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Control of insect pests in Colorado organic vegetable gardens

Whitney S. Cranshaw¹

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Quick Facts

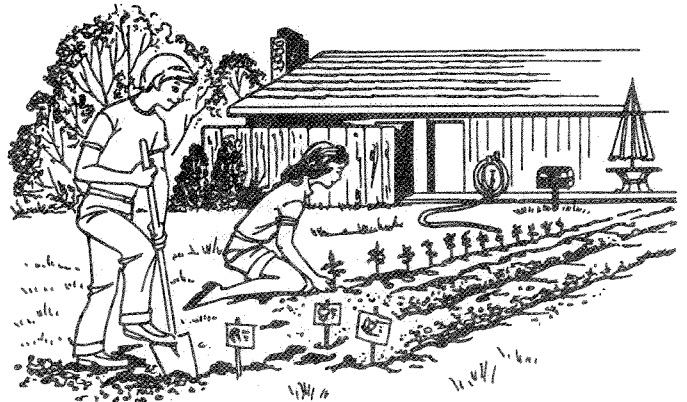
- Rotating certain crops can be considered a form of insect control for pest insects which overwinter as eggs or larvae.
- By removing crop debris and weeds around a garden you can eliminate pests that overwinter within crop residue or find shelter areas.
- When planning a garden, try to select plant varieties that are characteristically resistant to insect pests.
- Educate yourself on the variety of insects that can prove beneficial to your garden.

For a variety of reasons, many Colorado home gardeners attempt to grow vegetables with minimal reliance on pesticides, particularly insecticides. Among these growers are "organic" gardeners, who seek to rely solely on naturally derived sources of fertilizer and pesticides. With the vegetable insect and mite pests present in Colorado, acceptable levels of insect control can often be achieved in home gardens using "organic" control techniques.

Crop Rotation

Although space in a backyard garden is often limited, rotation of certain crops is desirable for insect control. This is primarily true for the few pest insects which overwinter as eggs or larvae in the soil around susceptible plants. In Colorado, crop rotation is effective for control of corn root-worm larvae which destroy the roots of sweet corn planted in the same site each year. It may be useful to avoid planting easily damaged root,

tuber, and caneberry crops in white-grub problem areas for one to two years. White grubs lay eggs in garden areas newly turned under from lawn areas.



Tillage and Sanitation

Tillage can be useful to control insect and mite pests that overwinter and are fairly immobile in the adult stages. Certain cutworms, white grubs, and wireworms may be exposed and killed by deep tillage. Spider mite eggs may also be buried and killed by tillage.

Sanitation can include the following aspects. Removal or burial of crop debris for control of insect pests that overwinter within crop residue, such as asparagus aphid. Removal of weeds and debris around a garden to reduce pest problems that use sheltered areas to overwinter, such as flea beetles, spider mites, millipedes, and slugs. Collections of decomposing organic matter should be located away from gardens and/or maintained so composting is rapid. Failure to do this can provide breeding sites for such plant pests as seed-corn maggots and slugs.

Transplants should also be carefully checked for insects when purchased or moved outdoors from the greenhouse. This is very important for whitefly control since this insect can only overwinter in Colorado within greenhouses.

¹Whitney S. Cranshaw, Colorado State University Cooperative Extension entomologist and assistant professor, entomology (6/85)

Environmental Modifications

Certain gardening practices favor pest problems and should be avoided. Turning under large amounts of undecayed organic matter into the soil, particularly animal manures, can cause an increase in egg-laying and damage by seedcorn maggots. Heavy mulching and other practices that increase moisture will contribute to an increase in populations of slugs.

Considerable research has been done on how various types of intercrops can affect insect populations in small plots. Often, an increase in plant diversity results in a decrease of insect pest populations. However, this effect is usually only significant in large acreages of the same crop. The small scale changes achieved by intercropping in a home garden usually have small impact on pest insect numbers. This includes intercropping with "repellent" or "companionate" plants, generally certain herbs and flowers. Studies have indicated very little effect of these repellent plants on insect populations.

Plant Health and Culture

Cultural conditions that promote rapid germination and plant growth can greatly minimize the effects of insect damage. This is particularly important for controlling seedling pests such as seedcorn maggot, cutworms and flea beetles. Vigorous seedlings can "outgrow" the effects of these feeding injuries. Plant vigor is also important for controlling damage by insects attacking more mature plants. Most vegetables can tolerate substantial leaf area loss without affecting yield, particularly before reproductive or storage tissues begin to form (fruits, tubers, bulbs, head).

Choosing plant varieties resistant to insect pests is another approach useful for insect control. Examples of vegetables grown in Colorado are: red varieties of cabbage to reduce cabbage-worm infestations, onions with more open top growth to limit onion thrips and certain tomatoes less favored by tomato psyllid. Unfortunately, there are few other cases where available vegetable varieties differ in resistance to insect attack. Note that well-adapted varieties will often tolerate an insect infestation better.

Biological Controls

A wide variety of beneficial insects feed upon insect and mite pests in Colorado. These include: insect predators (ladybird beetles, lacewings, syrphid flies, paper wasps, earwigs, minute pirate bugs, etc.) and insect parasites (tachinid flies, braconid and ichneumonid wasps, etc.). These beneficial insects are constantly reducing pest insect problems and are often effective enough to completely control pest insect populations.

