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Alternative Pest Control Methods for Homeowners

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Did You Know?

According to the U.S. Environmental Protection Agency, pesticide expenditures for home and garden use in the U.S. in 2007 were $2.7 billion, or 22% of the $12.4 billion total pesticide expenditures.

Using a comprehensive, or integrated pest management approach, will help home gardeners reduce their reliance on pesticides for pest control.

Integrated Pest Management or IPM

IPM is a pest management approach which combines methods to reduce risks to humans and the environment while maintaining economic viability. Following IPM practices minimizes the use of chemical control by relying on comprehensive pest management methods and using chemical control as a last resort. IPM applies to conventional and organic pest control. There are four basic steps involved in IPM: 1) set action thresholds, 2) monitor and identify pests, 3) prevention, and 4) control.

1. Set Action Thresholds

The action threshold is the point in which pest control action must be taken to prevent economic or aesthetic loss. The presence of a pest does not always merit action. Action thresholds are determined by the degree of damage by the pest and factors such as economic impacts, health, safety, and aesthetic concerns. To learn more about action thresholds, visit: https://extension.usu.edu/files/publications/publication/economic-injury-level96.pdf

Pest management specialist inspecting an orchard insect trap. Photo by Lynn Betts, USDA Natural Resources Conservation Service.

2. Monitor and Identify Pests

Routine monitoring for the presence of organisms can help you identify pest life stage, population growth, damage, and presence of beneficial organisms. Monitoring is as simple as visually examining plants for insects, or signs of stress or disease. You can purchase devices such as hand lenses and insect traps for more advanced monitoring.

Identifying pests or plant problems can help determine the best pest control approach and avoid applying the wrong kind of pesticide, or applying pesticides when it is unnecessary. Some pests pose very little threat, and could even be beneficial. Insect pests are often more easily controlled during early developmental stages. Therefore, timing can be critical for effective control.

3. Prevention

Prevention can often be effective in reducing pest damage enough to eliminate the need for chemical application. Taking measures to prevent potential pest problems can be effective and cost-efficient, cause little to no harm to humans and the environment, and can result in long term control. Preventive practices discourage pest establishment by disrupting environments favorable to pests. Creating diversity in your garden and promoting plant health are key factors in pest prevention. Cultural pest control is one form of prevention. Cultural control methods include removal of pest overwintering sites, crop rotation, sanitation, proper watering, appropriate fertilization, mulching, using physical insect barriers, and choosing pest and disease resistant plant varieties. Mechanical pest control discourages pest pressure using hands-on techniques such as hand removing insects, hand or mechanical weeding, trimming and removing highly infested branches or leaves, and trapping.

4. Control

Integrated pest management advocates that chemical control should be used as the last resort, when preventive measures are ineffective and there is a need for pest control based on action thresholds. Chemical application is appropriate when non-chemical approaches are no longer effective.

For IPM pest advisories as influenced by the current seasons' weather and crop conditions, and other information, visit: http://utahpests.usu.edu/ipm/

Selection and Application of Chemicals to Reduce Risk

- **Use Selective Pesticides**. While many pesticides help keep unwanted organisms under control, many of them also harm other beneficial organisms. Selective pesticides target specific pest species, causing little harm to non-target organisms.

- **Use Non-persistent Pesticides**. Non-persistent pesticides break down quickly in the environment. Pesticides with a half-life (time required for half the amount of chemical to degrade) of 30 days or less are considered non-persistent, and are usually broken down before leaching into ground water.

- **Spot-Treat**: When applying pesticides, only treat areas where the pests are a problem.

- **Schedule Application Timings**: Apply pesticides in mornings or evenings when pollinators are less active.

Organic Insecticides

There are many alternatives to conventional synthetic pesticides. These alternative pesticides are often called "natural" or organic pesticides because they are formulated from compounds found in nature. For a pesticide to be termed truly organic, it must have an "OMRI" seal on the label. For a list of organic/natural pesticides, refer to Table 1.

Organic pesticides can be grouped into categories based on where their ingredients are derived, such as botanicals, minerals, or oils.

Botanical Pesticides are comprised of plant-produced chemicals. Toxicity of botanical pesticides to wildlife varies depending on the substance.

- **Neem oil** is derived from the neem tree, native to India, and has insecticidal and fungicidal properties. It has relatively low toxicity to mammals. Neem oil controls some caterpillars, leaf miners, whiteflies, thrips, and mealy bugs. Azadirachtin is another organic ingredient derived from the neem tree.
- **Pyrethrin** is extracted from the chrysanthemum plant and is one of the most widely used botanical insecticides in the U.S. Pyrethrin is considered non-toxic to mammals and moderately toxic to honey bees. It is one of the safest insecticides because it breaks down very

quickly. Pyrethrin is primarily non-selective, targeting a wide range of insects.

Minerals may have unique properties that make them useful for pest control. Toxicity varies depending on the substance.

- **Copper sulfate** can be used as a fungicide, algaecide, or herbicide. It binds to proteins in fungi and algae, damaging and killing cells. Copper can kill bacteria, fungi, roots, plants, snails, and algae. It is used in organic agriculture.
- **Sulfur** can be used as a fungicide and miticide. It disrupts the metabolic function of fungi and other target pests that absorb it. Sulfur is less toxic than many conventional synthetic fungicides.
- **Bordeaux mixture** acts as a plant fungicide and bactericide. It is a combination of copper sulfate and hydrated lime, and when applied, creates a protective coating on plant surfaces. Bordeaux mixture must be mixed by hand from the individual ingredients. It can control many plant diseases, such as fire blight on pears and apples, and powdery mildew on grapes.
- **Diatomaceous earth (DE)** is a mineral dust containing particles which pierce exoskeletons of soft-bodied insects resulting in desiccation. DE is non-selective, and can harm beneficial insects. DE will lose effectiveness if allowed to get wet.

