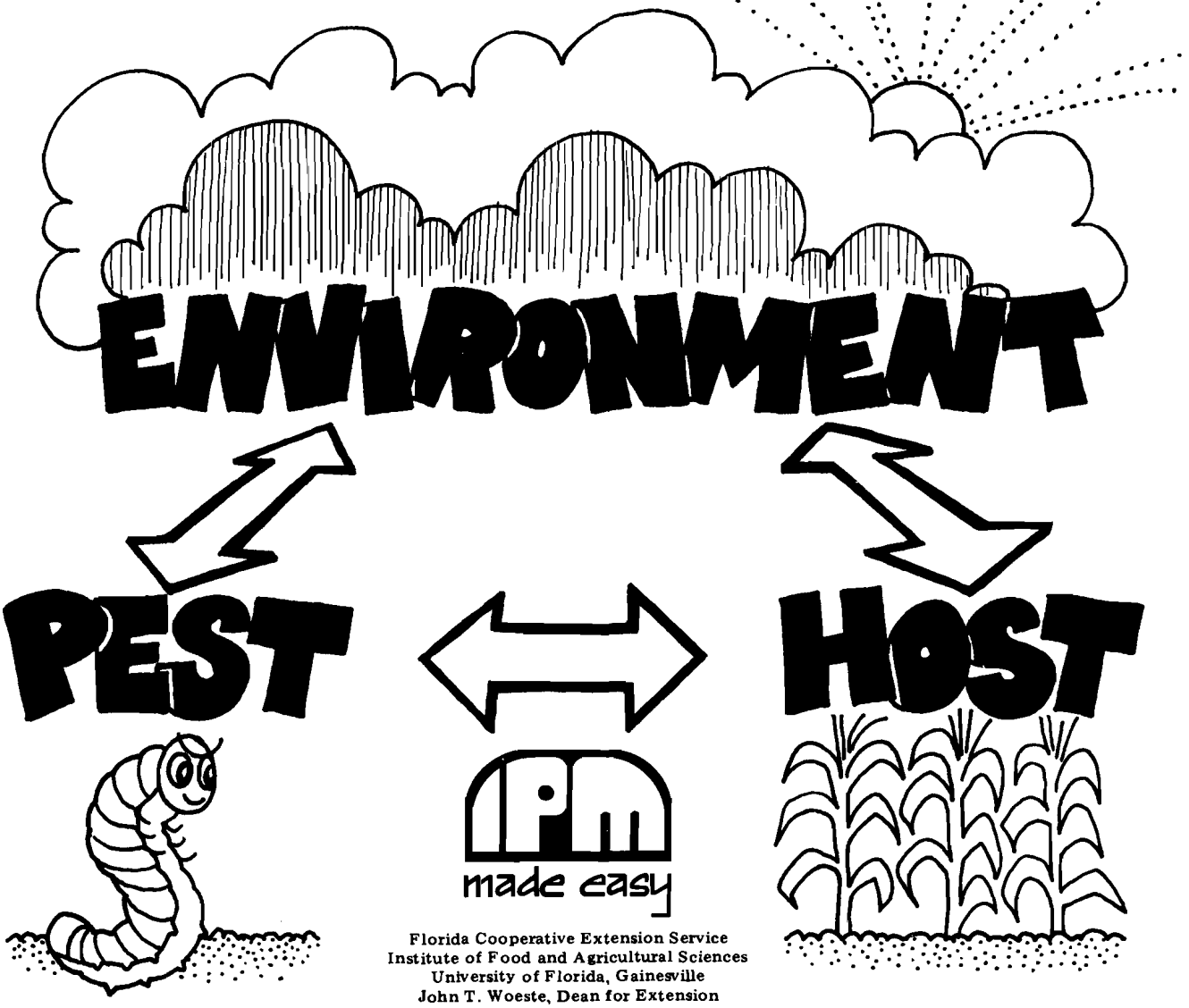
Circular 549

the ABC's of IPM



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The ABC's of IPM

C. A. Boyles, P. G. Koehler, and R. K. Sprenkel

To Help You

As you use this publication, watch for words written in *italics*. Look in the glossary in the back for an explanation of these words.

Statement of Purpose

In the 1960's and 1970's, people began to worry about the harmful effects of *pesticides* and other poisons. Pesticides are needed to manage many pests of man, his crops and animals. To help protect soil, water and air (the *environment*), man no longer uses some pesticides.

Integrated Pest Management (IPM) is an effective but less harmful way of managing pests of all kinds. An IPM user looks at the whole picture — the *pest*, the *host*, and the environment. Then following IPM methods, the user chooses one or several ways to manage the pest.

Most pesticides are made from the same materials as gas and oil. Gas and oil are also used to apply pesticides. Through IPM, wiser use of pesticides helps to save energy.

The purpose of this book is for you to learn the basic ideas of IPM. You should be able to manage pests safely, with less energy and lower costs.

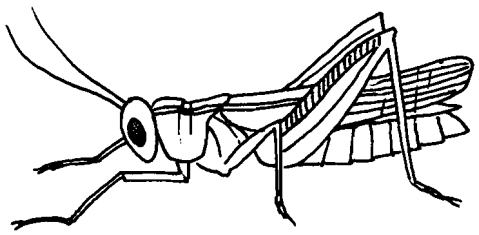
This publication is designed to introduce some of the factors that affect pest populations, and to explain pest management systems. Other publications in this series (IPM Made Easy) explore individual segments of an IPM program more fully.

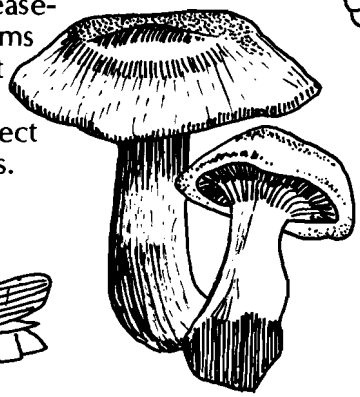
For more information check these publications, available from your County Extension Agent:

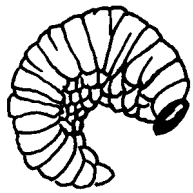
Pest Management — Where to Start — Circular 548
All About Pests — Circular 543
Using Natural Enemies to Manage Pests — Circular 545
Cultural Practices to Manage Pests — Circular 547
Spraying Away Pests — Circular 544
Plants Protected from Pests — Circular 546

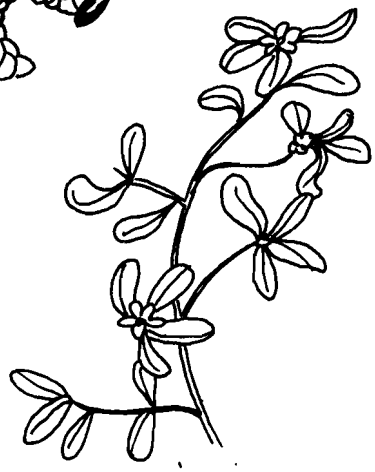
The Three Elements of Pest Management

Pests are living things. They may be insects, *vertebrates, nematodes,* or *pathogens* (disease-causing *organisms*). Also, weeds or organisms like *molds* and *mildew* are often pests. Pest means any living thing that man sees as harmful, destructive, or annoying. Pests affect man himself, his plants, or his surroundings.







