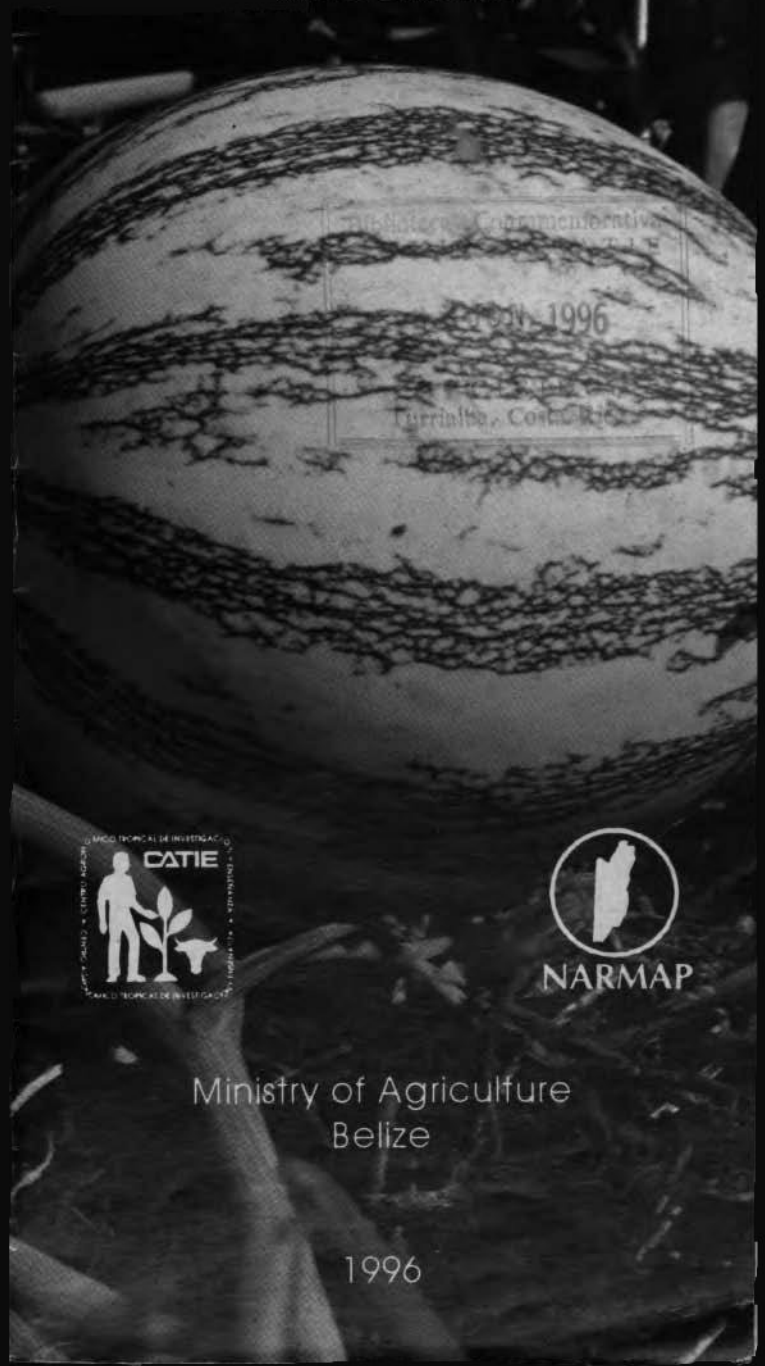
SUGGESTIONS FOR INTEGRATED INSECT AND DISEASE MAGEMENT IN CUCURBITS



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INTRODUCTION

Cucurbit crops include watermelon, melon, cucumber, pumpkins and squashes. Several pests and diseases attack these crops. The most important are **aphids, whiteflies, fruit worms, powdery mildew** and **downy mildew**.

Most farmers in Belize apply a great deal of pesticides against pests of cucurbit crops. This is expensive, may kill beneficial organisms, and leave residues in food and water supplies and can poison people.

An alternative is to use **Integrated Pest Management (IPM)**, that 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 and causing less harm to the environment.

In order to use **IPM** effectively, it is necessary that the pest be well, identified sampling conducted, so that the most adequate decision making criteria are used and that the appropriate control measure is applied.

