

SUGGESTIONS FOR INTEGRATED INSECT AND DISEASE MANAGEMENT IN PEPPERS



NARMAP

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INTRODUCTION

Several pests and diseases attack sweet pepper crops. The most important are **whiteflies**, the **pepper weevil**, **fungal wilt**, **bacterial leaf spot** and **bacterial wilt**.

Most farmers in Belize apply a great deal of pesticides against pests of peppers. This is expensive, kills beneficial organisms and leaves residues in food and water and can poison people.

An alternative is to use **Integrated Pest Management (IPM)**, which combines several methods such as agricultural practices, tolerant varieties, biological control and pesticides. In this way it is possible to reduce pest and disease damage and obtain good yields and profits without harming the environment or risking lives.

In order to use **IPM** effectively, it is necessary that the pests must be well recognized, sampling conducted, that the most adequate decisions making criteria used and control measure is applied.

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WHITEFLIES

What are whiteflies?

There are many types of whiteflies, but the one that causes most damage is known by the scientific name *Bemisia tabaci*.

Although called flies, these insects are really relatives of cicadas. They are very small with white wings, as photo 1 and 2 shown



Photo1. Whitefly adults



Photo 2. Whitefly nymphs

A great number of these flies are usually found under the leaves, either alone as adults or with their young as shown in photo 2. The young are called nymphs.

How do viruses cause damage?

Whiteflies have mouthparts shaped like tiny, fine needles which they insert into the leaf of the plant to suck the sap. As they do this, they introduce tiny organisms called viruses which cause disease in the plants.

As a result of this, the pepper plants may be shorter than normal, leaves may, turn yellow and, wrinkled (see photo 3) and produce little or no yield.



Photo. 3. Diseased plant.

Viruses are extremely tiny, too small to be seen with the naked eye. Sometimes the plant can appear healthy but have a virus, misleading the farmer.

In most fields, the plants become damaged after only a few weeks since the whiteflies transmit the virus easily.

Sometimes only a few flies are needed to completely ruin an entire field. For this reason it is important not to let them inject the virus into the plants.

The younger the plant, the greater the damage caused by the virus, such that small plants should be protected for the first eight or ten weeks after germinating. Although it is almost impossible to prevent

the flies arriving, delaying their arrival can result in much less damage.

How can this pest be managed?

It is recommended that seedbeds should be covered with a fine mesh (see photo 4).



Photo 4. Covered seedbeds

It is also a good idea to grow seeds in trays or cups made out of paper or cardboard (see figure 1). The seedlings can then be transplanted with their root ball of soil.



Figura 1. Transplants with root ball

This will help them grow healthy after transplanting and better resist virus attack.

Other recommendations for managing whiteflies are:

- **Locating** seedbeds at a good distance from old pepper fields.
- **Eliminating** plant remains and weeds such as "chichibe" on which the insects reproduce.
- **Planting** barriers or wind breaks of corn, sorghum or tall grasses, These should be planted on the sides of the plot most often facing the wind or breeze.

- **Tending** the crop carefully, applying fertilizer and watering when necessary so that the plants grow healthy and can better resist virus attack.

- **Applying** insecticides that do not harm the insects that are enemies of the whiteflies, so that these can help in their control. When spraying, care should be taken to only wet the undersides of the leaves where the adult flies and nymphs live.

THE PEPPER WEEVIL

What is the pepper weevil?

The pepper weevil is a small, grey or silvery black beetle smaller than the head of a match (see photo 5). Its scientific name is *Anthonomus eugenii*.



The females lay tiny white eggs, almost always in the flowers and buds, in which they hatch.

A small, fat C-shaped larva (maggot) hatches from each egg and starts to eat the peppers from the inside.

The larva then changes into a white pupa. The adult male and female weevils later emerge from the pupa and reproduce.

Less than three weeks elapse between the female laying eggs and the complete development of the adults.

Weevil damage starts when the pepper plants flower. If they do not find any flowers, the weevils may eat tender leaves but do not cause serious damage. They normally eat buds, flowers and fruits. The larvae or grubs cause the seeds to rot as they eat the peppers.

When there is a heavy attack of weevils, the plant may drop its buds, flowers and small fruits. The fruits may also ripen prematurely or be deformed.

Tiny holes can be found in fruits that have been attacked by weevils. The adult weevils come out through these holes when they are mature.

How can this pest be sampled?

Sampling must be done to find out the number of beetles that are in a field of pepper plants. This means that plants in certain areas of the pepper plot must be

examined. Only a certain part of the plant is examined and the sampling procedure lets the farmer decide whether or not to apply insecticide. This decision is based on what scientists call the **threshold**.