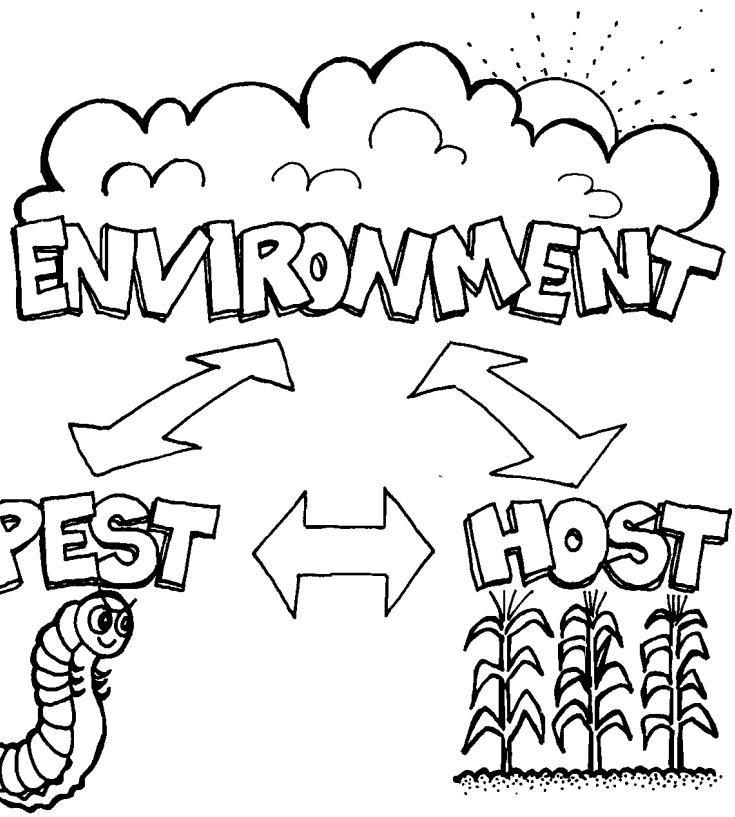


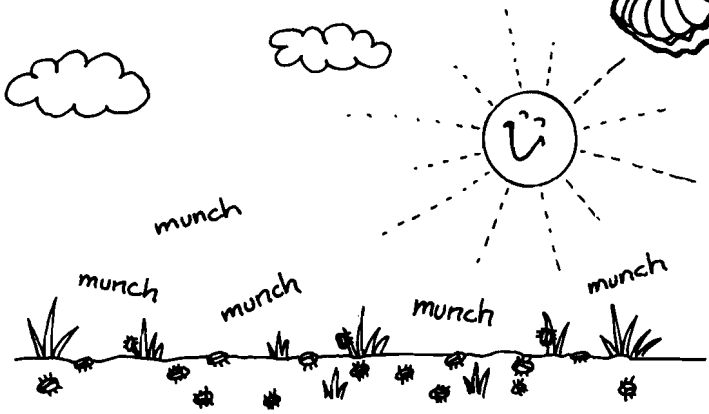
The host is what the pests damage. The host may be one of man's crops or animals. It may be man's buildings. It may even be man himself.

The environment is everything around the pests and the host. It includes anything that affects the pests and the host. Examples of environment are other animals and plants, water, soil, air, temperature, and sunlight.

The pests, the host, and the environment are the three elements of pest management.

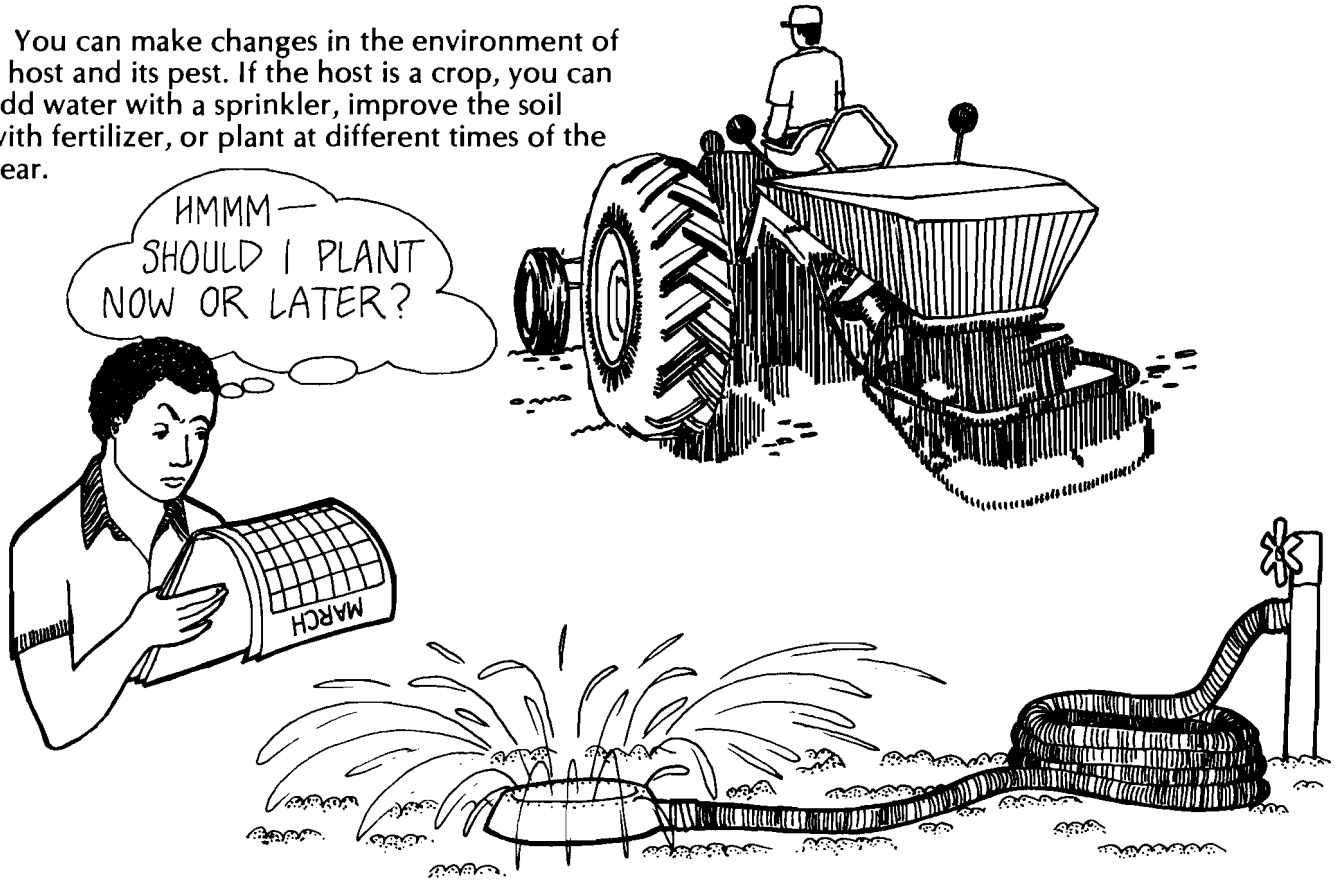
The three elements affect each other. For example, the kind of plant (host) you can grow often depends on the kinds of pests in your area and the time of year (the weather). The weather affects how well the plant grows, and the kinds of pests that develop.