APHIDS AND WHITEFLIES

What are aphids and whiteflies?

Cucurbits are attacked by several types of aphids, as shown in photo 1.

Photo 1. Group of aphids

They are also attacked by whiteflies, as shown in photo 2.

Photo 2. Whitefly adults

Aphids are very small and generally appear in groups together with their young, called **nymphs**.

The aphid nymphs resemble the adults by having legs, but they lack wings. The wings do not appear until the aphid is an adult. Both nymphs and adults are nearly always yellow, light green or yellowish green.

Whiteflies nymphs have neither legs nor wings, as can be seen in photo 3.

Foto 3. Whitefly nymphs

Nearly all aphids prefer to be on the shoots, stems and under the young leaves, although they sometimes appear under mature leaves.

Adult whiteflies tend to stay under young leaves, while the nymphs prefer mature leaves.

Both aphids and whiteflies have a type of fine needle instead of a mouth, which they use to pierce the leaves and suck the sap. When they suck, they waste a lot of sap which falls onto the leaves to form a sticky mass.

A black fungus known as "**sooty mold**" grows on the sticky sap, damaging the leaves and reducing production in the plants. In addition, aphids and whiteflies can transmit microorganisms known as viruses.

How can viruses cause damage?

Viruses are extremely tiny, too small to be seen with the naked eye. There are many types of viruses and different ones can sometimes appear on the same plant.

Viruses that are transmitted by aphids stick to the outside of the needle-like mouthparts of these insects. They may be removed when the aphids suck the sap of plants other than cucurbits. They can also be removed by some of the oils that are sprayed on to the plant leaves. In contrast, the viruses transmitted by whiteflies live inside the insect's body and cannot be removed this way.

Viruses produce different types of damage in plants. Depending on the type of virus which attacks the plant, it may be undersized (dwarf), have yellow, wrinkled or spotted leaves, leaves with blisters or serrated edges or leaves that roll up or down (see photo 4).

Photo 4. Leaf with symptoms

In addition, the plant has little or no yield, as can be seen in photo 5.

Foto 5. Fruit affected by viruses

The fruits that manages to form may have strange shapes or colors, be covered with warts and taste bitter.

Occasionally, the plant may appear healthy but have the virus inside, which is misleading. In most fields, all the plants become damaged over the space of a few weeks, since aphids and whiteflies transmit viruses so easily.

Sometimes **it needs only a few of these insects to completely ruin a field. Because of this, they must be prevented from injecting the virus into the plants.**

The younger the plant, the more damage the virus causes. For this reason, plants must be well protected during their first weeks of life.

Although it is impossible to prevent aphids and whitefly reaching the crop, they will cause less serious damage **if their arrival is delayed as much as possible.**

As well as sucking a great deal of sap and transmitting viruses, whitefly can also transmit a disease known as silvery leaf, shown in photo 6.

Foto 6. Silverleaf disease

The leaves of the plant turn completely silver in color and the yield is reduced. The damage is caused by a toxic substance in the saliva of whitefly nymphs.

How can these pests be managed?

-**L**ocating new plots a good distance away from old cucurbit fields.

-**E**liminating plant remains of old cucurbit crops.

-**D**estroy weeds surrounding recently planted crops, since these serve as breeding grounds for aphids and whiteflies.

-**P**lanting barriers or wind breaks of corn, sorghum or tall grasses as in photo 7.
This is especially important on the windward side of the field.
Some aphids feed on these barriers and in this way clean the viruses from their mouthparts. The barriers also help to reduce the effects of wind on bees that pollinate the flowers of the crop.

Photo 7. Plant barrier and plastic mulch

-Planting the crops more densely on the sides of the plot facing the strongest winds.
Diseased plants should then be uprooted to stop the virus spreading.
If other plants subsequently show signs of disease, they should also uprooted.

-Let weeds grow between the rows during the first weeks. When the soil is covered with weeds it confuses the aphids and whiteflies. Some of the weeds will also clean the virus from the mouthparts of the aphids.

-Cover the soil with white or silver plastic as shown in photo 7. This repels aphids and whiteflies.

