and Rhizoctonia are more aggressive under warmer, drier conditions.

MANAGEMENT STRATEGY
The control measures recommended are:

1. Seeds should be treated with a recommended fungicide EG, Captan or Rhizolex.

2. Nursery beds should be located on well-drained sites and treated prior to seeding with fungicide e.g. Captan or Rhizolex.

3. Covered beds should be well ventilated to prevent high humidity. Allow at least 0.76 m (2.5') between seedlings and shading material;

4. Improve heavy soils by adding organic matter;

5. Avoid applying excessive amounts of nitrate forms of nitrogen fertilisers;

6. Apply Banrot or Rizolex 2-3 days after transplanting to the soil at 1-2 tsp/3.78 l (5-10 g/ 3.78 l) and 1-2 tbsp/3.78 l (15-30 g/ 3.78 l) respectively. List all fungicide available on the local market or registered that can treat the problem. Show also whether its systemic or contact and for soil treatment

7. Water plants only when the soil or growth medium is dry, preferably in the morning to allow drying to occur by the late afternoon.

8. Avoid overcrowding of plants.

9. Avoid the movement of infested soil or contaminated plant material into the nursery bed.

10. Workers should clean their hands and tools before handling healthy plants.

11. Surface irrigation ponds may be a source of fungal contamination.

12. It is important to determine which fungus is responsible for disease development. This will influence the chemical(s) that is used.

13. Consider both broad-spectrum and systemic fungicides.

14. Fumigate nursery beds or apply a fungicidal soil drench if the disease appears.

    Photographs of seedlings in the various stages of infection. Specifically root damage and damage to stems with the rings showing weaknesses and where available the discoloration of the leaf.

Symptoms appear when the plant is under heat and water stress, and include wilting and death of the plants. The taproot will have reddish brown lesions which are a diagnostic characteristic for this disease. Diseased plants often produce an abundance of secondary roots above the rotted tap root.

Figure 15: Stem Rot

CONDITIONS FOR DEVELOPMENT
Rhizoctonia solani infection is thought to occur during the seedling stage of growth. If environmental conditions are less than optimum for the fungus, the plant may continue to grow while infected. Plants infected with Rhizoctonia root rot have reduced vigor compared to non-infected plants. In the dry period when the plant is mature, stresses such as excess heat, drought, and fruit set cause infected plants to wilt. This disease is most severe in fields that are planted pepper crop after crop. Additionally, this fungus has a tremendous capacity for saprophytic growth and can survive in the soil indefinitely in the absence of a host plant.

MANAGEMENT STRATEGY
The control measures recommended are:

1. Seeds should be treated with a recommended fungicide eg. Captan.

2. Avoid applying excessive amounts of nitrate forms of nitrogen fertilisers;

3. Apply Banrot or Rizolex 2-3 days after transplanting to the soil at 1-2 tsp/3.78 l (5-10 g/ 3.78 l) and 1-2 tbsp/3.78 l (15-30 g/ 3.78 l) respectively. List all fungicide available on the local market or registered that can treat the problem. Show also whether its systemic or contact and for soil treatment

CONDITIONS FOR DEVELOPMENT

The pathogen survives between crops on infected plant debris, soil, other solanaceous host weeds and can be carried on seed. The fungus enters the leaves directly or through wounds. Primary infection can occur on older foliage early in the season, but most secondary spread occurs as the plants age. Actively growing, young tissue and vigorous plants with adequate nitrogen generally do not express symptoms. Infection occurs during warm, rainy and humid weather.

