Earth-Kind Gardening Series

Mechanical Pest Controls

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With the emphasis these days on environmental and health issues, gardeners are searching for ways to grow healthy crops while still protecting the fragile ecosystems in their own back yards. Those goals may seem to conflict when insects or other pests invade the garden. There are times when the gardener may resort to pesticides to control a pest invasion, but there are also many non-chemical alternatives. Some of those alternatives are in a category known as mechanical (or physical) controls. Mechanical controls are usually more practical for small gardens, and they can be effectively used singly or in combinations.

Some Helpful Definitions

Mechanical Controls—the use of hands-on techniques as well as simple equipment, devices, and natural ingredients that provide a protective barrier between plants and insects.

Earth-Kind Gardening—a program developed by the Oklahoma Cooperative Extension Service and the Texas Agriculture Extension Service to address environmental garden and lawn issues. The program promotes an environmentally sound stance on pesticide and fertilizer use, water quality, resource conservation, and solid waste management. Earth-Kind Gardening encourages non-chemical practices such as cultural, mechanical, botanical, and biological controls for garden pests.

Organic Gardening—a system of growing healthy plants by encouraging healthy soil, beneficial insects, and birds (also known as "natural," "ecological," or "common sense" gardening). The philosophy includes the way gardeners treat the soil, design their gardens, and choose which plants to grow. It also includes how gardeners decide which fertilizers to use and how to control weeds and pests. Organic gardeners avoid the use of synthetically produced fertilizers, pesticides, and livestock feed additives. However, the term organic gardening has different meanings among different individuals, so a synthetically manufactured fertilizer or pesticide may be objectionable to one organic gardener, but acceptable to another.

Integrated Pest Management—a combination of pest management techniques to reduce the need for pesticides. IPM programs rely on monitoring pests and pest damage. IPM techniques include maintaining healthy plants, which resist insects and diseases better; encouraging natural predators of pests to stay in your yard; using non-chemical means to remove insects when possible, such as handpicking caterpillars on cabbage; and when using pesticides, choosing the one that is least toxic, most effective, and most pest-specific, and that has the least potential impact on the environment.

Exclusion Devices

Examples of exclusion devices include row covers, nets to keep birds away from ripening fruit, paper collars placed around stems of plants to prevent cutworm damage, and proper fencing or barriers to halt the spread of bermudagrass or to prevent pets and wild animals from damaging the garden.

Row covers are flexible, transparent or semi-transparent, woven or plastic materials used to enclose single or multiple rows of plants. They perform several functions:

- enhancing crop growth and early yield by increasing soil and air temperature,
- reducing wind damage, and
- providing a physical barrier to protect against insect pests.

Row covers as physical barriers have advantages such as being non-toxic with no residues. Woven and porous or perforated plastic covers allow water and air to pass through, while all row covers allow sunlight to pass through. However, row covers can be labor intensive, especially in windy areas. Also, physical barriers may prevent pollination of fruits and vegetables by insects. To provide for pollination, gardeners must raise the barriers at flowering time. Also, physical barriers may be ineffective against pests that can emerge from the soil under row covers to attack plants. Good sanitary practices help prevent this problem—gardeners should be careful about burying plant debris under the planting row or bed, because pests often overwinter in such debris.

Handpicking

Hand destruction or removal of insects and egg masses ensures quick and positive control. This method is especially effective with foliage-feeding insects such as squash bugs, hornworms, and bean beetles. Excluding labor, handpicking is the least expensive of all organic or natural control practices.

However, handpicking also has disadvantages in that it must be performed long before insect damage is noticeable and at the key stage of development of the insect. This is where scouting, an Integrated Pest Management technique, is important. Gardeners must actively monitor their crops, watching for the first sign of damage before insect populations get too high.

Traps and Attractants

Mechanical traps and attractants are used in two ways: to trap enough insects to lower crop damage, or to monitor how many and what species of insects are in the garden. Traps and attractants often appeal to an insect's needs for food, shelter, and reproduction.

One type of mechanical trap is a sticky barrier, which can be placed on the trunks of trees and woody shrubs to prevent crawling insects from causing damage.

One type of monitoring trap consists of sticky paper on stakes. The paper attracts insects because of its color or because of a sex pheromone in the sticky substance that attracts the insect. Most sticky traps are yellow, a color which seems to attract more insects.

Another example of a mechanical trap is the "shingle trap"—shingles are placed beneath plants to attract squash bugs. The gardener frequently lifts the shingles to remove and destroy the bugs.