-Spray the crop with agricultural oils, which helps to clean the aphids' mouthparts. Some oils also repel whiteflies. Care should be taken with these oils since they can burn the plants.

-Fortify the plants with fertilizer and irrigation so that they can better resist attack by virus.

-Apply insecticides that do not kill **natural enemies**. Which are insects that eat aphids and whiteflies. These enemies help to control the pests When spraying care should be taken to only wet the undersides of the leaves where there are more nymphs and adults.

FRUITWORMS

What kind of fruitworms are found in the fruits?

There are two species of worms that bore into cucurbit fruits. Scientists call them *Diaphania nitidalis* and *Diaphania hyalinata*. Both species attack watermelons, melons, cucumber, squash and pumpkins or squash. Caterpillars of *Diaphania nitidalis* are often called cucumber worm or pickleworms, since they prefer this crop along with pumpkim or squash. *Diaphania hyalinata* caterpillars are often called melon worms, since they are a common pest of this crop.

Worms of both species hatch from **eggs** laid by moths. A tiny **caterpillar** or larva (maggots) emerges from each egg, and later forms a cocoon or **pupa**. Adult male and female **moths** emerge from the pupa and later reproduce. The life cycle of these insects takes about one month to complete.

The **eggs** are small and flat in appearance. They may appear single or in groups on the shoots, young leaves, stems, flowers or fruits.

The larvae or maggots of the two species differ in appearance. Pickleworms are white or yellow when young and later develop dark spots, as shown in photo 8.

Photo 8. Pickleworm

When the caterpillars are fully mature, the spots disappear and the caterpillars turn pale green. Melon worms are green with two white lines, down the sides as shown in photo 9.

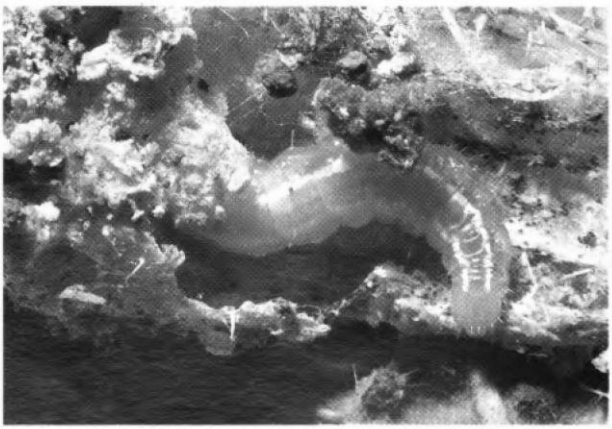

Photo 9. Melonworm

Both types of larvae feed on shoots, stems, leaves, flowers and fruits of the plants they attack. Pickleworms prefer the fruits and shoots. Young melon worms prefer the leaves, leaving them full of holes and covered in threads of silk. When they are mature, they prefer to eat the fruits.

Both types of worms bore tunnels in the fruits, leaving what appears to be sawdust outside the entrances. The holes are covered with silk, as can be seen in photo 10. The fruits may fall and lose their commercial value.

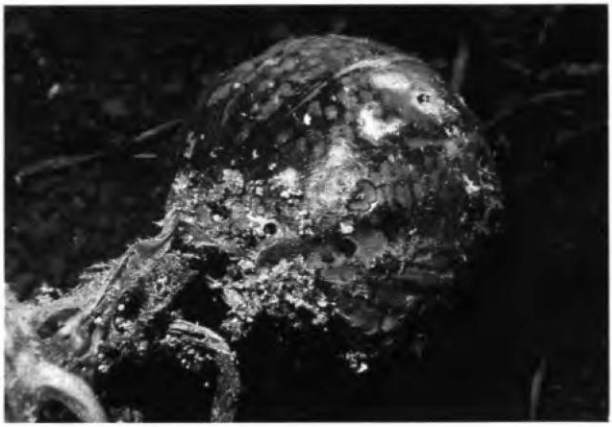

Photo 10. Damage by worms

How can these caterpillars be managed?

-**D**estroy plant remains from previous cucurbit crops.

-**P**lanting new plots far from old cucurbit fields.

