



# Alternative Pesticide Options for The Home Gardener

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Integrated Pest Management (IPM) is an ecosystem-based strategy that focuses on long-term management of pests or their damage through a combination of techniques such as biological controls, habitat manipulation, modification of cultural practices, use of resistant varieties, and chemical (UCIPM definition). Chemical controls are employed after other management techniques have proven ineffective and/or significant crop damage continues to occur.

Often, home and garden enthusiasts are not comfortable using many commercial pesticides around their homes. Below is a list of some common alternative pest management solutions for the home and garden practitioner. More information on IPM can be found in *Integrated Pest Management for the Home Garden*, University of Arizona Extension Publication number: AZ1521.



- Always read and follow label instructions.
- All pesticides including “home remedies” and “DIY” pesticides have inherent dangers so wearing appropriate personal protective equipment (PPE) and following labeling application instructions is paramount to reduce likelihood of exposure and off target movement.
- Always wear PPE and take precautionary steps to minimize exposure.
- Children may be especially sensitive to pesticides.
- Spray when bees and other beneficial insects are not present.

## Bacillus thuringiensis

*Bacillus thuringiensis* (Bt) is a naturally occurring bacterium found in soil. It must be eaten by the insect, usually in the larval stage, before it is effective. Bt forms crystal proteins that are toxic to many species of insects. Bt strains are species specific and thus allow for targeted control. For example; Bt *kurstaki* is used to control Lepidopterans like, cabbageworm, tent caterpillars, tomato hornworm and other leaf eating caterpillars. Bt *israelensis* is specific to Diptera species including; mosquitos, black flies and fungus gnat larvae. Bt *san diego* is effective on a limited number of leaf-eating beetles such as Colorado potato beetle and elm leaf beetle. Because of its species specificity Bt is considered a very safe pesticide to use in controlling target pests of vegetables or fruits without harming many beneficial insects.

Bt has been used in agriculture for decades; some common crops include corn, cotton, and sugarcane. In these crops the gene that produces the crystal proteins is identified in the donor organism (bacteria or fungus) and is then inserted into the plant genome and thus the plant produces its own species-specific insecticide.

## Beneficial Nematodes

Beneficial (Entomopathogenic) nematodes are worm-shaped microscopic organisms that colonize many soil dwelling insects, particularly larvae (grubs) of beetles (Coleoptera). Once nematodes enter the pest, they release a bacterium which multiplies quickly, ultimately killing the grub. Like other control methods including biocontrols eradication is not possible. Adequate soil moisture is required for nematode survival and ultimate efficacy. Obtain entomopathogenic nematodes fresh from natural pest control vendors and follow directions.

## Diatomaceous Earth

Diatomaceous Earth (DE) is made from the fossilized remains of microscopic, aquatic organisms called diatoms. DE is not poisonous and does not have to be ingested to be effective. DE dehydrates the insect by absorbing the fats and oils in their exoskeleton. The sharp edges are abrasive and speed the process of dehydration by damaging the insect exoskeleton. DE is effective as long as it stays dry and undisturbed. It is commonly used to control crawling insects. DE can be harmful if inhaled so using an appropriate PPE including a respirator during application is recommended.

## Grasshopper Bait

Grasshopper bait contains the microscopic fungi *Nosema locustae*, a naturally occurring fungus that is an affective grasshopper control. Spores of this microbe are fixed to wheat bran with a sweetener, both of which attract grasshoppers. Grasshoppers ingest the bran and become sick, eat less, and die. More grasshoppers become infected as they cannibalize diseased grasshoppers. Grasshopper bait works best on young grasshoppers and for small acreage. It acts too slowly for

immediate control. For larger areas, it is most effective when used as part of a long-term grasshopper management program:

## Milky Spore

*Paenibacillus popilliae* (formally *Bacillus popilliae*) is a soil-dwelling, rod-shaped bacterium. It has been used widely on Japanese beetles (which are not known to be present in Arizona). Here, it is applied to beetle grubs, often in a soil drench and causes slow death of the grubs. It is ineffective against adult insects. However, the bacteria will spread naturally in the soil with the death of infected beetle larvae.

## Neem Oil

Neem oil is a mixture of components that work together as a pest control in two different ways. Clarified Hydrophobic Extract of Neem Oil works like other oil sprays by smothering insects. Extracted neem oil contains the active ingredient azadirachtin which also acts as an insecticide.

Neem oil with azadirachtin works as a systemic and contact treatment insecticide. As a systemic, it is absorbed by a plant and transported through plant tissue. Azadirachtin reduces feeding capability, interferes with insect hormonal systems, and can act as repellent. Some soft-skinned insect larvae may be killed by direct contact with the spray. Neem oil can be purchased as a ready to use formulation (which requires no dilution), or as granules, dust, wettable powders or emulsifiable concentrates. In addition, neem oil can act as a fungicide and as a bactericide.

Recently a few Neem Oil products certified for organic agriculture have been found to be contaminated with synthetic active ingredients. The Oregon Department of Agriculture has issued Statewide Stop Sale, Use or Removal Orders (SSURO) on 5 different products with the active ingredient azadirachtin since July 2017.

## Pesticidal Soaps

Pesticidal soaps are based on potassium fatty acids and can be used as insecticides, herbicides, fungicides and algaecides. For insect management, soap salts must come in to direct contact with the insect in its liquid form. Once dry, it has little effect on insects. Soaps work by suffocating the insect and disrupting cell membranes. Soaps are generally used to control soft-bodied organisms such as aphids, thrips, and immature or flightless insects. Hard-shelled insects such as ladybugs and other beetles may be less effected.

## Pyrethrins

Pyrethrins can be derived from chrysanthemum flowers and have insecticidal properties. Pyrethrin can also be synthetically manufactured. The extract effects insect nerve membranes resulting in hyper excitation and ultimately death after contact or consumption. It is fast acting and breaks down quickly. Care

must be taken when using this pesticide. Pyrethrins should not be used on cats to control fleas or other pests. Some dogs may also have allergic reactions to pyrethrins. Pyrethrins are toxic to bees and other beneficial/benign insects and should be applied at times and in locations that minimize harm to these non-target organisms. Remember, insecticides derived from plants can be harmful to humans and non-target organisms.

## Spinosad

Spinosad is a naturally occurring bacterium found in soil that can be toxic to insects. The bacterium was first isolated from soil in an abandoned rum still in the Virgin Islands. It works through direct contact or by ingestion. It affects the nervous system of the insect, causing loss of muscle control. This leads to paralysis and ultimately their death, typically in one to two days. It is toxic to bees and should not be used when bees are foraging.

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