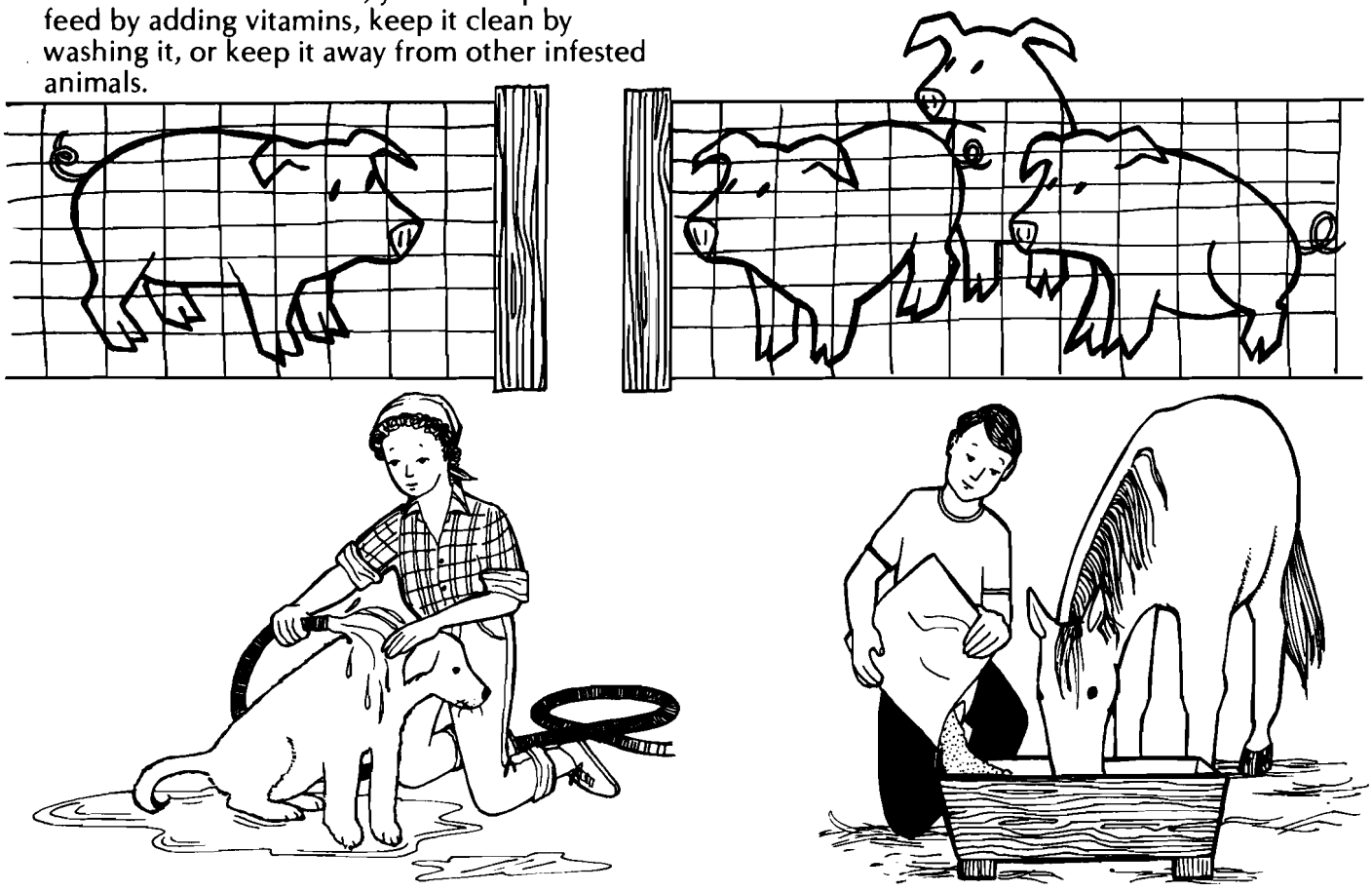


A common lawn pest, called a chinch bug, likes warm, sunny weather. During warm weather chinch bugs multiply rapidly. Then they can kill large areas of grass leaving bare soil. So, because one part of the environment (weather) was right for a pest problem to develop, the host (lawn) was affected.

You can make changes in the environment of a host and its pest. If the host is a crop, you can add water with a sprinkler, improve the soil with fertilizer, or plant at different times of the year.

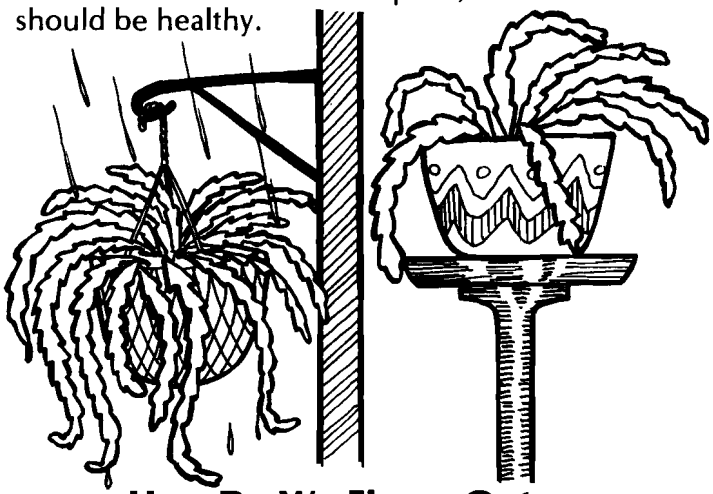


If the host is an animal, you can improve its feed by adding vitamins, keep it clean by washing it, or keep it away from other infested animals.



These are only a few examples. There are many others.

Each of these changes will affect the host and the pests in some way. If you make a lot of changes that are bad for the host, you may kill it. If you make a lot of changes that are good for the host and bad for the pests, the host should be healthy.



How Do We Figure Out A Pest Management System?

Because the three elements are all complicated, a pest management system is hard to figure out. Sometimes it helps to build a model. This is a lot like building a model airplane or car. Instead of being made of plastic or metal, a pest management model is written on paper. It is a simple explanation of how a complicated system works.

A model is developed in 5 steps. The following example will help you understand how this works. Most pest management models are hard to figure out. We will use a very simple example.

Step 1. Make an observation. This means you must look closely at something.

For example, you may have two plants. One gets a lot of water. One gets only a little. Your observation might be: "The plant that gets a lot of water is bigger than the other one."

Step 2. Make a statement. Take your observation and use it to make a general statement.

Your general statement might be: "The more water a plant gets, the better it will grow."

Step 3. Write the model. For a pest management system, this would probably be complicated. It would be a long sentence with a lot of math in it.

Your model might be: "More water equals (=) more growth."

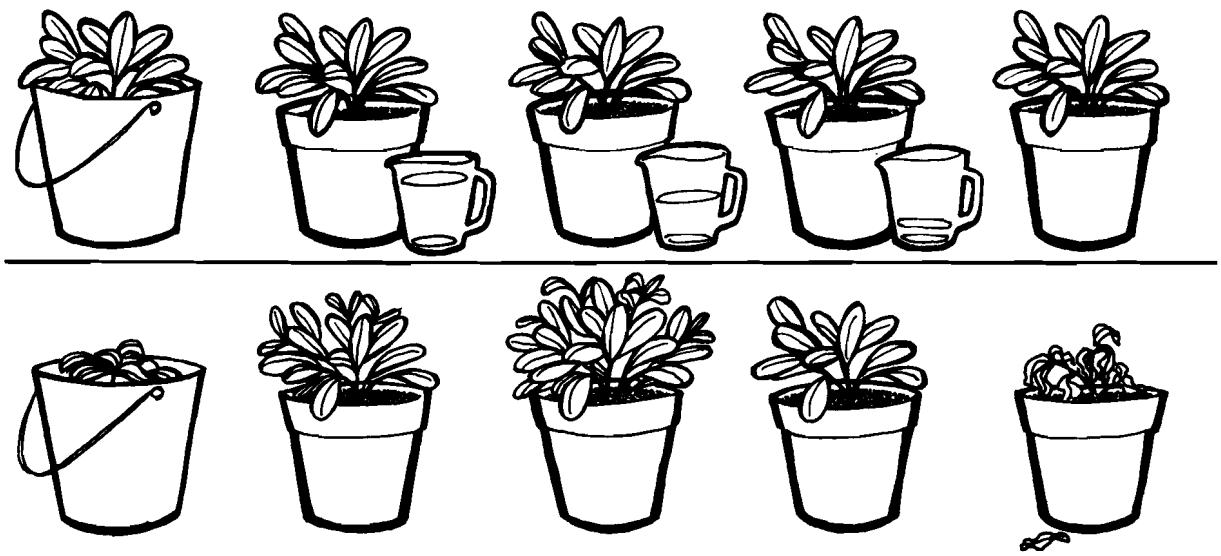
Step 4. Test the model and make any changes. For a pest management system, this may take many years.

For your system, it won't be too difficult. You might:

Put 5 plants of the same kind in 5 pots. Keep them out of the rain. Give one no water. Keep one standing in a bucket of water all the time. Give each of the other 3 pots a measured amount of water each day. One should get a little, one a lot, and one in between.

In a few weeks, you might find that both the plant with no water and the one in the bucket of water will die. Of the other 3, one will grow better than the other two. This will tell you the best amount of water to give this kind of plant.

Now your model might say: "More water, up to a point = more growth."



Step 5. Put the model into practice. For a pest management system, this also may take a long time.

Your model's information will be easier to put into practice. All you do is start giving all of your plants the amount of water that makes them grow best.

Watering is related to IPM. Plants that receive the correct amount of water can be healthy. This may help them live with some damage by pests, or to outgrow pest damage.

