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Integrated Pest Management for the Home Vegetable Garden

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Overview

Integrated Pest Management (IPM) is the name given to the practice of using a combination of tactics to keep pests from ruining a crop. These IPM tactics might or might not include chemical control, depending on the preference of each gardener. Non-chemical pest control tactics include cultural, mechanical, and biological controls as well as good sanitary practices. Most of these tactics are used as preventive measures in an attempt to help keep pests below critical levels. Even after preventive measures are taken, certain conditions can still allow a pest population to build up to injurious levels. If pests do build up, then a rescue treatment can be used to reduce the population of the pest and rescue the crop.

At the heart of IPM is the understanding that most crops can tolerate a certain amount of pest damage, thus a rescue treatment is not recommended until the pest population reaches a critical level that is referred to as a **threshold**. In the home vegetable garden, this threshold might be economic, but is more likely to be aesthetic. A commercial grower's produce must be nearly blemish free for fresh-market sales. For example, if a cabbage is found to have holes in the leaves from insect feeding, it will probably be culled or sold at a lower price, making the threshold economic. On the other hand, the threshold for home-grown vegetables is often dependent on an individual gardener's tolerance of the damage, and many gardeners do not mind a few holes in the outer leaves of a cabbage head.

Thresholds for different insect pests can vary greatly. An example of a low threshold is for striped cucumber beetle, which feeds on melon and cucumber plants and vectors bacterial wilt disease. Because bacterial wilt can potentially cause the complete loss of a crop, the threshold during the seedling stage is one cucumber beetle per two plants. In contrast, the threshold for corn leaf aphid on silking sweet corn is high: an average of fifty or more aphids per plant. Because one pest can affect different crops in different ways, the threshold for a certain pest on one crop might not be the same for the same pest on another crop.

Scouting the Garden

To evaluate the effectiveness of preventive measures and the possible need for a rescue treatment, the gardener should scout (inspect) the garden on a regular basis, at least once per week, or more often if time permits. When scouting, it is important to identify any pests that are present, and estimate the extent of the infestation.

Scouting a garden is done by examining a representative sample of each crop to determine the average infestation level. The number of plants to examine can vary according to the type of crop and size of the planting. You might look at all of the plants of a crop if there are only five or six in the planting, or you might look at a sample of 10 plants if there are as many as 50 or more plants per crop. Probably the best rule to go by for the average home garden is to examine enough plants to

feel comfortable that you know what pests are present and how much damage is being done.

