

*Ministry of
Agriculture and
Fisheries
St. Vincent and
the Grenadines*

A Crop Production Technical Guide

March 2003

Hot Pepper



Sponsor's Page

REFERENCES

A Training Manual for the Production of Hot Peppers BELIZE.

CARDI (Caribbean Agricultural Research and Development Institute) Technical Improvement File on Hot Peppers

HERMAN, Adams et al. 1999. Hot Pepper Lines for the Caribbean

Celestial Arts, 1997. The Pepper Pantry: Herbaneros

A Crop Production Technical Guide

Hot Pepper

*Ministry of Agriculture and Fisheries
St. Vincent and the Grenadines*

March 2003

ANNEX C: GENERAL FUNGICIDES

	Contact Fungicides	Systemic Fungicide/Bactericides	Soil Application	Foliar application	Altemaria	Anthrachnose	Cercospora	Downy Mildew	Powdery Mildew	Damping off
Kocide 101	✓			✓	✓	✓	✓	✓	✓	✓
Manzate 200Df	✓			✓	✓	✓	✓	✓		✓
Benlate				✓	✓	✓	✓		✓	✓
Bravo (Daconil 2787)	✓			✓		✓	✓	✓	✓	
Bordeaux Mixture	✓			✓						
Captan	✓		✓	✓	✓		✓	✓		✓
Chipco 26018	✓	✓	✓	✓	✓					
Trimiltox Forte				✓	✓	✓	✓	✓		✓
Alette		✓	✓	✓						✓
Subdue 2E		✓	✓							
Banrot	✓		✓							✓
Cupravit				✓	✓	✓				
Dithane M45				✓	✓	✓	✓	✓		
Peltar				✓	✓	✓		✓	✓	
Ridomil				✓				✓		✓
Mertect				✓					✓	
Calixin				✓						
Folicur		✓		✓	✓		✓			
Phyton			✓	✓	✓	✓	✓		✓	
Rizolex			✓							

CONTENTS

1. Introduction	6
2. Climatic Requirements	6
3. Recommended Varieties	6
4. Site Selection	8
5. Land Preparation	8
6. Seedling Production	9
7. Planting and Spacing	10
8. Water Requirement	11
9. Plant Nutrition	12
10. Other Cultural Practices	13
11. Pest Management	14
12. Weed Management	22
13. Harvesting and Yields	23
14. Post Harvest Handling	23
15 Record Keeping	24
16. Marketing	25
17. Cost of Production	26
ANNEX	27

1. INTRODUCTION

Hot Peppers, *Capsicum chinense*, are members of the genus Capsicum and the family solanaceae that include tomato and egg plant. Several species in the genus Capsicum have been described, but only two (2) are commercially produced in the Caribbean. This includes hot pepper varieties such as Scotch Bonnet, Habanero and the West Indies Red and Yellow. There is an extra-regional market demand for the varieties mentioned and even more so an increasing demand for the varieties that produce dark green berries (fruits). This guide therefore targets the production of hot pepper in St. Vincent and the Grenadines in a sustainable manner conducive to the principles of Good Agricultural Practices (GAP's).

2. CLIMATIC REQUIREMENTS

Hot pepper is a warm season vegetable, but can be grown under a wide range of temperatures (15°C - 32°C) and moisture conditions. Excess rainfall and temperatures between 32°C - 35°C, cause severe loss of blossoms.

3. RECOMMENDED VARIETIES

Only large varieties are grown for commercial purposes, which include the following:

(i) West Indies Red

This variety was developed in the Caribbean and therefore performs with excellence in the region. The pepper is large, light green with a brilliant sheen at maturity, and gives excellent yields. It is highly resistant to a number of the diseases that normally affect peppers. The West Indies Red has commendable storage life and its thick walls make it excellent for export.

