

SUGGESTIONS FOR INTEGRATED INSECT AND DISEASE MANAGEMENT FOR CABBAGE

Disseminated by the National Plant Disease Survey
United States Department of Agriculture



MAP

Which pests causes the most damage in cabbage crops?

From the seedbed to harvest there are many living things that feed on cabbage plants.

These include insects, fungi, bacteria and molluscs snails.

All of them damage the crop in a different manner.

Only some affect the crop every year. If the plants are not guarded against them, they can cause a great deal of damage to the yield. For this reason they are called pests.

Insects that damage the crop include the cabbage worm or caterpillars of the Diamondback moth *Plutella*, aphids and *Diabrotica*.

Diseases include the bacteria *Xanthomonas* which causes black rot in cabbage heads and the fungus *Sclerotinia* or *Sclerotium* which causes white mold or black head.

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RECIBIDO
Turrialba, Costa Rica

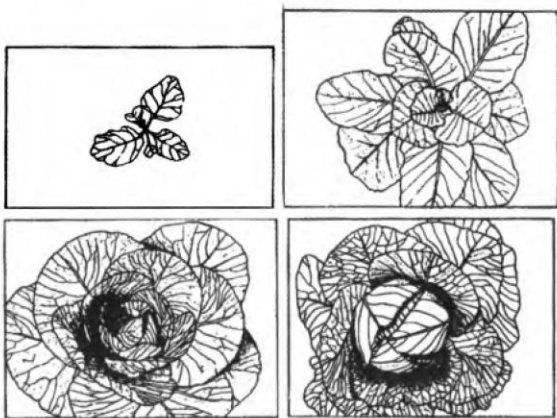
When do insects and diseases affect the crop?

The cabbage crop develops in four stages on phases. The first is the **seedling** stage in the seedbed, lasting between 20 and 30 days.

After transplanting, the plants produce **many leaves** during a stage lasting 20 to 30 days.

After this comes **head formation**, which lasts from 25 to 30 days.

The final stage is **head filling**, which takes between 20 and 25 days.



Each insect and disease tends to attack the crop at a certain stage. Some prefer to attack when the plants are young or small, and others when the heads have already formed. It is important to know when each pest attacks the plant and causes damage to the crop.

Which diseases affect small cabbage plants?

If the seedbed is very damp and overcrowded, seedlings can be found with constrictions at the base of the stem. This is caused by a disease commonly known as "damping off".

A number of fungi causes this disease, the most common being *Fusarium*, *Pythium* and *Rhizoctonia*. These fungi can survive in the seedbed. If the same soil is used year after year in the seedbed, the problem can become serious.



Which insects affect small cabbage plants?

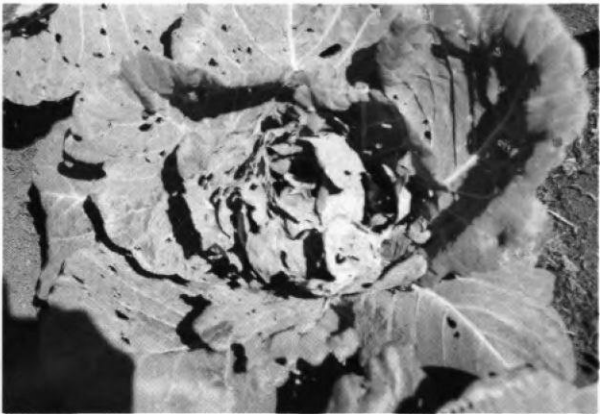


In the seedbed, or just after transplanting, larvae (maggots) such as white grubs, or *Phyllophaga* and wire worms, or *Agrotis* can affect the small plants. These cut roots and stems and this causes the plants to start to shrivel or wilt. Damage is not always the same each year nor does it affect all areas.

Which insects affect cabbage crops during the stage of leaf growth?

During the first 20 days after transplanting, several types of black, yellow, red or striped beetles can make holes in the cabbage leaves.