Insecticides with a physical mode-of-action include horticulture oils and insecticidal soaps. Horticulture oils are highly refined petroleum oils with insecticidal and fungicidal properties. They require thorough coverage of the pest to kill by suffocation, and degrade rapidly by evaporation. Insecticidal soaps are specific fatty acids that disrupt the waxy covering of the insect's cuticle, killing it through loss of water or dehydration.

Microbial insecticides are commercial products that contain insect toxins produced by bacteria, fungi, viruses, or protozoans. A great advantage is that they are highly specific for target pests, and usually do not harm beneficial insects. A common microbial insecticide is produced by the bacterium *Bacillus thuringiensis,* or Bt. There are several strains of Bt that target different groups of pests. The most common varieties are Bt var. *kurstaki* which kills moth caterpillars, Bt var. *tenebrionis* which kills the Colorado potato beetle, and Bt var. *israelensis* which kills fungus gnats and related fly larvae. Spinosins are another group of bacteria that have been developed into microbial insecticides, such as spinosad. There are several microbial products containing living insect viruses, such as Cyd-X which is specific for codling moth.

Lady beetle larva on plant with aphids.

Biological Control

Biological control, or bio-control, is the use of predators, parasitoids, and pathogens to control pests.

- Insect predators feed on other insects, or weedy plant species. Some insect predators, like praying mantis, are generalists that will eat both pests and other beneficial insects. More specialized predators, such as lady beetles, eat small, soft bodied insects such as aphids.
- Parasitoid insects like some wasps and flies will lay their eggs in or on host insects where the larvae will consume and kill the host. Most parasitoids are specialized for specific host insects.
- There are many pathogens (viruses, bacteria, fungi, and nematodes) that attack insects in their natural habitats. In general, warm and moist

environments enhance pathogen activity. Pathogens can be added through inoculative releases as in application of microbial insecticides (see description above).

- Many biological control organisms already exist in the garden and some are available commercially, such as lacewings, lady beetles, beneficial nematodes, and predatory mites.

Table 1. Examples of common organic pesticides.

Pesticide	**Type**	**Acute* Toxicity to Humans**	**Wildlife Toxicity**	**Use & Target Pests**
Bacillus thuringiensis (Bt)	Microbial-Bacterial	No rating	Low toxicity to aquatic life, natural enemies**, and honey bees.	Insecticide-caterpillars
Spinosad	Microbial-Bacterial	Slightly toxic	Non-toxic to slightly toxic to fish and birds; moderately toxic to earthworms; highly toxic to bees but little to no effect on honeybees and beneficials once applied and surface has dried.	Insecticide-codling moth, cheery fruit fly, earwigs, thrips, and caterpillars
Pyrethrin	Botanical	Slightly toxic	Low toxicity to mammals; moderate toxicity to honeybees and beneficials; and highly toxic to aquatic life.	Insecticide- wide variety of insects
Neem Oil	Botanical	Not toxic	Practically non-toxic to birds and mammals; low toxicity to aquatic life and natural enemies (beneficials); and moderately toxic to honeybees.	Insecticide, Fungicide, and Bactericide
Horticulture Oil	Oils	Not toxic	Low toxicity to mammals and natural enemies (beneficials); and moderately toxic to honeybees.	Fungicide, Insecticide, Miticide
Insecticidal Soap	Soap	Not toxic	Practically non-toxic to mammals and birds; and low toxicity to natural enemies (beneficials) and honeybees.	Fungicide, Insecticide, Miticide
Copper Sulfate	Mineral	Moderately toxic	Practically non-toxic to bees, moderately toxic to birds; and highly to very highly toxic to aquatic life.	Fungicide, Algaecide, Root Killer, Herbicide
Bordeaux Mixture	Mineral	Moderately toxic	Low toxicity to natural enemies (beneficials); and moderate toxicity to bees.	Fungicide

*Acute toxicity describes the immediate adverse effects (within 24 hours) upon exposure (oral, dermal, or inhalation). Long term toxicities are not included for this list of pesticides.

** Natural enemies refers to insect predators and parasitoids.

Safety Considerations

Pesticide labels are designed to protect humans and the environment, and they are required by law. It is a federal and state violation to use any pesticide in a manner inconsistent with the label. Labels include required and optional Personal Protective Equipment (PPE) descriptions appropriate for use with the pesticide, a list of pests and crops the product is intended for, and information on storage and disposal. Pesticides must be kept out of reach of children and pets, and should only be used when children and pets are not present. Always read the label before purchasing or using a pesticide. Utah State University Extension employees are not responsible for any misapplication of pesticide products. USU does not indorse products mentioned in this Fact Sheet.

References

Alston, D. G. (2011, July). Important Components of a Successful Pest Management Program. *extension.usu.edu.* Retrieved from https://extension.usu.edu/files/publications/publication/pest-program'96.pdf

Alston, D. G. (2011). General Concepts of Biological Control. *extension.usu.edu.* Retrieved from https://extension.usu.edu/files/publications/publication/gen-biocontrol96.pdf

National Pesticide Information Center Active Ingredient Fact Sheet. (n.d.). Retrieved from http://npic.orst.edu/ingred/aifact.html

UC Davis IPM Online Pesticide Active Ingredients Database. (n.d.). Retrieved from http://www.ipm.ucdavis.edu/PMG/menu.pesticides.php

U.S. Environmental Protection Agency. (n.d.). Retrieved from http://www.epa.gov/oppbppd1/biopesticides/whatarebiopesticides.htm