PESTICIDE USE CHART

Mealybugs	Mites	Leafhoppers	Hoppers	Ants	Midges	Flies	Cutworm	Grub	Mole Cricke	Leafminer	lacebug
✓	✓	✓	✓								
		✓	✓		✓	✓					
		✓	✓	✓							
✓	✓	✓	✓	✓			✓	✓	✓	✓	
		✓									
		✓									✓
		✓	✓								
		✓									
✓	✓	✓									
✓	✓	✓									✓
✓	✓	✓									✓
		✓	✓							✓	
	✓	✓	✓				✓	✓	✓	✓	✓
	✓									✓	
		✓	✓							✓	
			✓								
		✓									
	✓			✓						✓	

ANNEX B: GENERAL INSE

	Aphids	White fly	Beetle	Weevil	Caterpillars	Thrips	Stinkbugs	Scale Insects
Malathion	✓	✓	✓	✓	✓	✓	✓	✓
Karate	✓	✓	✓	✓	✓			
Sevin	✓				✓			✓
Basudin	✓		✓	✓	✓		✓	✓
Primor	✓							
Ambush 50	✓	✓			✓		✓	
Decis	✓		✓	✓	✓			
Ambush 50 EC	✓	✓			✓		✓	
M-Pede	✓	✓				✓		✓
Sunspray	✓	✓				✓		✓
Perfekthion	✓	✓				✓	✓	✓
Orthene	✓	✓	✓	✓	✓	✓	✓	
Dursban	✓		✓	✓	✓			
Dipel					✓			
Nomolt		✓			✓			
New Mectin (Vertimec)								
Belmark	✓				✓	✓	✓	
Torque								
Kelthane (Dicofol)								
Actellic			✓	✓				
Admire	✓	✓				✓		
Cascade						✓		

(ii) Scotch Bonnet

This is the most variable of domestic species and the most widespread within Latin America. Large-fruited, thick-walled types, which are used fresh, are common in the Caribbean, while in coastal parts of the Andean region, thin-walled types which are used dried, also occur. The Fruit can be extremely pungent and aromatic, with persistent pungency when eaten.

(iii) Caribbean Green

The fully developed berry is of a deep dark green color before it turns dark red. The length of the berry is 3.76 cm and the width is 3.32 cm resulting in a blocky shape. The fruit wall thickness is 2.6 mm and the number of locules per fruit is 4. It takes an average of 85 berries to weigh a kilogram (38 berries in 1 lb).

(iv) Caribbean Red

The fully developed berry is of a pale light green to cream color. The average fruit length is 4.2 cm and the average width is 2.8 cm giving the fruit an elongated shape. It takes an average of 89 berries to weigh a kilogram (40 berries in 1 lb) The fruit wall thickness is 1.2 mm. There are 4 locules per berry.

(v) Habanero

There are four (4) basic varieties of habanero which are originally from the Caribbean and South America. The habaneros are high yielding varieties and are very adaptable to local tropical conditions. The pepper vary enormously in size and shape according to the variety, ranging from berries ¼ inch in diameter and pods of up to 5 inches long. Caribbean habaneros are often flattened at the end and resemble a tam or bonnet. The pods are green at immaturity and range from red, orange, yellow or white at maturity. They have a distinct 'apricot like' fruit aroma and can hold their flavor, heat and aroma during storage.

4. SITE SELECTION

Hot peppers should be grown in open areas free from shade or overhanging trees. Avoid areas heavily infested with nut-grass.

Clay, sandy and stony soils should be avoided in addition to waterlogged areas or areas prone to flooding. Sandy loam or silt loam soils are best.



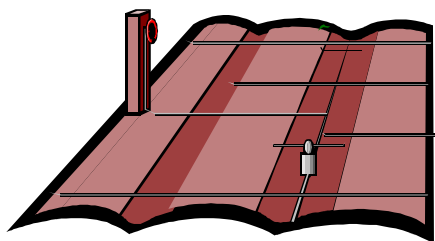
Sandy Loam or Silt Loam soils are best for cultivation

PEST	PESTICIDE	APPLICATION RATE (per gal water)	DAYS TO HARVEST
Weeds	Gramoxone	½ - 1 fl.oz	
	Round up	1½ - 2 fl.oz	
	Lasso	2 fl.oz	
	Herbadox	1¾ fl.oz	
Other Pests			
Mites	Torque	5 ml. (1 tsp)	7 days
	Cascade	5 ml.	—
	New mectin (light infestation)	½ - 1½ ml	7 days

5. LAND PREPARATION

Soils should be well ploughed to depths of 30 cm (12"). The addition of pen manure or organic matter to the soil assist the plants in early establishment and development. Ensure the land is well drained.