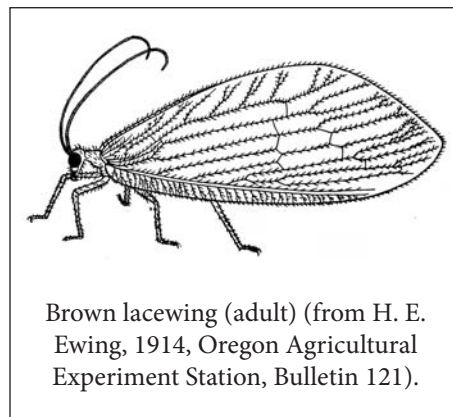
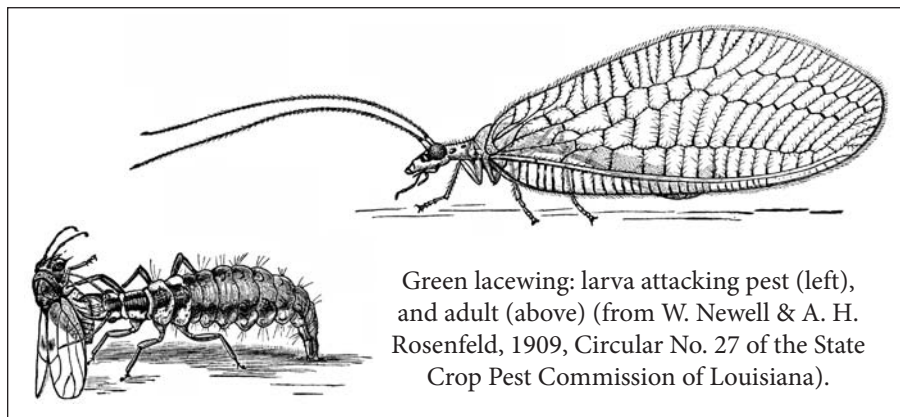
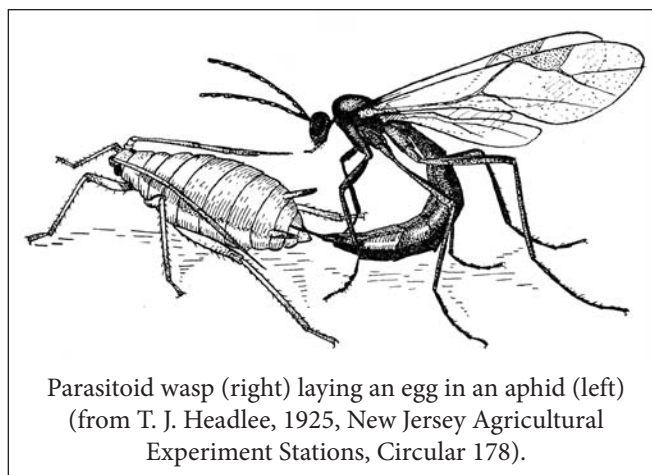
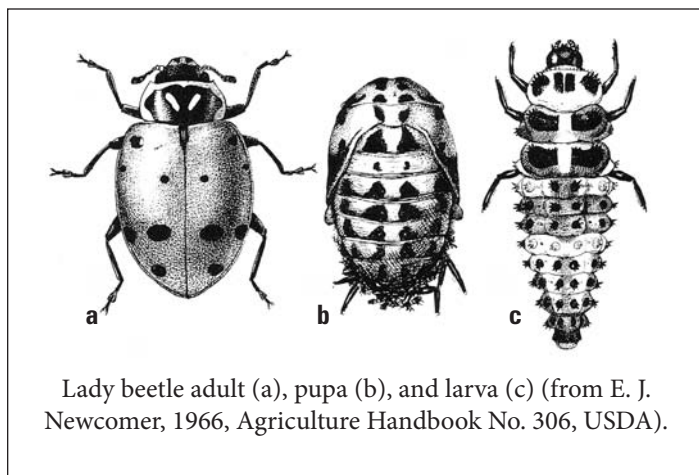
When examining plants, it is important to look at them closely. By looking closely, you will be able to see the egg masses, small larvae, or early stages of damage that are present before damage becomes excessive. Pests can be found on the underside of leaves, on top of leaves, on stems, in stems, in buds, on developing fruit, or on roots. All parts of the plant should be examined, even if they are not parts that will be harvested. For example, even though the pods of a bean plant might not show feeding damage from a bean leaf beetle, the damage the beetle does to the leaves can still cause a reduction in the yield of the plant and the quality of the bean. It is only by thorough scouting that you will truly know what is going on in your garden.

Not all insects found in the garden are pests. Lady beetles, lacewings, hover flies, mantids, parasitoid wasps, and soldier beetles are just a few of the beneficial insects that can be found. Observing beneficial insects as well as the pests should be part of the scouting program. In

the ideal garden, a healthy balance of beneficial insects and pests should be present. Spraying pests to the point of eradication should not be a goal. Doing so can kill the beneficial insects as well, or cause them to move to other areas where prey is available. In either situation, pest populations will generally reestablish more quickly than beneficial insects. This lack of beneficial insects can result in unchecked plant damage as the pest population builds up. Therefore, the presence or absence of a healthy population of beneficial insects, or parasitized pests, should be taken into account when determining the need for a rescue treatment.

Knowledge of which specific pests are present in the garden, along with background information about each pest's habits and life cycle, is the gardener's key to planning the most appropriate management strategy. For example, there are several options for managing the Colorado potato beetle. When the beetle larvae have just emerged from hatched eggs, certain types of insecticides or alternative measures can be used with good results; if the beetle larvae are older and larger, then other types of

Beneficial Insects that Feed on Pests



control measures should be considered. Scouting allows the gardener to know the relative size of the beetle larvae so that one of these tactics can be chosen.

Taking notes during each scouting session can provide a valuable resource for the gardener. Scouting notes form a record of which pests and natural enemies were present, and the extent of the infestations. The notes can include which control tactics were used. Scouting notes are useful both for the immediate future as the crop grows, and in the following years.

Control Measures

Cultural Control

Crop rotation is one of the simplest yet most effective types of control for many diseases as well as insects that have a single generation each year. This involves planting a crop in an area of the garden where it (or a related crop) has not been grown for at least one year. When a crop is grown in the same spot year after year, insects and disease organisms can become established in the soil. This can result in a more rapid infestation of pests each year. Rotating even a short distance from the previous site can help to deter, delay, or avoid damage.

Proper fertility and selection of varieties of plants that are resistant to diseases are also important parts of an IPM program. Plants that are healthy and vigorous are able to withstand pest pressure better than stressed plants.