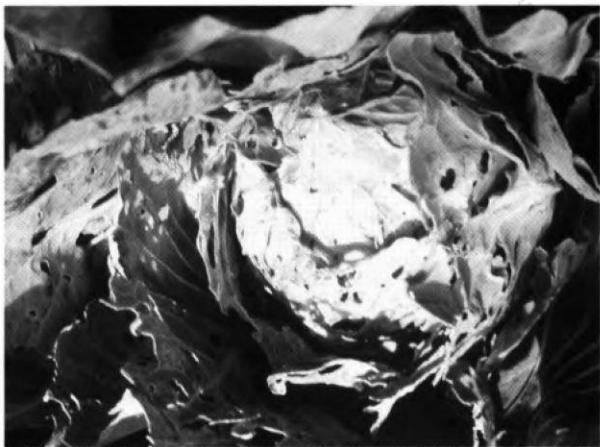
One of the most common insects to cause this type of damage are *Diabrotica*. The adults feed on the leaves, while the larvae (maggots) hide under the soil eating the roots.



If cabbage plants have enough water and nutrients, they can grow new leaves to make up for the damage. However, during drought, or dry spells the damage can cause crop losses.

Which insects affect the crop during head formation?

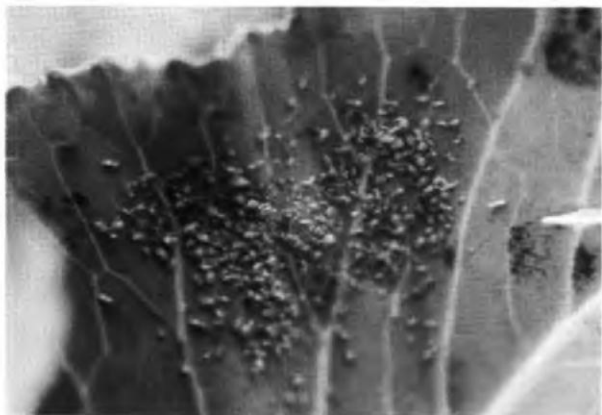
From 20 days after transplanting, when the cabbage plant is forming and filling the head, the pest that causes most damage is the Diamondback moth or *Plutella xylostella*.



Plutella is a very important pest in crops such as cabbage, cauliflower and broccoli.

The caterpillars feed on the leaves and flowers affecting the quality of cabbage heads and the flowers of broccoli and cauliflower.

What other pests affect the cabbage crop?



During leaf or head formation, colonies of insects can be found sucking the sap of the leaves.

These insects are aphids.

There are many species that affect cabbages, but the most common one is *Brevicorine brassicae*.

Do whiteflies affect the cabbage crop?



Recently, small white insects that hide under the cabbage leaves have been noticed. These are adults of the whitefly *Bemisia tabaci*.

On the lower leaves, small, cream colored insects that do not move have also been seen sucking the sap of the leaves. These are the immature stages of the same fly, and this indicates that the pest reproduces on the cabbage crop.

Whiteflies damage the cabbage crop by sucking the sap of the leaves.

Which diseases affect the cabbage crop during head formation?

Some plants develop light brown patches on the edges of the leaves when they are forming their heads. These patches later grow towards the veins in a "V" shape and become reddish yellow in color.





When there is a heavy attack, the heads may rot and produces a bad smell.

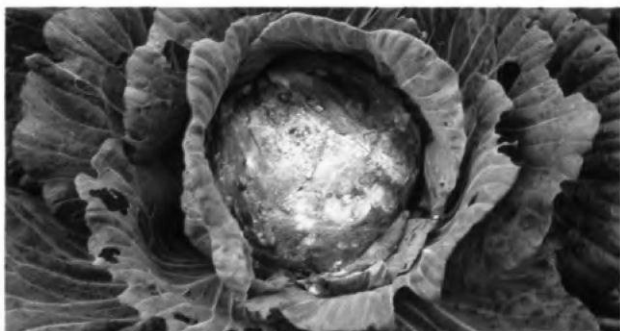
The disease black rot is caused by a bacteria called *Xanthomonas campestris*.

It survives in the soil and in plant remains from previous crops.

It can also survive in infested seeds.

The disease spreads through the crop due to rain splashing, movement and through any wounds in the plants caused by farm implements.

What other diseases affect cabbages?