Prepare ridges or raised beds along the contours.



Prepare raised beds or ridge and furrow

DISCLAIMER

The use of trade names in this booklet is to identify examples only and is not meant to endorse these products or discredit any similar product.

ANNEX A: PESTICIDE USE CHART

PEST	PESTICIDE	APPLICATION RATE (per gal water)	DAYS TO HARVEST
Diseases			
Pepper Mosaic	—	—	—
Bacterial Leaf Spot	Kocide Phyton 27	1 oz 5-9 ml (1-2 tsp)	10 days 1 day
Phytophthora Blight	Ridomil Banrot	¼ oz (1 tsp) ⅓ oz	14 days —
Bacterial Wilt	—	—	—
Anthracnose	Bravo Manzate	1 fl.oz 1 oz	7 days 5 days
Southern Blight	Captan Rizolex	1½ oz 1 oz	7 days —
Insects			
Aphids	Malathion Karate	½ - 1½ fl.oz 3 ml. (½ tsp)	7 days 7 days
Leaf Hopper	Sevin Basudin	1 oz 20 ml. (4 tsp)	7 days 7 days
Whitefly	Orthene Karate	½ oz 3 ml. (½ tsp)	14 days 7 days
Thrips	Malathion M-Pede	½ - 1½ fl.oz 3 - 4 fl.oz	7 days None
Pepper Stemborer	Basudin	20 ml (4 tsp)	7 days
Mole Cricket & Field Cricket	Basudin	20 ml (4 tsp)	7 days
Mealy Bugs	Basudin Malathion	20 ml (4 tsp) ½ - 1½ fl.oz	7 days 7 days

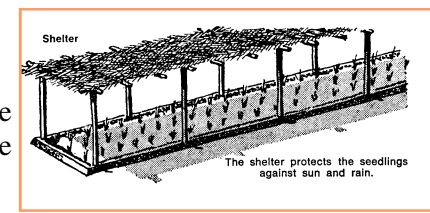
6. SEEDLING PRODUCTION

Use healthy seeds to guarantee good germination of healthy, vigorous seedlings. One hundred grams of seed (¼ lb) have approximately 20,000 seeds, enough to plant two and a half (2½) acres of land.

Hot pepper seeds germinate within 8 - 12 days. They grow slowly in the initial stages

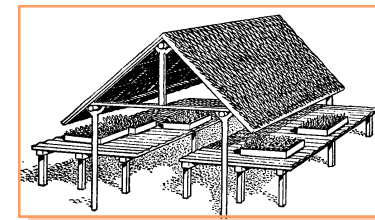
Seedlings can be raised in:

(i) **Shaded Seed bed** - Prepare beds on a clean weed free piece of land with a fine tilt.



(ii) **Seedling Boxes** under covering.

Use boxes of dimension 14" X 20". Sow seeds thinly ¼ inch deep. Water soil well. 1-2 weeks after germination, thin out seedlings 3 -4 inches apart. Thinned seedlings should be transplanted into individual cells of seedling boxes or seed trays.



(iii) **Seedling Trays**

This is probably the most efficient way of producing seedlings. Use premix peat-based commercial mix or coconut coir as the planting medium. Sow a single seed per cell.

Generally, seed beds, seedling boxes or trays must be kept moist at all times. Use a nutrient solution during daily watering, but avoid excessive applications.

Provide shade for seedlings - no more than 35% - 40%. Harden seedlings by exposure to direct sunlight and reduce the amount of watering before transplanting.