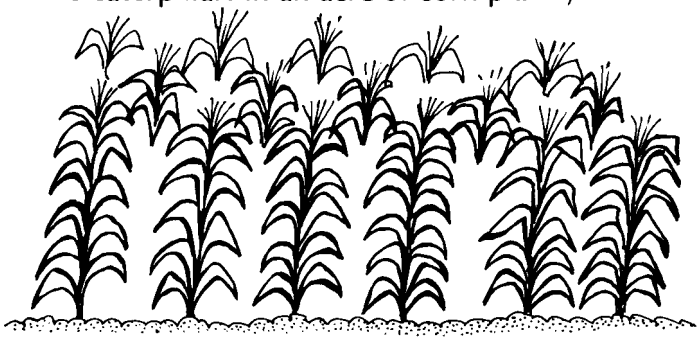
How We Measure Numbers of Pests

We've already said that a pest management system is big, and hard to understand. It would be impossible to count all of the pests in any system. For example, try counting all of the weeds in a vegetable garden! We think of the numbers of pests in a different way.

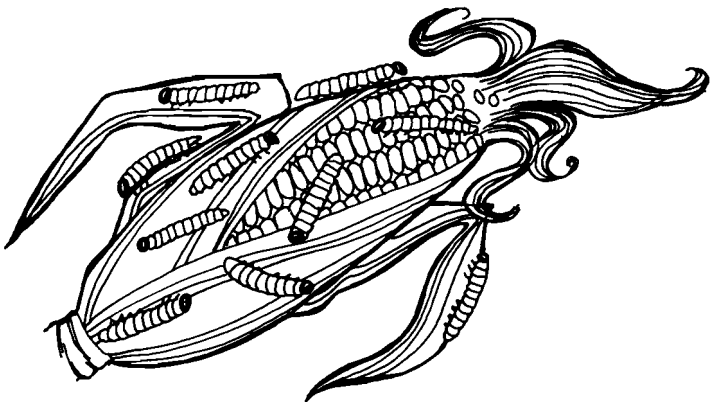
In nature, organisms exist in groups. These groups are called *populations.* A population is a group of organisms that are all the same *species.* Members of the group can breed with one another and have young.

Population density is the number of organisms of one kind in a known area.

The population density may be low (such as 10 caterpillars in an acre of corn plants).



The population density may be high (such as 10 caterpillars in an ear of corn).



For every pest, there is a density that is too high. This density is different for each pest and each situation. To find out what density is too high, we can't look at just the pest. We also must look at the host and the environment. Remember, the three elements are all connected to each other.

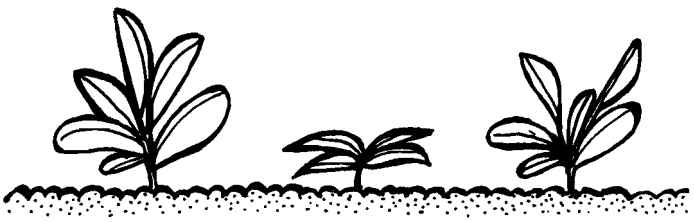
A threshold is when the damage level or injury to the host becomes too much. Damage level is the amount of damage the pests cause. This can be very hard to define. It is related to the host's environment. For example, we can talk about corn and nematodes. If corn plants get enough water, a few nematodes may not damage them. If the weather is very dry though, the same number of nematodes may cause plants to grow slowly or die. Or, the plants may not produce any ears of corn.

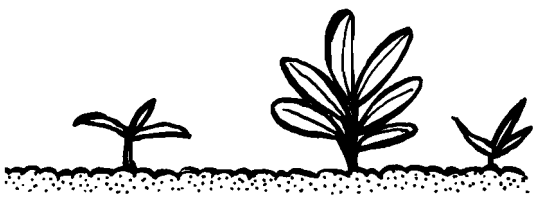
Damage level is also related to the number of pests that are present. The more pests there are, the more damage they can cause.

Now, let's look at the word "injury." There are two different kinds of injury.

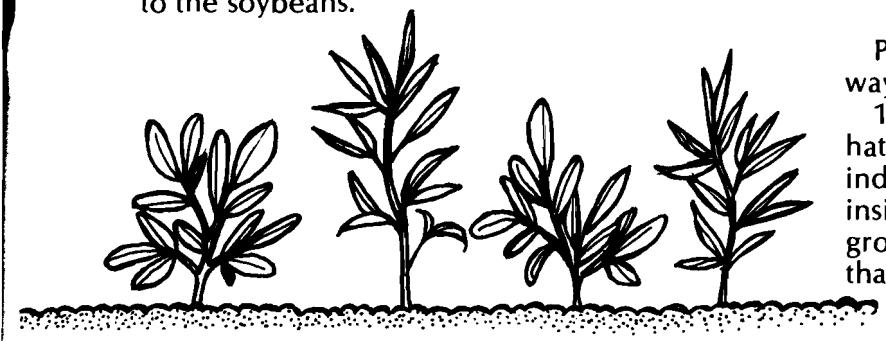
First, there is economic injury. This has to do with money, an important part of agriculture.

The best way to explain economic injury is to use an example. Suppose you have a field of soybeans. There are weeds between the soybean plants. The weeds use *nutrients* that the soybean plants need. When there are only a few weeds, or they are small, they use only small amounts of nutrients. The amounts they use probably will not hurt the soybeans.





But, suppose the weeds are of a species that grows very tall. Now the weeds need large amounts of nutrients. The shade from the weeds keeps the soybean plants from getting enough sun. The soybean plants also don't get all the nutrients they need. They don't make as many beans as they would if there were fewer weeds so the farmer won't make as much money. The weeds are causing economic injury to the soybeans.



The other kind of injury is esthetic. This has to do with whether or not you like something. Again, let's use an example.

Suppose you're sitting on a chair on the back porch. Lots of little gnats fly around your face, and get in your eyes and nose and mouth. Even though the gnats aren't destroying anything, you don't like them.

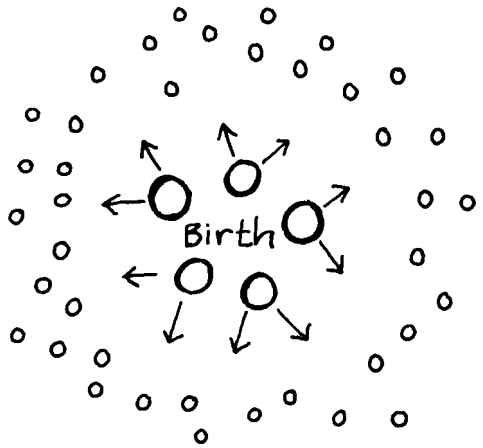
Now you should be able to understand threshold. Threshold is a certain number of pests or an amount of damage. At that number or amount, you need to use a control. Below the threshold you do not use a control.

The threshold is different for each combination of pests, host, and environment. Now you can see why a system is complicated.

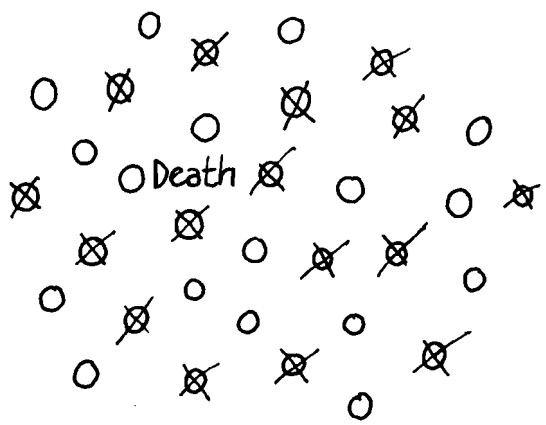
Population Changes

Populations change over time. There are four ways in which this happens:

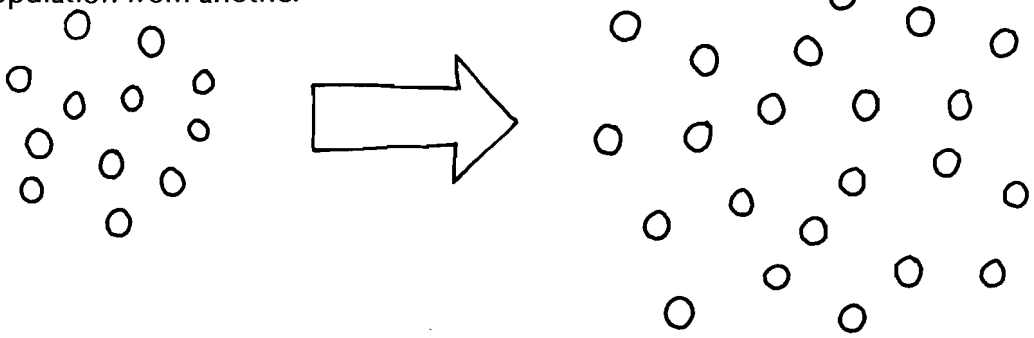
1. **Birth** — Birth includes being born, hatching and germinating. It means that new individuals come into the population from inside the population. As these individuals grow, the population affects the host more than it has before.