Samples should be taken once a week up until the first buds appear in the peppers. Five areas are chosen in the field. These should each contain 20 pepper plants and the five stations should be spaced evenly in the plot (see in figure 2).

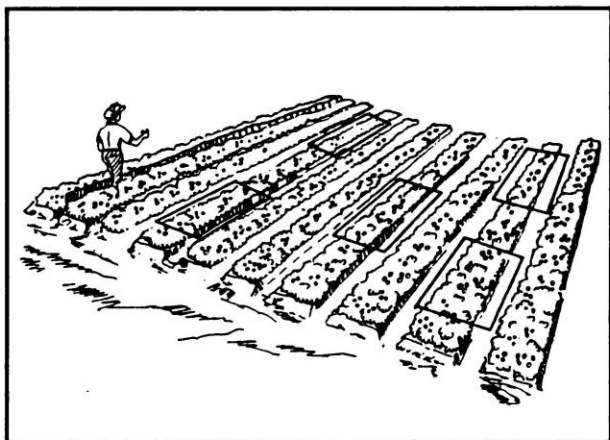


Figure 2. Sampling areas

For the first two weeks of sampling, four of the stations should be at the edge of the plot and one in the center.

The terminal bud or tip of each pepper plant should be carefully examined (see arrow in figure 3), and the number of weevils counted.

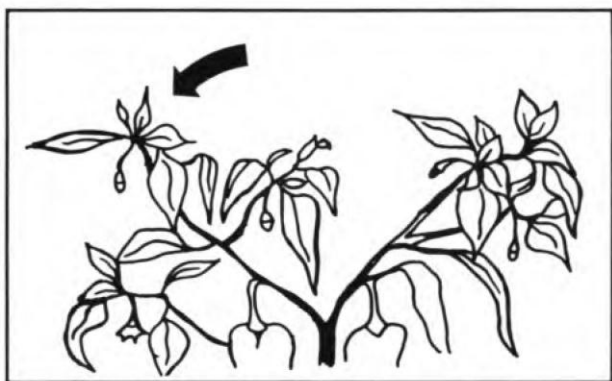


Figure 3. Buds for sampling

Care must be taken not to touch the bud or otherwise disturb the weevils, or they will hide.

Sampling should be done in the morning before 9:30 or in the late afternoon after 5:00 since the weevils dislike the sun and it is hard to find them in strong sunlight.

How can the pest be managed?

Insecticide should be applied only if the following thresholds are crossed in the 100 plants sampled:

- One adult or mature weevil per sweet pepper plant.

- Two adults per hot pepper plant.

Insecticide must be applied early in the morning or late in the afternoon.

Other methods of controlling pepper weevils are:

- **Removing** plant remains and weeds such as nightshade, which weevils like.
- **Burying** or destroying fallen fruits.
- **Placing** new pepper plot far away from old pepper plots.
- **Surrounding** the plots with high barriers of corn, sorghum or eggplant.
- **Planting** two to four rows of peppers at the edge of the plot one month before sowing the rest of the plot. These rows form what is called a trap crop since they attract the weevils. When these rows start to flower, insecticide should be sprayed twice a week.

FUNGAL WILT

Fungal wilt is a disease of peppers that is caused by a fungus with the scientific name *Sclerotium rolfsii*. It often occurs in pepper plots in Belize, Guatemala and El Salvador.

How can you recognize fungal wilt?

The pepper plants wilt very quickly in all parts. Where the stem is close to the soil there is rotting, surrounded by white, cotton-wool-like growth, as shown in photo 6. Small white, orange or brown balls can sometimes be seen on the white growth and these are the seeds of the fungus (see photo 6). These seeds are used to recognize the fungus.



How can fungal wilt be managed?

Diseased plants must be removed and weeding must be done while the weeds are still small. The pepper crop should be rotated with corn or sorghum for two years. Beans should not be used in rotation with peppers since both crops are attacked by fungal wilt. Excessive watering should be avoided.

BACTERIAL LEAF SPOT

What is bacterial leaf spot?

This disease is also known as "bacterial blight" or "angular spot".

It is caused by a bacteria with the scientific name *Xanthomonas campestris* pv. *vesicatoria*. It is the most common Central American bacteria affecting leaves. It appears regularly after transplanting and in some cases, its damage can be seen in seedbeds.