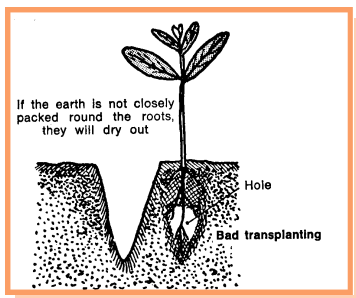
7. PLANTING AND SPAACING

7a. PLANTING

Planting should be planned taking into consideration the following:

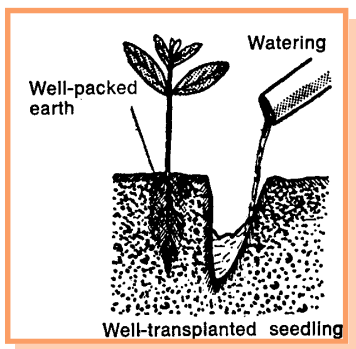
Time to harvest for the market - harvest from October.
Availability of water and labor for planting and establishment.

Transplant seedlings at 4-5 weeks old or when they are at the 4-5 true leaf stage. Transplanting should preferably be done in the evenings when temperatures are low or it is cooler, to avoid excess transpiration. Use healthy, properly hardened seedlings. Bury plant roots firmly into the soil, but not more than half the height of the seedling. Apply water to the field or at the base of the plants soon after transplanting. If plastic mulch is used it must be placed before transplanting.



BAD

There is a proper way of transplanting seedlings.



GOOD

ANNEX

A. Pesticide Use Chart

B. Insecticide Use Chart

C. Fungicide Use Chart

17. COST OF PRODUCTION

Labor Operations	Unit	Rates (\$)	No.	Costs (\$)
Land Clearing	Man-days	25.00	10	250.00
Land Preparation (ridges)	Man-days	25.00	15	375.00
Transplanting and Manuring	Man-days	25.00	12	300.00
Insecticide Application	Man-days	25.00	21	525.00
Fungicide Application (x2)		25.00	4	100.00
Weedicide Application		25.00	1	25.00
Weeding (manual) (x2)		25.00	24	600.00
Fertilizer Application (x21)		25.00	105	2625.00
Miracle Gro Application (x15)		25.00	15	375.00
Harvesting		25.00	264	7600.00
Materials				
Seedlings	-	-	7260	1089.00
Fertilizer (NPK Mg)	sacks		50	2000.00
Manure	sacks	6.00	10	60.00
Miracle Gro	kg	13.00	3	39.00
Insecticides				300.00
Herbicides				100.00
Fungicides				200.00
				16,563.00

Assumptions (1 acre of West Indies Red)

Plant Spacing - 2ft WR x 3ft BR

Plant Density - 7260

Marketable Yields - 36000 lbs

Maturation Period - 70-90 days

Price per Unit Yield - \$0.85¢/lb

(WR - within Row; BR - between row)

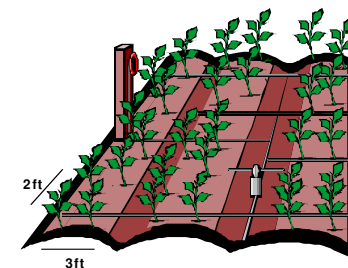
Total Cost of Production - \$16,563.00

Total cost per Unit of output - \$0.46/lb

Gross Margin - \$14,037.00

7b. SPACING

Transplant seedlings onto raised beds or on ridge and furrow, spaced at 3ft between rows and 2ft within rows. Closer spacing can make the fruits difficult to harvest and also results in damaged plants.



8. WATER REQUIREMENTS

Hot peppers require large amounts of water - 5 litres per plant per day - and so the soil should remain moist as much as possible.

As a general rule, watering should be on a 'little and often' basis during the period of establishment, and then in greater quantities as the plant develops. When harvesting begins, it is usual to reduce watering a little. Too much water facilitates bacterial and fungal diseases. On the other hand, if the soil is left to dry out to the point at which the plant wilts, root scorch, followed by the development of fungal root rot may occur. If the drying out of the soil reaches this stage, it is particularly important to allow the plants to recover with a small application of water before applying any liquid or granular fertilizer.