The use of a *trap crop* can be a control in itself or used in combination with chemical or mechanical controls. A trap crop, which is planted around the crop to be protected, can be any plant known to be highly attractive to a pest. One example is to leave a patch of smartweed at the end of the garden to draw away the Japanese beetle. Once the trap crop is infested, the trap crop may be sprayed to kill the insect, the insects can be hand picked, or the insects may be left to feed on the trap crop.

Mechanical Control

Several types of barriers can be used to protect a crop. *Row covers*, which allow for the penetration of sunlight and the movement of air and moisture (but not insects), can be used to protect a crop from migrating insects. If crop rotation is not used, however, this type of cover can trap insects emerging from the soil in with the crop, creating a false sense of security. *Collars* made of paper plates, tin cans, and aluminum pans can also be placed around the base of individual plants to

protect the upper plant parts from crawling insects such as cutworms that live in the soil, or to protect the stem base from egg-laying by the cabbage maggot fly or cutworm moths.

Several types of *traps* are also available for pest control or monitoring. Traps that attract an insect by color (usually yellow or white) can be made using colored cards covered with a sticky substance, or colored bowls filled with soapy water. Other traps use a scent or “pheromone” to attract the pest to a sticky surface or an enclosure. Traps such as these should not be relied on to control insects in an open area, but should be used more as an indicator of the pest’s presence.

Mechanical control also includes simply *removal* of a pest by hand. For example, Colorado potato beetles can be removed by walking down the row of plants with a broom in one hand, which is used to gently tap each plant over a bucket that is held in the other hand. The dislodged pests can be destroyed by crushing or drowning in some soapy water. An aspirator can be used to remove flea beetles or other small insects from plants. An aspirator is a mouth-operated suction device.

Sanitary Control

Removal of overripe produce will help in preventing the movement of scavenger type insects, such as picnic beetles, or yellowjackets, into the garden. Complete removal of infected plants can help in preventing further spread of a disease. This involves taking the diseased plant completely out of the garden area, not just pulling it and leaving it in the area. For plants that are susceptible to tobacco mosaic virus, the banning of all smoking or chewing tobacco products from the garden area is an important practice.

Biological Control

Biological control relies on naturally occurring organisms. In some instances this may be a fungus or bacterium that attacks the pest when weather conditions are right. It can also be the action of beneficial insects as well as toads and birds. The lady beetle and its larvae are well known for their habits of feeding on aphids.

To attract and preserve a population of local beneficial insects, grow flowers such as dill, sweet alyssum, cilantro, and angelica (even a few dandelions and wild carrots), and protect the eggs and larvae that are already present on the plants by using chemical controls only when necessary or using those that are considered to be “soft” on beneficial insects.

If beneficial insects do not seem to be present naturally, they can be purchased commercially. The success of this approach depends on which type of predator is purchased. Lacewings sold as eggs or pre-fed larvae can be effective for controlling aphids and other small pests. Lady beetle adults collected and shipped in from distant locations seem to be of lesser value for pest control than local populations, making their purchase uneconomical.

Chemical Control

If a pest population reaches threshold levels despite preventive measures and other types of controls, chemical insecticides can be the last resort as a rescue treatment. Even chemicals are not a foolproof way of controlling pests. If the pest is too far along in its growth cycle or has built up a resistance to a pesticide, then use of a chemical might do more harm than good. The squash bug, for example, can be controlled with a chemical in its younger stages, but is difficult to control chemically in its adult stage. Repeated spraying to try to control it at this stage may only result in killing the beneficial insects present. In a situation such as this, the grower of a small planting of squash would be better off removing the bugs and egg masses by hand.

Chemicals for insect control are divided into several classes. Table 1 lists these classes and gives some examples of each. Gardeners interested in organically grown crops usually use products from classes 2–6, but not from class 1.

Toxicity of a pesticide to humans and other mammals can be high (for products such as carbaryl), or low (for products such as pyrethrins), or anywhere in between. Botanical and microbial pesticides tend to break down more rapidly than conventional pesticides. Rapid breakdown can be favorable because the insecticide is in the environment for a shorter period of time, but it also offers a shorter period of protection for the plant, which can result in the need for more frequent applications.

Insecticidal soaps and oils are often considered part of an organic pest control program. Oils work on the basis of suffocation of insects and their eggs. Soaps are used as desiccants on soft-bodied insects. Both need to come into direct contact with the insect to be effective. Care should be taken when using these products to avoid damage to sensitive plants. Plants are more sensitive to soaps and oils when they are under stress from high temperatures (> 85°F).