When there is a high level of humidity in the atmosphere, the fungus *Sclerotinia* or *Sclerotium* can start to grow on the cabbage plants.

At the beginning, the fungus affects the lower leaves and base of the stem.



Later it extends over the whole head producing a white mold.

The fungus survives in the soil and in plant remains from previous crops to attack the following plantings or crop.

How can pests and diseases in the seedbed be avoided?

The success of the cabbage crop depends on the quality of seedlings in the seedbed.

The seedbed should be made using soil that has not been used previously for growing cabbages.

The soil should be removed and mixed with plenty of organic matter such as chicken or cow manure or organic fertilizer.

The seedbed should have a height of at least 8 to 10 inches, depending on the time of planting. In the rainy season, the seedbeds should be higher.



How can cabbage seedbeds be disinfected?

The seedbed can be disinfected by adding 1/2 lb. of white lime per yard of soil and mixing well.

If white lime is not available, ashes can be used.

The white lime should be added at the mixing of the manure with the soil.



A safe area close to the seedbed should be chosen for boiling water in a iron drum. The soil should then be soaked with boiling water at a rate of 5 gallons per yard of soil.

The seedbed can be sown 2 to 3 days after treatment with white lime and boiling water.

Which cabbage varieties should be grown?

In order to select the best cabbage varieties, the climate of the area must be known very well. It is also useful to know the soil type, fertility, availability of water and previous damages caused by pests and diseases.

At the moment, most farmers grow hybrid seeds such as the variety GREEN BOY.

This variety has a high yield but is very susceptible to the disease known as black rot caused by *Xanthomonas*. It is also known that this variety is heavily attacked by diamondback moth.

Another variety is called IZALCO. It is very resistant to *Xanthomonas* attack and produces an excellent head. In addition, diamond back moth do not like it because the leaves have a waxy covering.

However, it has very poor resistance to fungi which produces leaf spots the leaves and white mold.

There are many other varieties of cabbage, and choosing the best one for yield and resistance to pests and diseases can only be decided after trials on the farm.

How can Diamondback moth be managed?

In order to manage the Diamondback moth, it is important to know how it reproduces.

The moths lay eggs in groups of 8 to 10 eggs on the cabbage leaves.



The caterpillars hatch and feed on the leaves.

After feeding for 8 to 12 days, the caterpillars form a pupa or chrysalis covered in a fine white down.

After 4 to 5 days the adult moths emerge and start a new cycle.



How to prevent moths entering the cabbage crop so easily.

The moths move from older fields to newer ones. For this reason it is not advisable to plant a new crop close to an older crop or the remains of a crop.

Plant remains and residues from previous cabbage crops should be removed from the field before transplanting the new crop.

Barrier crops of corn, sorghum or Taiwan grass can be planted around the cabbage plot to reduce moth attack.



What are the effects of intercropping on Diamondback moths?



When cabbages are grown in association with other crops such as carrots, corn, cilantro, onion or rice, the incidence of moth damage is greatly reduced, resulting in good yields with few insecticide applications.

When cabbages and carrots are planted in the same field, the moths are confused and unable to find the cabbage plants as easily.

How can the level of moth infestation in the cabbage crop be measured?

To know the level of infestation, the number of caterpillars on the cabbage plants must be counted.

Beginning 8 days after transplanting, caterpillars should be counted every week until harvest.

To count the caterpillars, 5 evenly spaced points or locations are chosen in the field.

At each point, 10 plants are chosen. The number of live caterpillars on each plant are counted.

The numbers of caterpillars on each of the 10 plants at each point are recorded in a notebook. The average number of caterpillars per plant can then be worked out.

This gives the level of infestation in the crop.

At what infestation level is caterpillar control economically worthwhile?

The best time to control caterpillars is when there are 25 or more caterpillars on 50 plants.

Profits from the cabbage crop are greater when this number is used as a basis for deciding whether or not to control.

However, fluctuations in the price of cabbages, the cost of pesticides and labor can also affect the infestation level at which we need to control the caterpillars to maximize profits.

In recent years, many insecticides have been used to control caterpillars.

The pest has become resistant to nearly all the chemical products used against it.