Drip irrigation is more effective in comparison to the use of overhead sprinklers which create conditions for foliar diseases.

Drip irrigation is recommended for peppers.

9. PLANT NUTRITION

Suggested nutrient requirement for hot pepper yield of 5t/ha are estimated at Nitrogen 180 kg/ha (396 lbs/ac); Phosphorus 22 kg/ha (49 lbs/ac) and Potassium 200 kg/ha (440 lb/ac).

Fertilizer application must however take into consideration nutrient recovery rate from the soil by the crop as well as the natural fertility of the soil. Therefore soil and leaf analyses are recommended for each farm. The organic matter content of the soil and the rate of leaching also influence application rates. Fertilizer application must therefore be specific to farms or geographical areas with similar soils. The following rates are suggested for St.Vincent and the Grenadines.

1 week after transplanting	Apply 1 oz NPK (12:24:12) in a circular band 2 inches from the plant and cover lightly with soil.
3 weeks after transplanting	Apply 2 oz NIP (12:12:17+2 MgO) in a circular band 4 inches from the plant and cover lightly with soil.
6 weeks after transplanting	Apply 2 oz NPK (12:12:17+2 MgO) as spot placement about 8 inches from the plant.
9 weeks after transplanting and onwards	Apply 1 oz NPK (16:8:24) at 14 days intervals.
Also apply a foliar fertilizer (e.g. Miracle Gro, Phostrogen, Calmax at 3 weeks intervals.	
This will require 5898 lbs NPK per acre during the first 6 months.	

Add organic matter liberally to increase the water holding capacity of the soil as well as increase its fertility.

Foliar fertilizers, especially those with relatively high phosphorus and calcium content, should be applied at least once per month.

16. MARKETING

In general, both the USA and the UK are undergoing a consumer trend that favors greater use of spicy foods. As a result, there is greater consumption of hot peppers in the USA and UK as mainstream consumers develop stronger taste for ethnic cuisine.

St.Vincent and the Grenadines, through the St.Vincent marketing Corporation, exports to the USA, taking advantage of the niche market that exists for about six (6) months of the year, i.e. from November to March. However, the local market requires year round production.

Fruits of the highest quality are required for export. The market usually demands mature green or ripe (yellow or red) fruits. Peppers should be firm and shiny. Wilted, diseased or blemished peppers are unacceptable. Wipe all soiled fruits as washing is not recommended.

Generally, in the summer, there is competition from growers in the other countries such as Mexico and the USA.

Currently, the St.Vincent Marketing Corporation has entered into contractual arrangements for the production of peppers.



Grading and selection are required. The green peppers are separated from the red ones and packed in well ventilated boxes of the size and strength that can withstand pressures from those above during shipment

15. RECORD KEEPING

The importance of record keeping cannot be overstated. It is not only the basis by which the farmer can make a proper economic analysis on profit or loss, but has become an international requirement as it relates to food safety.

The following records should be kept

1. Cultural Activities

The date, cost of labor, materials and other cultural activities should be noted. These include

- land Preparation
- Fertilizer Application
- Pest Control
- Other
- Planting
- Weed Control
- Harvesting

2. Pesticide Record Sheet

The pesticide record sheet should have the following information:

- Crop data (variety, planting date, product code etc.)
- Name of pesticide
- Place of application
- Dosage and the application dates
- Period of time before harvest
- Name and person responsible for application
- Date of last equipment calibration

3. Training and Documentation

- Operator
- Position or job performed by employee
- Experience
- Date of training
- Training material topics
- Information on institution responsible for training and certificate.
- Signature.