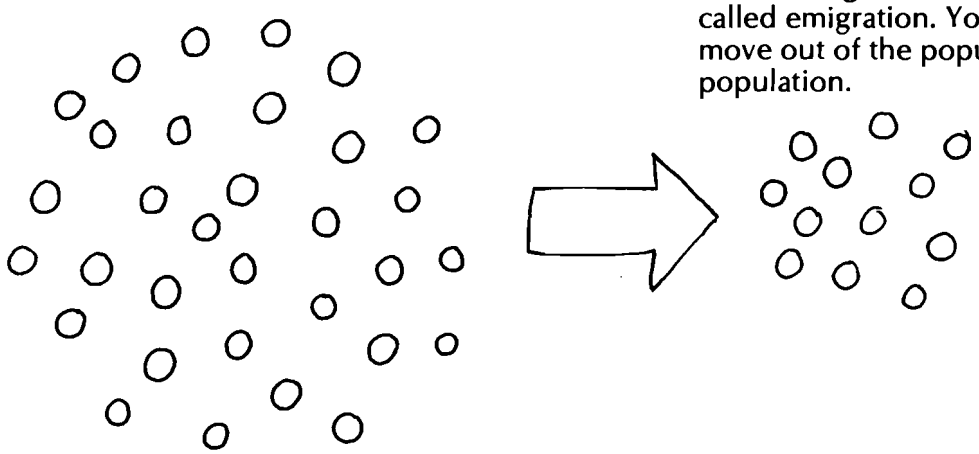
2. **Death** — Death causes a population to decrease. Man can sometimes take advantage of this. By using a pesticide or some other method, he can kill large numbers of a pest. This reduces the damage to the host.

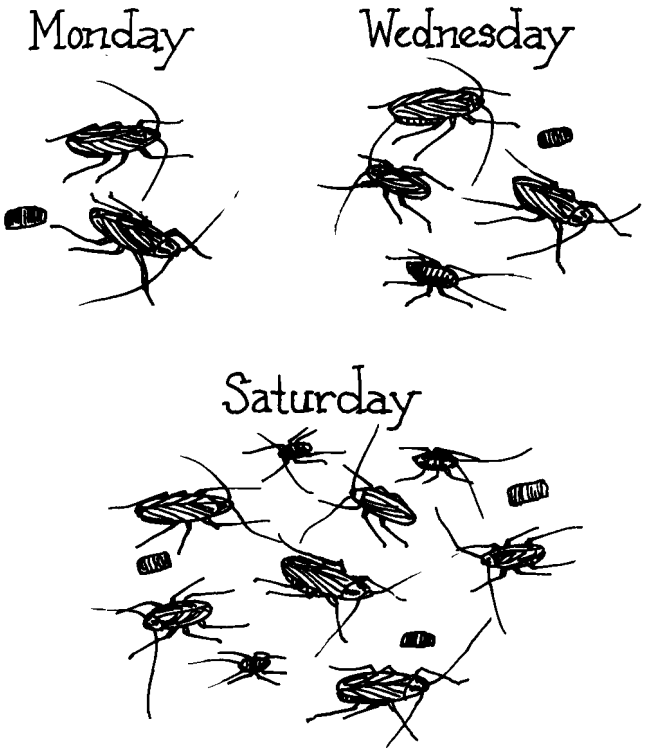


3. **Moving into the population** — This is called immigration. Young or adult organisms move into the population from another population.



4. **Moving out of the population** — This is called emigration. Young or adult organisms move out of the population into another population.





These are the only ways a population can get larger or smaller.

Many things affect how fast and when a population gets larger or smaller. We will talk about a few of them. How fast and when a population changes are very important to pest management.

You should remember two important ideas about pest populations:

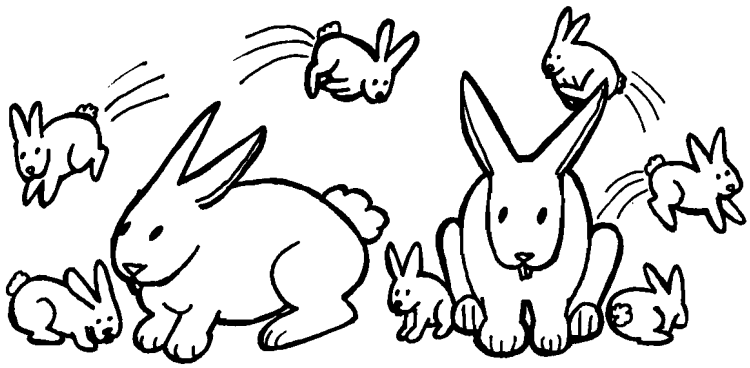
Idea #1 — Pest populations change in 4 ways above without any help from man.

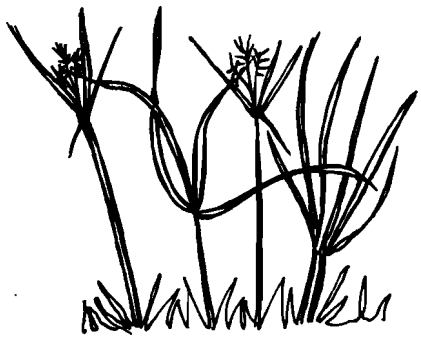
Idea #2 — Man can affect the way pest populations change. Man can cause the pest populations to grow larger or smaller. Pest management is properly directed efforts to make the pest population smaller.

How Pest Management Works

1. How many births? This is called reproductive rate. Some organisms have a high reproductive rate. This means many young are born (or hatched or germinated) in a short time. Organisms with a high reproductive rate often become pests.

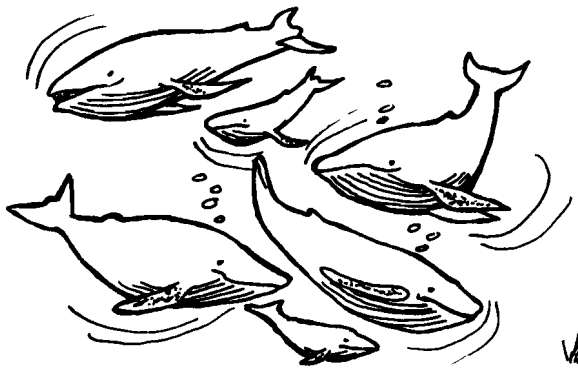
Examples of this kind of organism are rabbits and nutsedge.

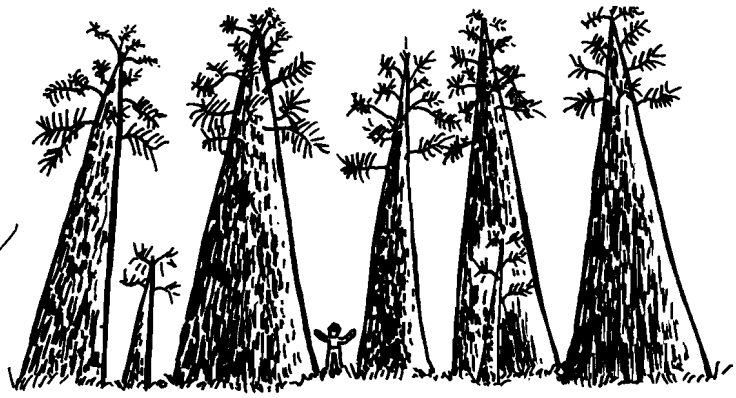




Some organisms have a low reproductive rate. This means few young are born (or hatched or germinated) during a long time. Organisms with a low reproductive rate seldom become pests.

Examples of this kind of organism are whales and redwood trees.