Traps and attractants often appeal to an insect's needs for food, shelter, and reproduction.

A disadvantage of traps or attractants is that they may trap beneficial insects. Also, while some traps may be homemade using simple, inexpensive materials, others are expensive and must be cleaned or replaced periodically. Many traps and attractants are available on the market.

Water Pressure Sprays

A forceful stream of water will sometimes dislodge insects such as aphids and spider mites from foliage and plant stems. This practice must be repeated since many of the insects are likely to return.

Water pressure should be used only on sturdy plants to avoid plant damage. This method may also be a problem since frequent applications of water could increase diseases such as black spot on roses or could cause root problems if the soil is already too wet. Therefore, use water sprays in the morning, so plants will dry out during the day.

Insect Vacuums

The use of vacuums to remove certain kinds of insects from plants is growing in popularity, especially among commercial producers. These tools may contain a disposable cartridge lined with a non-toxic, sticky gel to trap insects sucked up by the machine. Commercial producers have large vacuum equipment attached to and powered by tractors. On a smaller scale, hand-held, battery powered vacuums are available, some of which have a small hose attachment to use when reaching across a row or bed.

In home garden or for indoor use, a plant can be shaken to dislodge flying insects such as thrips and whiteflies as well as aphids that are in a flying stage of growth. When the plant is shaken and the insects begin to fly, they can be sucked into the vacuum hose held in the air near the plant. Vacuums may also remove crawling insects or insect eggs. The vacuum nozzle may be placed directly on plants with strong or thick leaves, but caution is needed on plants with tender foliage. It may be safer to those plants to shake them and vacuum underneath to catch any insects that fall.

Diatomaceous Earth

Diatomaceous earth is composed of finely ground skeletons of fossil diatoms. Sharp edges of the ground diatoms scratch the waxy or oily outer layer of soft-bodied insects, which die eventually from dehydration.

Because its function is to scratch the insect's outer body covering, diatomaceous earth is categorized as a mechanical pest control. However, it may also be considered a mechanical barrier or repellent because some insects will not crawl on or feed upon plant foliage sprinkled with it.

Diatomaceous earth is a dusty product that looks similar to flour. There are various formulations, including one sold for swimming pool filters, which does not help control insects because it has been altered by high heat to make it a stable filter material rather than an absorber of insect oils.

Before buying or applying diatomaceous earth, gardeners should read the label and look for the insect control formulation, since some brands are not labeled for vegetables. It is considered a pesticide, but it is non-toxic to birds and mammals. On the other hand, diatomaceous earth can be a disadvantage because it may also kill beneficials such as ladybugs, and it is less effective against pests in humid weather.

Gardeners must wear a dust mask when applying diatomaceous earth to plants.

Insecticidal Soaps

Several insecticidal soaps are distributed for control of insects and mites. Available under a variety of trade names, their active ingredient is potassium salt of fatty acids. Soaps are chemically similar to liquid hand soaps. However, there are many features of commercial insecticidal soap products that distinguish them from the dishwashing liquids or soaps that are sometimes substituted. Insecticidal soaps sold for control of insects:

- are selected to control insects
- are selected to minimize plant injury
- are of consistent manufacture

Certain brands of hand soaps and liquid dishwashing detergents can be effective as an insecticidal soap. However, **there is increased risk of plant injury with these products.** They are not designed for use on plants. Dry dish soaps and all clothes-washing detergents are too harsh to be used on plants. Also, many soaps and detergents are poor insecticides. Identifying safe and effective soap-detergent combinations for insect control requires experimentation. Regardless of what product is used, soap-detergent sprays are always applied diluted with water. Using commercially prepared insecticidal soaps instead of homemade solutions is highly recommended.

Common Insects and Mechanical Treatments

Mechanical Treatments

Insects	horticultural oils	diatomaceous earth	insecticidal soaps	row covers	traps and attractants	vacuums
ants		•	•		•	
aphids	•	•	•		•	•
apple maggots					•	
armyworms					•	
cabbage worms				•		
codling moths	•			•		
Colorado potato beetles		•		•		
corn earworms	•				•	
cucumber beetles				•		
cutworms		•	•			
earwigs		•				
flea beetles				•		•
fungus gnats					•	•
leafhoppers			•	•		
leaf miners	•			•		
leaf rollers	•				•	
looper caterpillars				•	•	
mealybugs	•		•			
psyllids	•		•			•
slugs and snails		•			•	
sowbugs		•				
scales	•		•		•	
squash bugs				•		
squash vine borers				•		
spider mites	•	•	•			•
tarnished plant bugs				•	•	
thrips	•		•		•	•
whiteflies (greenhouse)	•		•		•	•
whiteflies (sweet potato)	•		•		•	•

This is a generalized list of mechanical treatments recommended for common garden insect pests. However, these treatments are sold under many different brand and trade names. Always read the label of a product to see if it is formulated for use against the particular insect you want to control. The chart does not list every insect pest you may find in your garden, but it does include many of the most common ones.