10. OTHER CULTURAL PRACTICES

a. Mulching

Depending on the scale of production and the accessibility of the mulch, this practice may prove to be very advantageous. It helps to maintain uniformity in the degree of moisture throughout the field, besides it assists in weed control. It is also important that when mulch is selected, that it be free of weed seeds and should be adequately dried if vegetative material is used.

b. Barriers

Corn barriers can be established around the border of the farm. This is a useful method since it does not only provide a secondary source of income but attracts natural enemies that are predators of some of the insects that attack the pepper plant, such as aphids among others.

11. PEST MANAGEMENT

DISEASES

Pepper Mosaic

Several viruses affect hot pepper production in St. Vincent causing increased cost of production and reduced yield. Tobacco mosaic virus, cucumber mosaic virus and potato virus are three common viruses of pepper.

Symptoms

Affected plants usually show striking checkered color, mottling on leaves and young stems. Leaves are therefore not uniform in color or shape but show dark green, light green colors or even white cream mottles. The plant looks stunted and does not respond to fertilizer application.

Spread

Many viral diseases are seed borne; therefore use of infected seeds is an important means of spread. Whiteflies, Thrips and Aphids also spread these pathogen from plant to plant during normal feeding.

Control

Control of this pest involves the use of one or more of the following actions:

- Purchase and use only certified seeds or seeds collected from high yielding disease-free plants.
- Rogue and destroy diseased plants as soon as they are observed.
- Practice crop rotation.
- Keep insects, especially Aphids, Whiteflies, Leafhoppers and Thrips under control. Spray with a suitable insecticide.

Bacterial Spot

Symptoms

On leaves, bacterial spots are recognized by the presence of several small spots about 0.5 - 2.0 mm, especially on the under surface. The spots have a central depression on the upper leaf surface and slightly raised brown areas centrally on the lower service. On fruits, raised 2mm spots with distinct halo are visible.



Xanthomonas campestris
(water-soaked spots with
brown centers and thin
chlorotic borders)

Spread

13. HARVESTING AND YIELDS

Harvesting can be done up to 6 months after planting. The first matured fruit can be expected approximately 70-80 day after transplanting depending on the variety. It is important to harvest at the right stage of development. Harvesting should be done once per week to prevent overripe fruits. It should be done in dry weather as wet peppers spoil easily. Do not expose the crates to direct sunlight or strong winds for long periods. Fruits should be picked early in the morning with the stalk attached. The use of field bags is not recommended as peppers are hollow and can be easily crushed. Use field crates or shallow boxes. The harvested peppers should be firm, shiny, free of blemishes, cracks and soil. Yields vary with spacing; at a spacing of 2ft x 4ft, up to 30,000 lbs/acre is possible.

At the recommended spacing of 2ft x 3ft, up to 36,000 lbs/acre have been achieved.



Crates are used to harvest peppers

14. POST HARVEST HANDLING

Careful handling is important to reduce post harvest losses. Injury will encourage decay. Hot peppers should not be washed after harvesting, as wet fruits spoil easily. Store the harvested pepper in a cool place to maintain turgidity.

Shelf life and quality are directly affected by maturity of fruits at the time of harvest. Immature fruits will rapidly shrivel and wilt due to moisture loss.

An entire field of peppers may be lost due to a build up of pests and diseases as seen above. This field was affected by white flies, mealy bugs and a serious build up of fungal diseases.



12. WEED MANAGEMENT

Weed management begins before crop establishment. After selecting the field in which the crop is to be established, carefully examine the type of weeds present. Identify major problems weeds for special attention and direct weed control efforts, manual, chemical or otherwise to eradicate these weeds from the plot before establishing the new crop.

Good soil tillage is an important second step in weed management since this operation dislodges and sometime bury difficult to kill perennial weeds. This operation however spreads weed seeds and bring to the soil surface millions of dormant ones buried in the soil.

The third step in good weed management therefore rests with the control of seedling weeds during the first 4 weeks after tillage or after land clearing. Hand weeding can be used to control this early weed growth, however since it is very time consuming and costly the use of a pre-emergent herbicide or stale seedbed techniques will reduce costs.