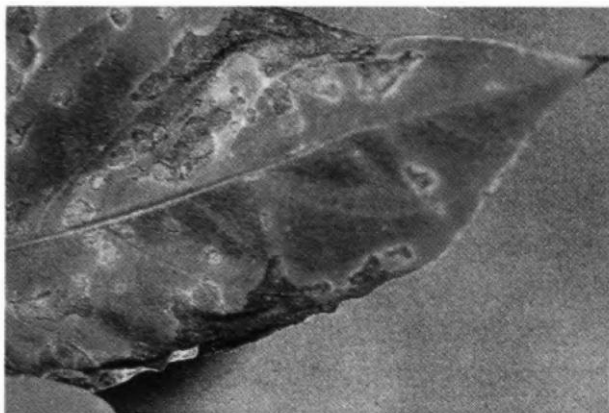
It can attack all the pepper plants in the field and causes most damage when there is plenty rain with wind or when overhead sprinklers are used. Damage is greater when the plots have not been fumigated with copper based fungicides such as tri-basic copper sulfate and copper hydroxide (e.g. Kocide or Cupravit Blue). A bactericide such as Agrimycin can also be used.

Bacterial leaf spot is spread by the splashes of raindrops onto the plants and by humid winds.

The bacteria that produces the disease enter the plant through leaves and fruits that have already been damaged. The bacteria live in the remains of diseased plants that have been left on the ground in plots. They can also live in the roots, leaves and stems of plants that have survived from previous harvests. The bacteria can survive for five months in the soil, and up to ten years in seeds.

How do you know its bacterial leaf spot?

The bacteria that causes the damage can grow on young fruits, leaves and even stems. On the leaves, the bacteria first appears as round spots with light colored edges, as can be seen in photo 7.



These spots then become uneven in shape and turn dark brown. The middle of the spot nearly always falls out. In the stem, it causes small, dark wounds. On young fruits, it causes small, dark green, oily blisters. At first these spots are bordered by a light colored edge which disappears with age. Part of the damaged area drops off leaving an uneven, light brown to black hole in the fruit. Bacterial leaf spot does not damage mature fruit.

How can bacterial leaf spot be managed?

There are no commercial varieties of pepper that are free of attack from this disease. However, some varieties of peppers are attacked more badly than others. Once the plants have the disease, it is very difficult to control. For this reason it is best to:

-Plant healthy seed to avoid its appearance.

-If the seed is suspected of carrying the disease it should be soaked for one minute in a 1% sodium hypochlorite (clorox) solution before planting.

-Seed trays should also be treated and the soil used for planting should be as clean as possible.

-After harvesting the crop, the old plants and residues should be removed and the field should be cleaned, removing any plants that might have the bacteria.

-In plots where the disease has appeared, it is best to plant pasture after harvest and let the plot lie fallow for one or two years.

-If bacterial leaf spot strikes, it can be treated by spraying with tri-basic copper sulfate or copper hydroxide e.g. Kocide or Cupravit Blue together with mancozeb. If there is a drop in humidity after application, the treatment will give good results. However, in areas of high humidity, the disease will not be eliminated.

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BACTERIAL WILT

How can you recognise bacterial wilt?

This disease is caused by a bacteria with the scientific name *Pseudomonas solanacearum*. It occurs in crops such as peppers.

It often causes problems in peppers sown in the hot, wet regions of Belize.

The first symptom or sign of the disease is wilting in the plants, as shown in photo 8.



BIBLIOTECA

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Young plants die rapidly so that the problem may be interpreted as lack of water or root damage caused by insects.

The wilting starts in the lower leaves. Sometimes wilting only occurs on one side of the plant and in a few days the whole plant wilts, without the leaves turning yellow.

The disease can appear from the time when the plant has between five and eight leaves up to when it bears fruit.

The bacteria that cause bacterial wilt live in the soil at a depth of up to two feet. On plots sown with crops that are not damaged by the disease, it can survive for over ten years. The bacteria enter the roots through small wounds that may have been caused by insects, nematodes or tools used in the field.

As well as peppers, the disease can affect potatoes, tobacco, peanuts, eggplant, bananas and soybeans. It spreads from plant to plant through splashes of rainwater

or irrigation water as well as through runoff. It can also be spread by farm tools, machinery and materials, tractor tires and the poles used to support plants.

How can bacterial wilt be managed?

Once the plant is affected, it is very difficult to control.

The best measure is to ensure that it does not appear by using healthy seed. If the seed is suspect, it should be soaked for one minute in 1% sodium hypochlorite solution (clorox) before planting.

If seedlings are to be transplanted, the seedbed should be treated and after harvest at fields should be cleaned of all crop residues and other plants where the disease can survive. In places where the disease has arisen, it is best to plant grass and let the area lie fallow for one or two years.

If the disease appears it should be managed using copper hydroxide e.g. Kocide or Cupravit Blue together with mancozeb. This is effective when temperatures after application are lower. In very wet areas, these products will not kill the disease.