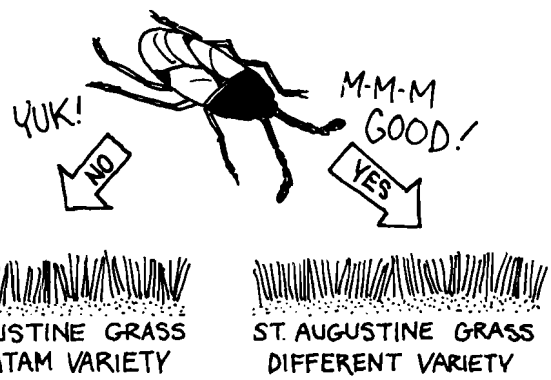


Man can change the reproductive rate of some pests. One way to do this is to change the pest's environment.

An organism that is in a good environment will be healthier than one that is not. This is also true of populations.

A healthy population will have a higher reproductive rate than an unhealthy population.

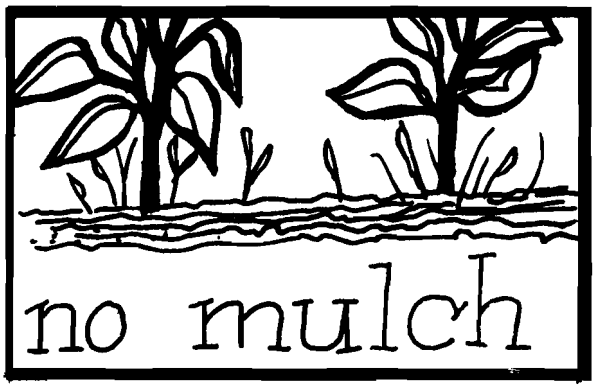
We can find ways to change a pest's environment. One way to do this is to use resistant varieties. These are kinds or varieties of hosts that taste bad or are bad for pests. To learn more about resistant varieties, see **Circular 548, Plants That Are Protected from Pests.**

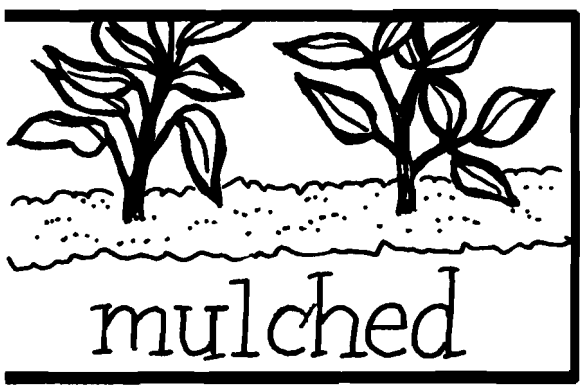


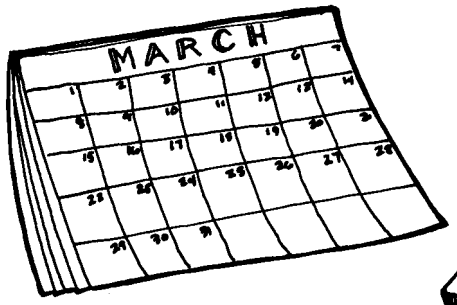
Another way to change a pest's environment is to change the time of planting a crop. By planting early in the spring, plants will be big and healthy before some pests are around to damage them.

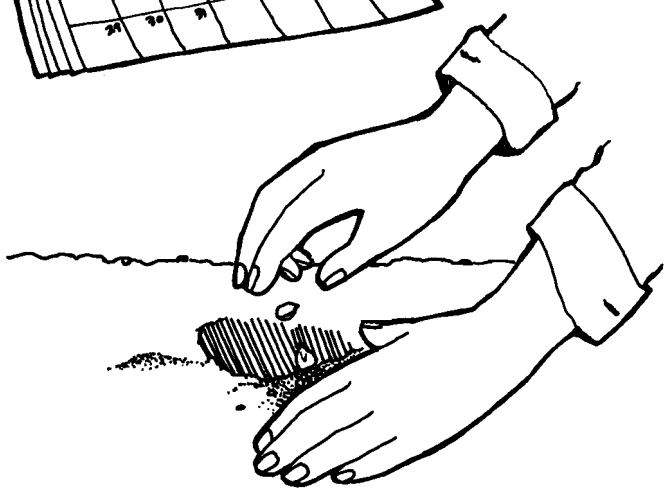
Man can also stop weeds from growing. One way to do this is by mulching.

A mulch is a soil covering. It is placed on the ground between plants.



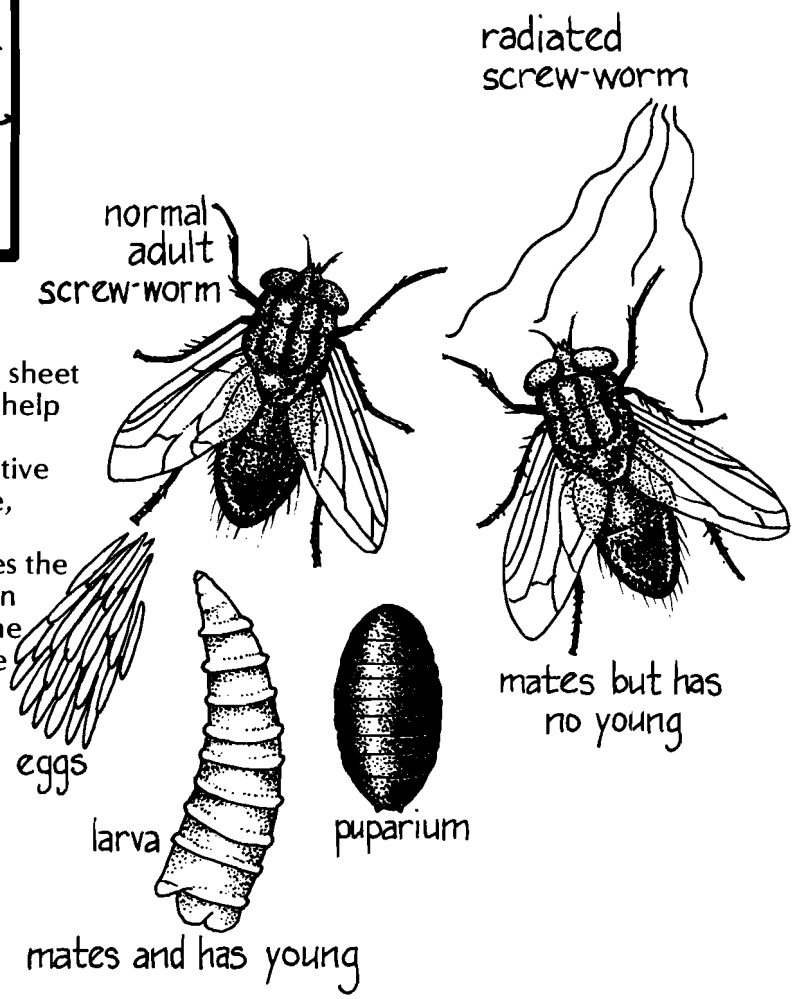


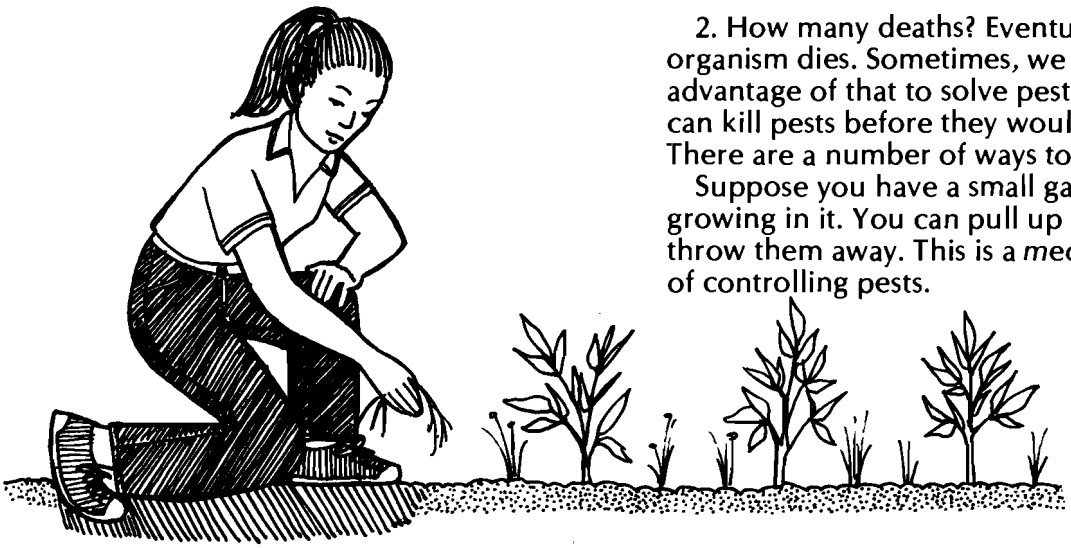




A mulch may be pine needles, leaves, a sheet of plastic, or many other things. Mulches help keep weeds from growing.