Susceptible Insects

Most research with insecticidal soaps and detergents has involved control of plant pests. In general, these sprays are effective against most small, soft-bodied arthropods, such as aphids, young scales, whiteflies, psyllids, mealybugs, and spider mites. Larger insects, such as caterpillars, sawflies, and beetle larvae, generally are immune to soap sprays. However, a few large insects, including boxelder bugs and Japanese beetles, are susceptible.

Insecticidal soaps are considered selective insecticides because of their minimal adverse effects on other organisms. Lady beetles, green lacewings, pollinating bees, and most other beneficial insects are not very susceptible to soap sprays. Predatory mites, often important in control of spider mites, are an exception, a beneficial group of organisms easily killed by soaps.

Application

One of the most serious potential drawbacks to the use of soap-detergent sprays is their potential to cause plant injury (phytotoxicity). Certain plants are sensitive to these sprays and may be seriously injured. For example, most commercial insecticidal soaps list plants such as hawthorn, sweet pea, cherries, and plum as being sensitive to soaps. Portulaca and certain tomato varieties also are sometimes damaged by insecticidal soaps. The risk of plant damage is greater with homemade preparations of household soaps or detergents. When in doubt, test soap-detergent sprays for phytotoxicity problems on a small area a day or two before an extensive area is treated.

Plant injury can be reduced by using sprays that are diluted more than the 2 to 3 percent suggested on label instructions. To reduce leaf injury, wash plants within a couple of hours after the application. Limiting the number of soap applications can also be important, as leaf damage can accumulate with repeated exposure.

However, because of the short residual action, repeat applications may be needed at relatively short intervals (four to seven days) to control certain pests, such as spider mites and scale crawlers. Also, application must be thorough and completely wet the pest. This usually means spraying undersides of leaves and other protected sites. Insects that cannot be completely wetted, such as aphids within curled leaves, will not be controlled.

Environmental factors also can affect use of soaps. In particular, soaps (but not synthetic detergents) are affected by the presence of minerals found in hard water, which results in chemical changes producing insoluble soaps (soap scum). Control decreased if hard-water sources are used. Insecticidal soaps may also be more effective if drying is not overly rapid, such as early or late in the day.

Soap and detergents can offer a relatively safe and easy means to control many insect pests. As with all pesticides, however, there are limitation and hazards associated with their use. Understand these limitations, and carefully follow all label instructions.

Horticulture Oils

Oils are petroleum-based products containing certain fatty acids that form layers on plant parts to smother insects or provide a mechanical barrier to prevent damage. There are two kinds of oils: growing season (summer) and dormant. Some common examples include:

- **Sunspray (6E Plus)**: Normal dormant use. Summer use on vegetables, greenhouse ornamentals, flower and foliage plants, some fruit and nut trees, some field crops, blueberries, grapes, olives, and citrus.
- **Ortho Volck Oil Spray**: Dormant and summer use on citrus, fruit and shade trees, evergreens, and some shrubs.
- **Scalecide**: Dormant and summer use on fruit and shade trees, ornamentals, evergreen, and small fruit. Indoor or outdoor use.

Mixes of dormant oil and sulfur are also available. "Dormant" refers to the time of year the application is made. Remember, as a general rule, that oils control insects, not plant diseases. Sulfur-type products control diseases. An exception is the use of some sulfur products to control mites.

RULES FOR USING OILS

- wear a mask
- coat the leaves, stems, and ground
- treat test plants first and look for damage
- spray at the right time
- do not mix chemicals
- use low rates
- do not use when temperature is above 90°F

Watch the Oklahoma Gardening television show for more Earth-Kind garden, lawn, and landscape tips. The show is broadcast at 11 a.m. Saturdays and 3:30 p.m. Sundays on the Oklahoma Educational Television Authority channels.

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