MANAGEMENT STRATEGY

1. Plant disease-free seeds and plants; avoid bruising seedlings before planting.
2. Maintain plant health through proper water and fertilization regimes; nitrogen and phosphorus deficiencies increase susceptibility to early blight.
3. Garden areas should be rotated out of tomatoes, pepper and eggplant for 3-4 years so that hosts of the disease are not present.
4. Minimize leaf wetness by watering plants in the morning or at the base of the plant.
5. Remove infested plant material after harvest, or incorporate material into the soil.
6. Several foliar fungicides are available for early blight. Mancozeb, chlorothalonil and copper are effective against early blight when applied at approximately 7-10 days intervals. Spraying should commence at the first sign of disease or immediately after bloom.
7. Plant varieties that are resistant or have a lower susceptibility to early blight.

azoxystrobin: 5 to 6.2 fl oz/A
chlorothalonil: 1.3 to 1.8 lb/A

Maneb/mancozeb: Rates vary according to formulation.

RHIZOCTONIA ROOT ROT

Rhizoctonia Root Rot is caused by the fungus Rhizoctonia solani, one of the casual agents for Damping Off. This pathogen infects a large number of vegetables causing root rot of mature plants as well as seedling. The affected stages of growth are pre-emergence, seedling stage, vegetative growing stage, flowering stage, fruiting stage and post-harvest affecting all parts of the plant.

SYMPTOMS

Early infection gives rise to seed decay and pre- and post-emergence damping-off. Later infection causes stem canker, eyespot and other diseases which results from the decay of the stem cortex and may be accompanied by stunting, yellowing and leaf-roll symptoms. A cool and damp environment is optimal for infection.

BACTERIAL SPOT

Bacterial spot is caused by the bacterium Xanthomonas campestris pv. vesicatoria. The same bacterial disease affects tomato. The stages of growth of the plant affected are the vegetative, flowering, fruiting and post harvest with the affected parts being leaves, stems, fruits, seeds and inflorescence.

SYMPTOMS

Necrotic spots may appear on leaves, stems and fruits. Leaf symptoms appear first on the undersides of leaves, lesions begin as circular, water-soaked spots that become necrotic with brown centres and chlorotic borders and can become enlarged up to 6.4 mm (¼ diameter). The spots are slightly raised, have dead, straw coloured centres with a dark margin. The spots are angular because the bacteria spread along the veins. On the upper leaf surface the spots are depressed with a brown border around a beige center. Several lesions may coalesce, resulting in large necrotic areas, and large numbers of lesions can occur on leaf margins and tips where moisture accumulates. The presence of numerous spots results in leaf yellowing and abscission or a scorched or blighted appearance.
Narrow or elongated raised cankers may appear on stems which eventually become rough and light brown.

Fruit spots are initially circular and green turning brown, but become raised with a cracked, scabby surface.

Figure 3: Necrotic spots on leaf

Figure 4: Cracked, scabby surface on pepper

CONDITIONS FOR DEVELOPMENT

The disease if favored by long periods of high relative humidity (RH) with free moisture on the leaves. When plants are exposed to high RH (more than 85%) for a few hours during several days, the pathogen can produce disease symptoms. Bacteria are spread from plant to plant by splashing rain and by touching and handling wet plants.

Sprays are not effective against bacteria inside the tissue. The most-important sources for bacterial spot are infested seed and diseased transplants. In addition, the pathogen is soil borne both on dried plant debris and, possibly, in the soil itself for at least one year. The disease spreads rapidly during warm, rainy weather and persists in crop debris.

MANAGEMENT STRATEGY
The control measures recommended are:

1. Practice crop rotation, using at least a one year rotation between tomato or pepper crops with non host crops

2. Use disease-free seeds and transplants;

3. Seed treatment by soaking seeds in 1.3 % sodium hypochlorite (one part bleach solution (5.25%) to four parts water) for 40 minutes with agitation. One litre of solution treats 0.5 kg of seed. Rinse thoroughly and dry seed immediately or soak in water at exactly 50 °C for 25 minutes, then cooled and dried;

4. Twice weekly applications of a copper-mancozeb mixture, such as Mankocide 2 - 4 tbsp / 3.8 l of water every 5-7 days. Spray preventatively especially during the rainy season, alternating a combination of Kocide 101 or Kocide DF and Manzate with Mankocide every 5-7 days or in combination with 200 ppm streptomycin (1 lb / 100 gal water. Note Streptomycin cannot be used in field. Copper fungicides may help to reduce secondary spread, but their effectiveness is limited by rainfall and dew formation.