One other way to change the reproductive rate is by using birth control. For example, scientists have learned to treat adult screwworm flies with radiation. This makes the flies *sterile*. These flies are then released in places that have screwworm problems. The treated males mate with wild females. The females lay eggs that don't hatch and the population then gets smaller.





2. How many deaths? Eventually, every organism dies. Sometimes, we can take advantage of that to solve pest problems. We can kill pests before they would normally die. There are a number of ways to do this.

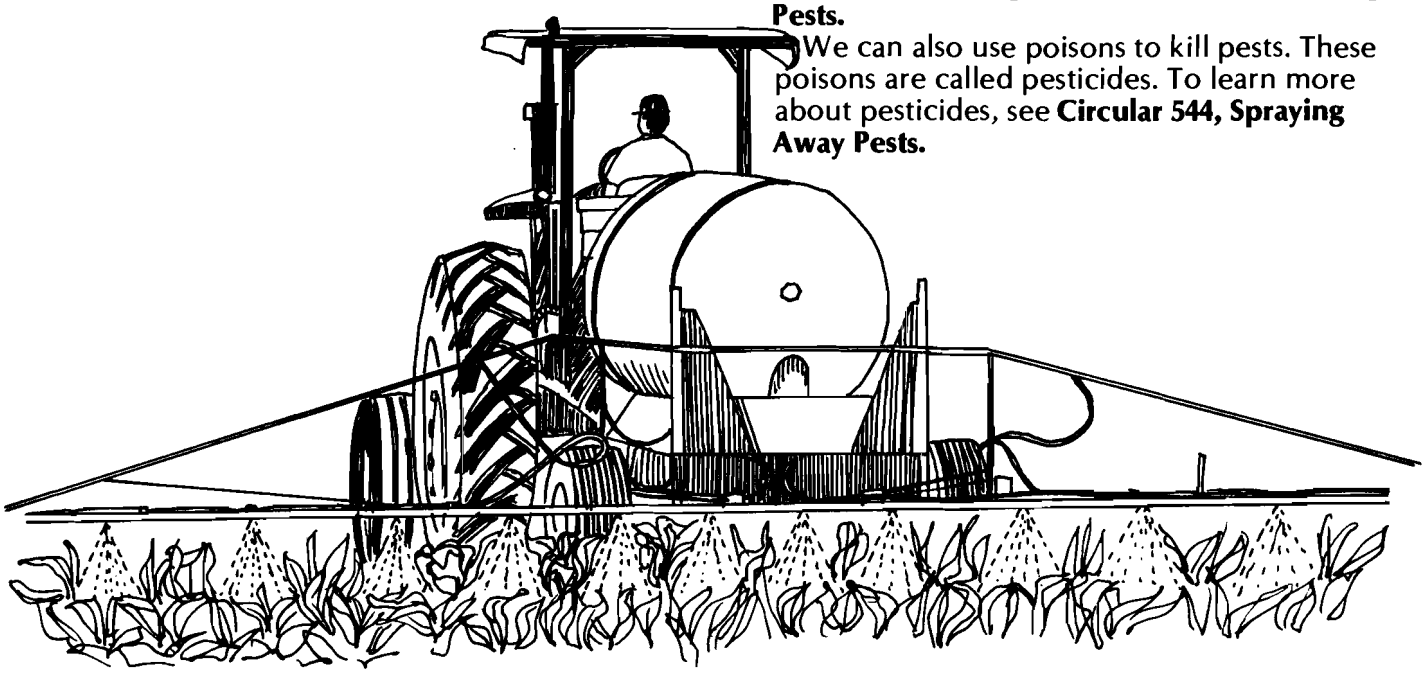
Suppose you have a small garden. Weeds are growing in it. You can pull up the weeds and throw them away. This is a *mechanical* method of controlling pests.

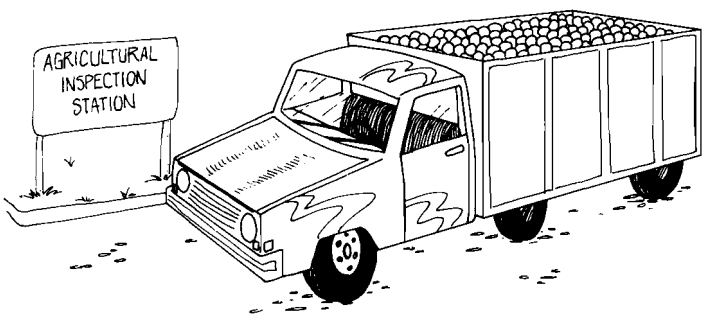
Man's plants and animals are not the only hosts for other organisms. Some organisms feed on or eat pests. These are the pests' natural enemies.

Natural enemies often can help keep pests from becoming a problem. By killing pests, they help keep the population small.

To learn more about natural enemies, see **Circular 545, Using Natural Enemies to Manage Pests.**

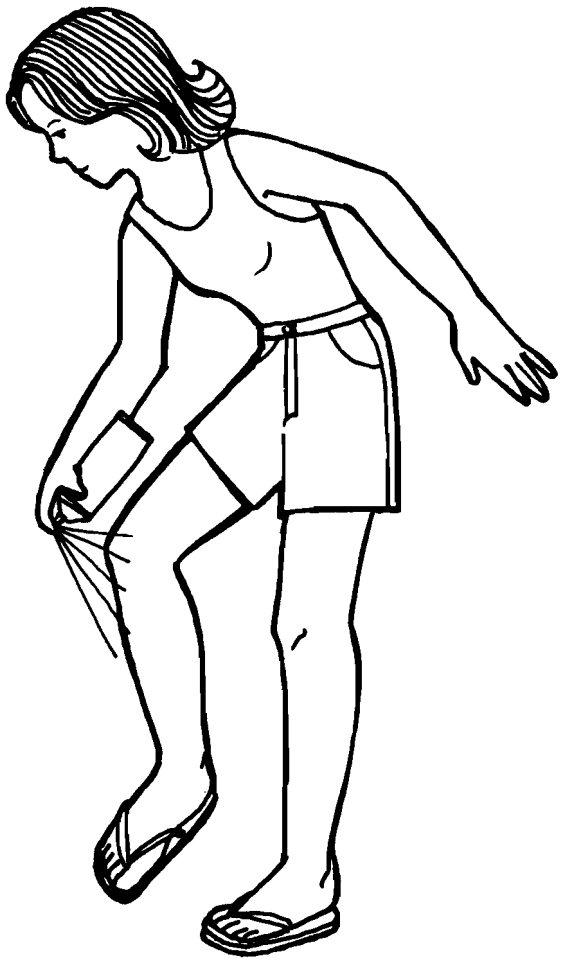
We can also use poisons to kill pests. These poisons are called pesticides. To learn more about pesticides, see **Circular 544, Spraying Away Pests.**



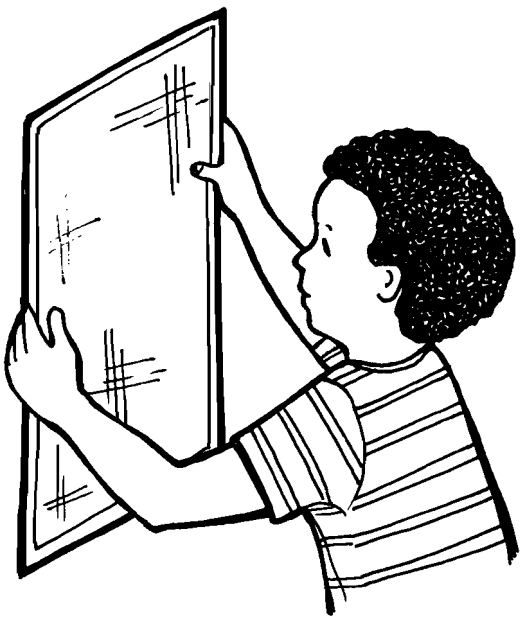


3. How much immigration? We can find ways to stop individuals from moving into a population. Sometimes laws help control the spread of pests. Agricultural inspection stations are along some roads. Trucks carrying agricultural products must stop. If these trucks have certain pests on them, they cannot go any further.