Table 1. Types of Chemical Controls

1. Conventional synthetic insecticides
 - carbaryl (Sevin)
 - malathion
 - pyrethroids: permethrin, esfenvalerate, lambda-cyhalothrin, bifenthrin
2. Inorganic insecticides
 - kaolin
 - sulfur
 - lime sulfur
3. Botanical insecticides
 - pyrethrins, pyrethrum
 - neem
 - rotenone
4. Microbial insecticides
 - B.t (Dipel, Thuricide, etc.)
5. Smothering agents
 - soaps (Safer Insecticidal Soap)
 - horticultural oils
6. Microbially derived insecticides
 - spinosad

If any type of pesticide is needed for a rescue treatment, be sure to follow the directions on the label. Do not apply at higher rates than directed on the label or use on crops that are not listed on the label. Most insecticides have a pre-harvest limitation, which means the product is not allowed if the crop is going to be harvested within a certain number of days. For most of the newer softer insecticides, this limitation is just one day or even zero days, but for most of the harsher insecticides the limitation is 3, 7, or 14 days. Be certain to wear protective clothing if the label suggests it; wearing waterproof gloves and a long-sleeved shirt is a good idea. Do not apply any type of insecticide on flowering plants that are being visited by bees, because bees need to be kept alive and healthy so that they will pollinate our crops.

Integrated Control

Control tactics that can be used for common vegetable pests are listed in table 2. These tactics can be used individually, but they offer better chance of success when combined in an integrated pest management program.

Table 2. Tactics for Controlling Common Vegetable Pests

(•• = very effective; • - somewhat effective; — = not effective or unknown)

	Cultural								Mechanical				Biological	Chemical		
	crop rotation	trap crop	row cover	variety selection	planting date	tillage	sanitation	reflective mulch	collars	traps	hand removal	hosing/irrigation	predators & parasitoids	microbial insecticides	standard insecticides	soap or oil
CATERPILLARS																
armyworm	—	—	—	—	—	—	•	—	—	—	—	—	•	•	••	—
cabbageworms	—	—	••	—	—	—	•	—	—	—	•	•	•	••	••	—
corn earworm	—	—	—	—	•	•	—	—	—	—	—	—	•	•	••	•
cutworms	—	—	•	—	—	—	•	—	•	—	—	—	—	•	•	—
European corn borer	—	—	•	—	•	—	•	—	—	—	—	—	•	••	••	—
hornworms	—	—	•	—	—	—	—	—	—	—	••	—	••	••	••	—
squash vine borer	—	—	•	—	•	•	•	—	—	—	•	—	—	—	•	—
stalk borer	—	—	•	—	—	—	•	—	—	—	—	—	—	—	—	—
BETLES																
asparagus beetles	—	—	—	—	—	—	—	—	—	—	•	—	—	—	••	—
bean beetles	—	—	••	—	•	—	—	—	—	—	•	—	—	—	••	—
Colorado potato beetle	•	••	••	•	••	•	—	—	—	••	••	—	•	••	•	—
corn rootworm beetles	•	—	—	—	—	—	—	—	—	—	•	—	—	—	••	—
cucumber beetles	—	••	••	•	•	—	—	—	—	—	•	—	—	—	••	—
flea beetles	•	•	••	•	—	—	—	—	—	—	••	—	—	—	••	—
Japanese beetle	—	•	•	—	—	—	—	—	—	•	••	—	—	—	••	—
OTHER PESTS																
aphids	—	—	••	•	•	—	—	•	—	•	—	•	••	—	••	•
leafhoppers	—	—	••	•	—	—	—	•	—	•	—	—	•	—	••	•
onion thrips	—	—	•	•	—	—	•	—	—	•	—	•	•	—	•	•
root maggots	•	—	••	—	•	•	•	—	•	—	—	—	•	—	•	—
slugs	—	—	—	—	—	•	—	—	—	•	•	—	—	—	•	—
spider mites	—	—	—	—	—	—	—	—	—	—	—	•	••	—	•	•
spinach leafminer	—	—	•	—	—	•	•	—	—	—	••	—	—	—	•	—
squash bug	—	—	•	—	—	—	•	—	—	•	•	—	•	—	•	—
stink bugs	—	—	•	—	—	—	•	—	—	—	—	—	—	—	••	—

This publication contains pesticide recommendations that are subject to change at any time. These recommendations are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. Due to constantly changing labels and product registration, some of the recommendations given in this writing may no longer be legal by the time you read them. If any information in these recommendations disagrees with the label, the recommendation must be disregarded. No endorsement is intended for products mentioned, nor is criticism meant for products not mentioned. The author, The Ohio State University, and Ohio State University Extension assume no liability resulting from the use of these recommendations.

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