-**A**pply a biological insecticide prepared from *Bacillus thuringiensis* bacteria (Dipel or Larvo-Bt). This insecticide does not harm people or the environment. It works well when the caterpillars are small. Some farmers mix it with regular insecticide **but using half the dosage** indicated on the label. This reinforces the action of the biological insecticide without harming the caterpillars' **natural enemies,** which help to control them the pest.

POWDERY MILDEW

What is powdery mildew?

Cucurbits are attacked by a fungus scientists call *Oidium* spp. This fungus can damage the leaves, stems and in some cases, even the fruits of cucumbers, melons and watermelons. The disease produces yellow spots on the leaves as see photo 11.

Photo 11. Yellow spots with white fungus growth

On the underside of the leaf, the yellow spots are covered with a white fungal growth. For this reason it is called **powdery mildew**. The white fungal growth contains the spores of the fungus which can spread the disease to other leaves and plants.

The disease destroys the tissues that make up the leaf. This results in a decrease in the quantity and quality of fruits.

The disease appears in all cucurbit producing regions of the world and the fungus which is responsible can change so that it can attack resistant varieties.

The fungus survives in cucurbits grown out of the normal planting season and in volunteer plants planting. The wind and insects transports the fungal spores.

The fungus can germinate and attack plants even when no water is present. For this reason it can also appear during dry weather, unlike other fungi. When there is abundant water, powdery mildew may be reduced. The fungus only takes seven days to penetrate the leaves and damage them.

How can powdery mildew be managed?

-Planting cucumber, melon and watermelon varieties that are resistant to attack by this fungus. In Belize, a watermelon hybrid or cross called "Top Yield" is resistant to this type of disease. However, when weather conditions favor fungal attack, fungicides should be used to help protect the crop.

-Fungicide application is the most commonly used method for fighting this fungus. Sulfur products such as wettable sulfur and dinocap can be used since the fungus does not develop resistance to them. However, the fungus can develop resistance to other products such as Benlate, Bayleton, Baytan and Saprol, which, then no longer control it.

-Destroy plant remains of previous crops.

DOWNY MILDEW

What is downy mildew?

As well as powdery mildew, there is another fungus, *Pseudoperonospora cubense*, which causes the disease downy mildew. This fungus grows on the leaves producing oily spots which later turn yellow. In cucumbers the spots may form between the veins of the leaf. In some cases the leaf shows a kind of spotting that may be confused with a viral attack as see in photo 12.

Photo 12. Mosaic symptoms or spots caused by virus

If the fungal attack is severe and temperature and humidity levels are favorable, the fruit can be damaged. It must be remembered that under these conditions, other fungi and some bacteria can also cause damage to the leaves. For this reason, it is important to be observant and notice the early signs of oily spots so that control measures can be taken quickly.

Downy mildew attacks cucumber, melon and watermelon crops. Like powdery mildew, it can change so that it is able to attack previously resistant varieties.

Staggered plantings, that is planting the some crop continuosly, and large areas under the same crop favors the spread of downy mildew. The fungus that causes the disease is spread by wind, raindrops and splashes. It needs humidity to germinate and penetrate the leaves, unlike powdery mildew. Fungal growth can be seen on the plant just 3 or 4 days after arrival. The fungus survives in plant material left behind after harvest and in plants grown outside the normal planting season.

How can downy mildew be managed?

-Plant resistant varieties of cucumber, melon and watermelon. In Belize, the water melon hybrid "Top Yield", which is resistant to this disease, is often grown. A cucumber hybrid called "Poinsett" is often planted since it is also resistant. However, fungicides should always be applied as well.

-During wet weather, fungicide should be applied at the first sign of the disease. Contact fungicides such as Antracol, Dithane-M-45, Manzate or Bravo can be used. Alternatively, systemic fungicides such as Alliette and Ridomil can be applied. These **should be applied** alternating with other fungicides to prevent the fungus **developing resistance**.

-Sprinkler should not be used at night or in the morning when the leaves are still wet with dew. This type of watering encourages fungal development because the plants stay wet for a long time.

-The rows of plants **should** run in the same direction as the prevailing winds. This allows better ventilation and air movement, which is important in these crops. The plantings should not be too thick as this increases the humidity.

-Plant residues from previous crops should be completely eliminated.

Notas:

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