   Rates: Kocide 2-3 tbsp/3.8 l

   Manzate 1 tbsp/3.8 l

   Mankocide 2-4 tbsp/3.8 l

BACTERIAL SOFT ROT

Bacterial Soft rot is caused by the bacteria Erwinia carotovora pv. carotovora affecting pre-emergence, seedling stage, vegetative growing stage, flowering stage, fruiting and post-harvest stages. The affected parts of the plant are the leaves, stems, roots, fruits, growing points and vegetative organs.

SYMPTOMS
Bacterial soft rot of pepper causes a soft rot of the fruit. At first, a small water-soaked lesion appears on the tissue which rapidly enlarges in diameter and depth. The area then becomes soft, watery and slimy grey or brown. The epidermis usually remains intact, while the interior has changed to a watery mass hanging like a water-filled bag usually possessing a foul odour. The disease is most frequent when

EARLY BLIGHT

Early Blight is caused by the fungus Alternaria solani and the stages of growth affected are the fruiting and post-harvest stages affecting the leaves, stems and fruits.

SYMPTOMS
The disease appears first as small, irregular brown dead spots on older leaves up to 16 mm in diameter with concentric black rings, with spots surrounded by a yellow area. As the lesions enlarge, they often develop concentric rings giving them a 'bull's eye' or 'target-spot' appearance. With many lesions the whole plant turns yellow. On the stems, lesions are brown. Fruit infections occur while the fruit is green. Spots are dark, leathery and sunken with a ridged appearance. Infected fruit often drop and losses greater than 30% of immature fruit may occur.

Figure 12: excessive yellowing of plant

Figure 13: necrotic lesions on leaf

Figure 14: Necrotic lesions on stems

in several tropical and regions. In general, disease symptoms caused by the various species of Colletotrichum are similar and microscopic analysis is necessary to identify species.

CONDITIONS FOR DEVELOPMENT

The pathogens are seed borne and survive on plant debris from infected crops and on other susceptible plant species as well as alternate hosts such as solanaceous crops. The fungus is not soil-borne for long periods in the absence of infested plant debris. During warm and wet periods, spores are splashed by rain or irrigation water from diseased to healthy fruit. Diseased fruit act as a source of inoculum, allowing the disease to spread from plant to plant within the field and increase in number under continuous cultivation.

Wounds in fruit are not required for infection but wetness is needed for spore germination and infection.

The optimum temperature for fruit infection is 20–24°C with fruit surface wetness, although infection may occur from 10 to 30°C. However, the longer the period of fruit surface wetness the greater the anthracnose severity.

MANAGEMENT STRATEGY

The control measures recommended are:

1. Use only clean seed from disease free plants or seeds treated to reduce any fungal populations. Seeds can be disinfested with a 30 minute soak at 52 °C.

2. Practice crop rotation out of infested fields with a three year interval;

3. Use only transplants free of disease symptoms; or

4. Apply protective spraying at flowering and continue with harvesting at weekly intervals when conditions for development are favourable.

   Benlate – systemic foliar, seed and post-harvest treatments -
   1-2 tsp/3.8 l (5-10 g/3.8 l)
   Control – contact, foliar applied - 1-2 tbsp/3.8 l (15-30g/3.8 l)
   Saprol – systemic, foliar applied - 1-2 tsp/3.8 l (5-10 ml/3.8 l)

the weather is hot and humid. During post harvest, decay generally begins as a stem end rot followed by total collapse of the fruit.