Weeds will continue to emerge during the life of the crop. In addition to the measures outlined above, these can be controlled by mulching, correct spacing of crop and the application of a post-emergent herbicide, e.g. Roundup, Gramoxone. It is important to remember that weeds must be destroyed before they produce flowers, fruits and seeds.

This disease is spread mainly by wind, rain splash and surface runoff water. The movement of agricultural workers from field to field also lends to the spread of this disease.

Control

- Ensure there is good soil drainage in the entire field.
- Maintain good weed control practices.
- Use crop rotation with crops not affected by this disease. e.g. Cucurbits.
- Destroy crop residue, especially those from infected plants.
- Spray with suitable fungicides.

Phytophthora Blight

Symptoms

Affected leaves develop brown irregular spots about 1 - 4 mm. These spots are surrounded by yellow halos. Spots may merge with other neighboring spots to form larger spots. Severely spotted leaves turn yellow and fall. Affected stems may develop brown patches along its length, especially at the soil surface level. As the disease progresses, the entire stem decays at the soil level, causing death of the plant. This rot is called a collar rot as it occurs on the region of

the stem often referred to as the collar.



Spread

The disease is spread mainly by wind, rain splash and surface runoff water. Transmission on the

The rot on stems may occur at the stem joints, resulting in death of the plant above the affected area.

hands of agricultural workers is also an important means of spread.

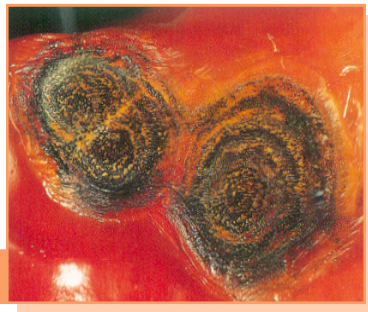
Control

- Ensure there is good soil drainage in the entire field.
- Maintain good weed control practices
- Use crop rotation with crops not affected by this disease.
- Keep fruits off the soil
- Destroy crop residue, especially residue from infected plants.
- Spray with suitable fungicides.

Anthracnose

Symptoms

This disease is mainly seen on ripe fruits, which develop soft circular slightly sunken necrotic spots with centrally placed rings of black fungal fruiting bodies.



Circular rings on the ripened fruit.

Spread

Use of infected seeds to establish a new crop is a major source of spread. Wind and rain splash are also agents of spread, especially when diseased fruits are not promptly destroyed.

Control

- Use clean certified seeds.
- Crop rotation.

seedlings are pulled down into the soil. They may also cause uprooting due to the tunneling activities. Mole Crickets also cause damage by drying out the soil and feeding on the roots.

Control

Insecticide baits can be used which may be scattered or placed in the infested areas.

Cutworms

The adult are moths with varying colors and are active at night. However, it is the larvae that cause the damage. The larvae may vary in color from light gray to black and when fully grown reaches about 1½ inches in length.

Symptoms

The damage occurs mainly to the seedling or small plants. The small larva in the initial stages feeds on the foliage, leaving small irregular holes in the leaves. The fourth instar feeds under or slightly above ground and girdles the stem of the plant. The girdled plant then topples and dies.

Control

- In cases where there is a history of this problem on the particular farm, a soil treatment should be done soon after planting in the late afternoon. In other locations where this problem is not frequent, spot treatment is more feasible.
- Fields should be kept weed free
- When infestation is low, the larvae, which often lie resting about an inch beneath the soil surface close to the plants cut the night before, can be uncovered and crushed.
- Use appropriate pesticides.

the adults but are smaller.

Symptoms

The leafhopper causes hopper burn, although it is rare in pepper. When this occurs, the tips and sides of the pepper leaves turn yellow to brown and become brittle.

Control

- Remove infested plants.
- Spray with suitable insecticides.

Pepper Stem Borer

Damage is done by the larvae of this insect, which is a beetle belonging to a group called Long-horned beetles or Longicorn Beetles.

The adult beetle has a “cylindrical grayish body” with hard shell-like outer wings. The antennae are as long as the insect itself, and usually curved backwards. The beetle is about ½ inch long. They are nocturnal and hide during the day. They make a squeaking sound when picked up.