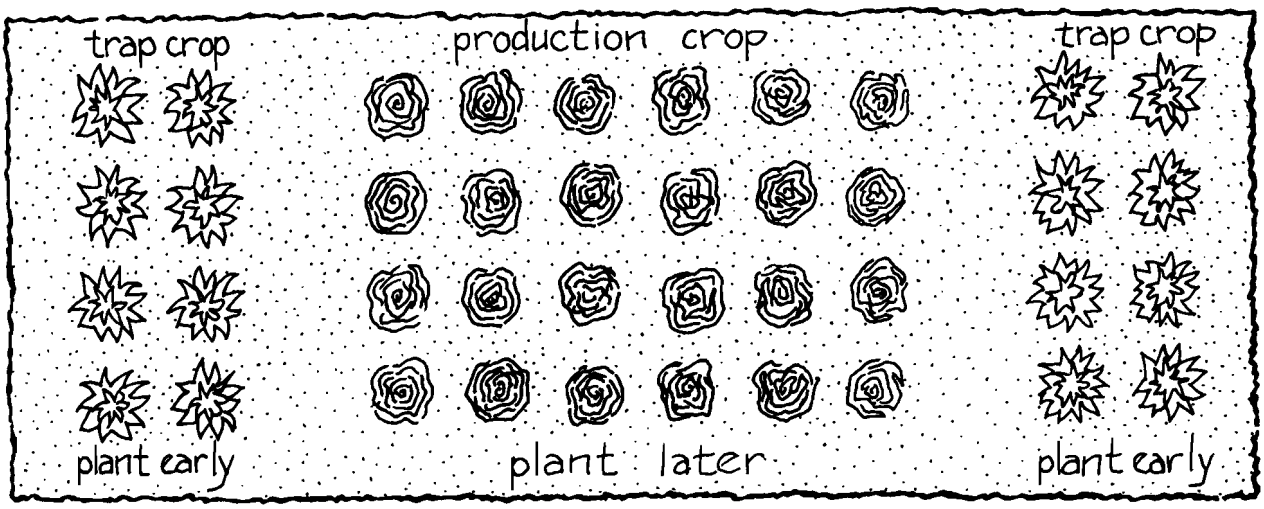
Some chemicals can keep pests away. These chemicals are called *repellents*. An example is a spray or liquid you might spread on your skin to keep mosquitoes away.



We also can put up barriers to keep pests out. An example of a barrier is a screen on a window to keep flies and mosquitoes out of the house.

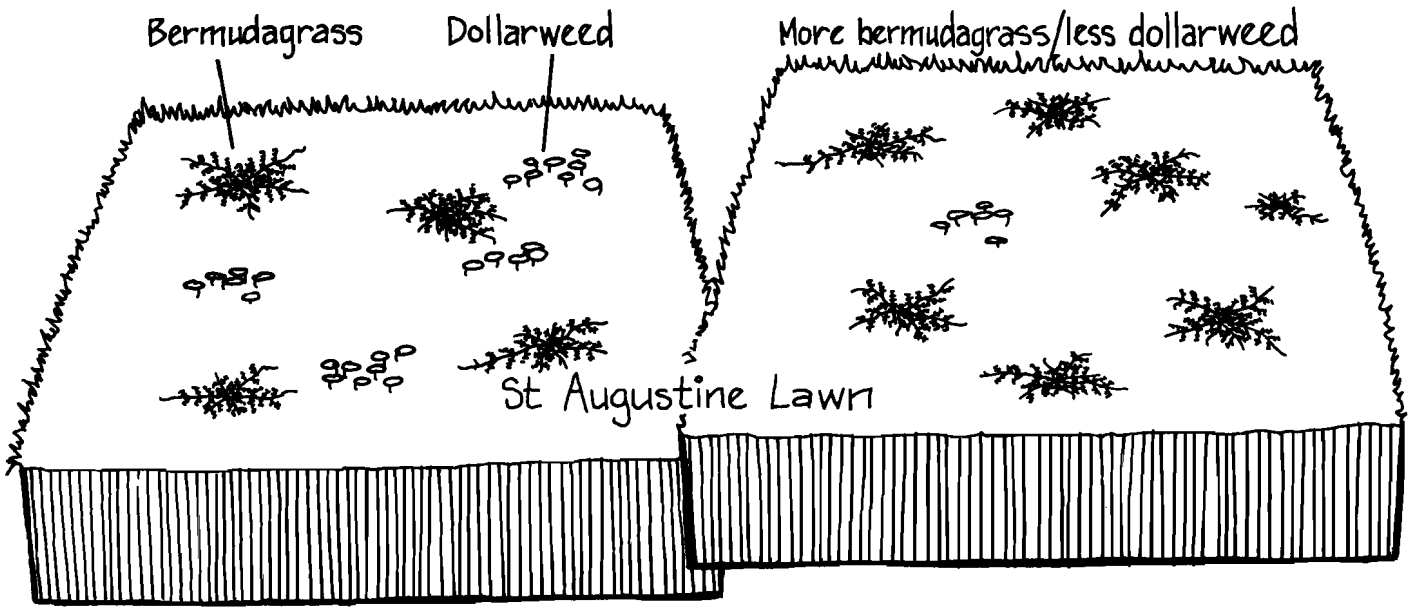


4. How much emigration? We can encourage individuals to move out of a population and into another area. One way to do this is to use trap crops. A trap crop is a plant that is very attractive to a pest. It is planted near the main crop. Most of the pests go to the trap crop instead of the main crop.



Sometimes, two or more organisms use the same part of the environment. Each one reduces the amount that the other one can use. This is called competition.

Competition can take place between members of the same species. It can also take place between members of different species. Competition can cause some of the pests to move out of the population.



Why Is This Important To IPM?

If you haven't already guessed, Integrated Pest Management can be very complicated. You must think about a lot of questions.

- What kind of pest is the problem?
- How many pests are there?
- What stage or size are the pests?
- How much damage have the pests caused?
- How much damage can the host stand?
- Is the host suffering from other stresses (such as other pests, earlier pest damage, or hot dry weather)?
- Are natural enemies or host resistance preventing the pest from increasing?
- Are the pests increasing or decreasing in numbers?

Once you have thought about these things, you can ask yourself the two really important questions.

1. What should be done about the pest?
2. What can **I** do about the pest?

Glossary

1. Environment — Surroundings, including anything that affects man, other animals or plants.
2. Host — Any plant or animal that shelters or gives a home to a parasite or other natural enemy.
3. Mildew — A soft, fuzzy growth, usually whitish or gray.
4. Mold — A soft, fuzzy growth. Molds come in many colors.
5. Nematode — A tiny worm-like organism that lives in the soil and damages the roots of plants. Nematodes may also live in water, in animals, or in plants.

6. Nutrients — Food; substances that promote growth and development in plants and animals.
7. Organisms — Living things; includes all animals and plants.
8. Pathogen — Very tiny organism that causes a disease. The three types of pathogens are fungi, bacteria, and viruses.
9. Pest — An organism that hurts something or is bad for something that belongs to man. A pest may be an insect, a plant, an animal, a disease, or any other kind of organism.
10. Pesticides — Poisons that are used to kill organisms that man regards as pests. Insecticides kill insects. Herbicides kill plants. Fungicides kill fungi.
11. Population — A group of organisms, all of the same species, that lives in an area. They are capable of reproducing.
12. Repellent — A chemical that an organism does not like, and that drives the organism away.
13. Species — One kind of plant or animal; a group of plants or animals that are alike. Man is one species. Dogs are one species. One species may have different varieties. For instance, German Shepherd and Doberman are varieties of dogs.
14. Sterile — Having no reproductive power, unable to have young.
15. Vertebrates — Animals that have a backbone such as, fish, birds or mammals.

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