Figure 5: Soft Rot of Pepper

Figure 6: Pepper Decay

CONDITIONS FOR DEVELOPMENT

Bacterial Soft Rot occurs on many fruits and vegetables. The bacterium survives in plant debris, insects, and even in soil. The bacterium enters through wounds caused by insects or mechanical means. Rainfall and high temperatures favor disease development. Harvested fruit can become infected from contaminated wash water.

MANAGEMENT STRATEGY

The control measures recommended are:

1. Planting in well-drained soils at adequate planting density;

2. Minimising physical damage to fruits during harvesting and handling;

3. Use chlorinated water (50 ppm) to wash fruits;

4. Good storage condition (21°C). Control and monitor the temperature and relative humidity during storage;

5. Applying copper sprays prior to harvest during hot wet weather will reduce disease losses;

6. Rotate with non-hosts for at least 2-3 years;

7. Harvest fruit when dry and handle carefully to avoid creating wounds; and

8. Avoid washing fruits where possible, if necessary use chlorinated water.

Bacterial Wilt

Figure 7: Bacteria Wilt invade plant tissue

Bacterial wilt is a serious soil borne disease caused by the bacteria Ralstonia solanacearum which infects through the root and invades vascular tissues affecting the plant water uptake. The disease affects the vegetative growing stage of the plant and affects the fruits, leaves, roots, seeds, stems, vegetative organs and generally the whole plant.

SYMPTOMS

Symptoms begin with wilting of the leaves and after a few days, a permanent wilt results, maintaining the green colour of the leaves. The vascular tissues in the lower stem of the wilted plants show a dark brown discolouration. These symptoms are similar to phytopthora blight caused by Phytopthora capsici but is distinguished by the external darkening of the lower stem for the blight. Furthermore, a cross section of the stem of a plant with bacterial wilt produces a white, milky strand of bacterial cells in clear water. This distinguishes the wilt caused by the bacterium from that caused by fungal pathogens.

Figure 8: Vascular discolouration

Figure 9: Wilting of plant

CONDITIONS FOR DEVELOPMENT

Infested soils are the main source of the inocula. Disease free areas can be infested through infected planting material (transplants), contaminated water, or machinery and labourers contaminated from infested fields. Transmission by seed is not common in pepper but is reported in tomatoes and boulangers. Within the field, irrigation water flowing from infested plants is the chief contaminant. High temperatures and high soil moisture are the main factors associated with incidence and severity.

MANAGEMENT STRATEGY

The control measures recommended are:

1. Follow a crop rotation regime with non susceptible crops;
2. Plant only bacteria-free seeds and transplants; or/and
3. Rogue diseased plants and burn.

ANTHRACNOSE OR RIPE ROT

Several species of the pathogenic fungi in the genus Colletotrichum causes Anthracnose or Ripe Rot and affects the plant's leaves and fruits at all growth stages including post-harvest stages. The disease can also affect other fruits and vegetable crops such as tomato, banana, mango and papaya.

SYMPTOMS

Symptoms occur primarily on ripening fruit often where fruit is touching the soil or plant debris. On ripe fruit there are small, sunken circular depressions up to 30 mm in diameter. The center of the lesions becomes tan in colour while the tissue beneath the lesion is lighter-coloured and dotted with many dark-coloured fruiting bodies of the fungus that form concentric rings in the lesion. The pink-coloured areas on the surface in the central portions of the lesions consist of large masses of fungal spores.

Green fruit may also be infected but symptoms will not appear until the fruit ripens at harvest time. Such an infection is called latent. Young fruit infected by C. acutatum can have visible symptom development. Foliage and stem symptoms appear as small, irregularly shaped gray-brown spots with dark brown edges. Among the Colletotrichum spp. that affect pepper, C. gloeosporioides has the widest host range among solanaceous crops and various biotypes have been reported on hosts. C. acutatum has caused severe fruit and foliar damage to peppers

Figure 10 & Figure 11: Circular Sunken Depressions on Fruits