Products that still give good results are those based on the bacteria called *Bacillus thuringiensis*. These include DIPEL and Larvo2x. Both should be used following the manufacturers recommendations.

What are the natural enemies of insect pests that attack cabbage?

A pest's natural enemies are other living things (organisms) that kills the pests, lives off them or gives them diseases.

Spiders feed on Diamondback moth caterpillars.

The wasp shown in the picture also eats these caterpillars and other pests.



There are several wasps that lay eggs in the caterpillar's body.

The wasp *Diadegma* shown in the picture is one of the most important parasites of moth caterpillars.



Like any other organism, the Diamondback moth suffers from diseases.

The bacteria *Bacillus thuringiensis* attacks the caterpillar's digestive system, causing it to disintegrate.

The fungus *Beauveria bassiana* affects caterpillars, pupae and adults causing its death (see picture).



Applications of insecticides and fungicides also affect these natural enemies.

In areas where many applications of pesticides are made, the natural enemies' populations disappear and new pests appear as a result.

For this reason, pesticides should be used with great care and only when absolutely necessary.

How can black rot of cabbage heads be managed?

The bacteria *Xanthomonas campestris* which causes this disease survives in the soil and in plant remains from previous crops. It can also reach cabbage plots by infected seed and it can be propagated in the field by rain and farm implements.

Once it has arrived, there is no way of curing the disease. For this reason, prevention is the only means of managing this disease.

The farmer must ensure that the seed is free from disease.

Seed can be disinfected by placing it for 15 minutes in water heated to 131°Fahrenheit.

All plant material from previous cabbage crops should be removed after harvest to prevent the bacteria from multiplying. If a cabbage field is attacked by this disease, the site should not be planted with cabbage again for at least three years.

Using varieties that are tolerant of the disease, such as IZALCO, can help reduce damages in the field.

Frequent weeding helps spread the disease through out the field.
It is best to limit weeding by machete to two or three times during the crop cycle.

How can the incidence of white mold or black head be reduced in cabbages?

The fungus that causes this disease can survive for several years in the soil and needs high humidity or moisture to affect cabbage plants.

For this reason, cabbages should not be planted in fields where previous crops were affected by this disease.

Drainage should be improved to prevent excess water in the fields.

In acid soils, the incidence of the fungus can be reduced by adding 20 to 30 sacks of white lime per manzana (2 acres), every 2 to 3 years.

In areas where there is a high incidence of this disease, it is best to avoid planting varieties like Izalco. This variety is very susceptible to the fungus.

If the fungus is detected (observed) soon after transplanting, 1 to 2 ounces of white lime can be applied to the base of each affected plant and those surrounding it.

At the same time, a fungicide such as Benomyl should be applied to stop the disease spreading.

However, if most of the cabbage heads are already affected and the soil is very damp, there is little hope of saving the crop.

Chart for recording pest incidence in cabbage crop

Farm: _____

Area: _____

Transplanting date: _____

Recording date: _____

Weather : _____

Plants 1 2 3 4 5 6 7 8 9 10

Location 1

Location 2

Location 3

Location 4

Location 5

Note:

- Number of live Diamondback moth caterpillars on each plant.
- Number of aphid colonies on each plant.
- Number of spiders or other beneficial organisms.

Calculate:

Average number of live caterpillars per plant =

More than 25 caterpillars per 50 plants will damage the crop.

Chart for recording disease incidence in cabbage crops

Farm _____

Area: _____

Transplanting date: _____

Recording date: _____

Weather: _____

Plants 1 2 3 4 5 6 7 8 9 10

Location 1

Location 2

Location 3

Location 4

Location 5

Note:

H = Healthy

X = Black rot caused by *Xanthomonas*

S = White mold caused by *Sclerotinia*

Calculate:

% healthy plants

% plants with black rot

% plants with white mold

Can pests and diseases of cabbages be controlled without using a lot of chemical products?

Results from different areas have shown that it is possible to obtain good cabbage yields without using a lot of chemical products.

To do this, the farmer must know the pests, take good care of the crop, be observant and assist the pests' natural enemies.

In this way the farmer can reduce his costs and reduce the risks of poisoning.