The larva is creamy white and has a brown head with well developed chewing mouth parts.

The adult inserts its eggs into the plant stem. After hatching the larvae enter the pith of the stem where they feed and develop.

Mole Cricket

Adults have well-developed wing covering ¾ of the abdomen when held at rest. They fly at night, can run quickly, but are poor jumpers. These insects have enlarged, shovel like legs modified for digging. The adults are cylindrical, 1½ inches long and dull brown in color. The nymphs are similar to the adults but are wingless.

Damage

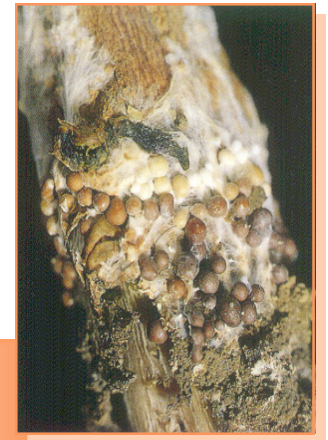
The mole cricket chews the lower stem, and at times, destroys the entire vegetable seedling from underground tunnels. As they eat, the

- Destroy crop residue, especially from affected plants.
- Spray with suitable fungicides

Southern Blight

Symptoms

Affected plants die from a sudden wilt, and are usually associated with white fungal growth around the stems of these plants in the collar region (area of stem at soil surface level). The presence of white, cream or brown yeast-like beads may be evident around the base of affected plants as the disease progresses.



Spread

Spread of this disease occurs readily on farm

Note the matured tan brown sclerotia or yeast-like beads on the base of the affected

tools used in cultivation. Infected plant tissue left in the field is also a major source of disease spread.

Control

- Do not transplant seedlings affected by this disease.
- Rogue and destroy diseased plants and the infected soil at the base of the plant. Dispose of in a safe area on the farm that is not being or will not be used for crop establishment.
- Spray with suitable fungicides.

MITES

Mites

Symptoms

Affected plants may appear stunted. The leaves curve downward and leaf size is greatly reduced. In severe cases, the terminal shoots appear bronzed and new leaves become successively small and culminate with cessation of new leaf development. Fruit production is greatly reduced and fruits may also be scarred.

Control

- Early weed control to remove alternative host before crop establishment.
- Do not establish new fields down-wind of old infested fields.
- Spray with suitable acaricides

INSECT PESTS

With sucking insects, the presence of the insects on the crop will be more readily seen than the symptoms associated with damage in many instances.

Aphids

These are small green, brown or black insects with or without wings seen clustered on young shoots (stem and leaves). The wingless forms are pear-shaped and measure about 1.5 mm. They possess long legs that are very distinct, and a pronounced head. When disturbed all of the insects in the colony display a twitching body motion at frequent intervals.

Control

Use appropriate insecticides - (see Whitefly)

Whitefly

These are small white insects, usually 2-3 mm long. Each possess four wings with the two outer wings held horizontally while at rest.

The insect is covered with fine white scales that become easily detached from the body if handled. They are usually present in larger numbers under the leaves of the pepper plant than at any other location.

Symptoms

When the underside of the leaves are inspected in bright day light, droplets of “honey dew” excreted by the adult fly are observed. Since these are sucking insects they generally weaken the plants by sucking sap, causing the leave to shrivel, turn yellow and droop.

Control

- Spray with suitable insecticides
- Crop rotation.
- Remove alternative host plants

Thrips

These insects are extremely small, with a slimy body which is colored yellowish brown or black. The nymphs have similar habits as the adults, rasping and sucking sap from the plants.

Symptoms

The leaves are distorted and curl upward giving a boat-like appearance. The lower surface of the leaves develops a silvery coloration that later assumes a bronze coloration.

Control

Use appropriate insecticides.

Leaf Hoppers

These are of various forms, colors and sizes which do not exceed 3 mm in length and fly quickly when disturbed. Nymphs resemble