It is important that these beneficial insects be appreciated and conserved. Reducing insecticide use is the best way to conserve beneficial insects in a garden.

Several insect predators and parasites are commercially available for release in a garden including ladybird beetles, lacewings, Tricho-

gramma wasps, and praying mantids. Abundant evidence suggests that these releases produce little biological control of pest insects in most situations. However, in a greenhouse there are many biological controls useful for insect and mite control.



Related extension publications that can be consulted include Service in Action Sheet No. 550, *Beneficial Insects in the Home Garden*, and *Commercial Sources of Biological Control Organisms*; available from the extension entomology at CSU.

Physical and Mechanical Controls

Various methods can be employed to exclude or destroy insects and other plant pests. Hand-picking is one of the more obvious techniques and often effective for control of larger insects such as the tomato hornworm, Colorado potato beetle, and the Mexican bean beetle. Small insects such as aphids and whiteflies can be easily crushed by hand.

Various barriers can be used to prevent insects from reaching the plant. These include the use of small caps to prevent flea beetles from injuring seedlings, collars to avoid cutworm injury, and wood ashes placed around plants to reduce slugs.

Traps are also useful for controlling plant pests. Several insects, as well as slugs, seek day-shelter and will collect under boards placed on soil where they can easily be destroyed. A moistened, rolled-up newspaper is particularly attractive to earwigs, although earwigs in a garden usually feed on small insects such as aphids. Slugs are drawn by beer placed in a shallow saucer and will drown. Sticky, yellow boards can trap whitefly adults and winged aphids.

Considerable attention has been given to the use of certain insect traps that involve insect sex attractants (pheromones) or lights. These kinds of traps have been useful for sampling insects. However, neither trap has been effective for controlling garden insect pests. Pheromones attract only male moths and fail to control egg-laying females. Light traps may catch large numbers of flying insects but few of these are pest species.

Sprays and Dusts

Various sprays are compatible with organic gardening and are useful for pest control on vegetables in Colorado. The simplest treatment is vigorously hosing plants with water to dislodge and destroy spider mites. This can be a very effective technique and should be considered a part of any spider mite control effort.

Bacillus thuringiensis (BT) is a naturally occurring bacterial disease of some insects that is produced and sold under a variety of trade names (Thuricide, Dipel, Biological Worm Spray etc.). BT acts as an insect stomach poison and can effectively control most caterpillars, such as the tomato hornworm and the worm complex on the cole crops (cabbage, broccoli, cauliflower, etc.). BT often takes one to three days to kill a caterpillar after it eats treated foliage. However, insects stop feeding on the plant almost immediately.

Pyrethrins are the insecticidal-active ingredients extracted from certain chrysanthemums. Pyrethrins are highly effective in control of many of the larger insects found on foliage, such as beetles and caterpillars. Whiteflies, thrips and certain aphids may also be controlled. Pyrethrins are extremely fast-acting, producing a "knockdown" of the pests within minutes. Pyrethrins are also rapidly broken down by sunlight and usually do not persist more than a day. Pyrethrins formulated for use in gardens are not commonly available in Colorado retail stores but can be found.

Rotenone is the insecticidal-active ingredient found within roots of certain South American plants. It's formulated as dust and kills most chewing insects.

Of the organic pesticides, rotenone is one of the few that requires preharvest intervals following an application. Typically the waiting period is one to three days. Rotenone is also extremely toxic to fish and hogs. The availability of this ingredient in Colorado is fairly good.

Nicotine sulfate, sold under the trade name of Black Leaf 40, is derived from tobacco and related plants. Used as a spray, it's effective against many insect pests, particularly aphids. Nicotine is highly toxic to humans and should only be used with great caution. Preharvest intervals are re-

quired on certain crops and should be followed.

Diatomaceous earth is applied as a dust and has some insecticidal activity by scratching the insect body, causing excessive water loss by the insect. In most trials the degree of control with diatomaceous earth has been low.

Ground insect or plant extracts are often mentioned in gardening magazines as sprays to control various insect pests. Anecdotal cures are commonly stated but in controlled experiments little or no insect control has been demonstrated. In one situation, where insects dying from a disease organism (virus, bacteria) are included in these homemade sprays, some control may be expected by spreading the disease organism.

Mineral oils are effective for control of corn earworm. Oils should be injected into the corn ear tip soon after pollination. Oils can reduce seed set if applied before pollination is complete.

Soaps can be highly effective for controlling small bodied plant pests such as aphids, spider mites and the potato/tomato psyllid. Insecticidal soaps are now commercially available in Colorado and some liquid dishwashing soaps are also effective for insect control. Certain plants can be injured so a small area should always be tested first. Thorough plant coverage and repeat applications are essential when using soaps for insect control. More information on soaps is included in Service in Action sheet no. 5.547, *Use of soaps and detergents for insect control in Colorado*.

Remaining Insect Problems

A few insect problems in Colorado vegetable gardens cannot be controlled with organic techniques and are difficult to control by any method. The most obvious are the many grasshoppers that continually move into a garden from breeding areas in pastures, along roadsides and waste areas. Management of grasshopper breeding areas is the best control for this problem. Insects that transmit plant diseases (aster yellows, mosaic viruses, beet curly top, bacterial wilt of cucurbits) are also difficult to control since the insects are highly mobile and transmit the disease organisms rapidly. The best control for these insect transmitted plant diseases is the use of plants resistant to the disease.