BASICS

Friendly pesticides for home gardens no. 2.945

by L.P. Pottorff [1]

Quick Facts...

Pesticides are substances and/or organisms intended for preventing, destroying, repelling, or mitigating a pest.

Sabadilla is considered among the least toxic of botanical insecticides and can be highly irritating to eyes and produce sneezing if inhaled.

Pyrethrum is the most widely used botanical insecticide in the U.S.

Pyrethroids are synthetic materials designed to imitate natural pyrethrum, have the basic chemistry of pyrethrins, but are modified to improve persistence, insecticidal activity, etc.

Sulfur is probably the oldest known pesticide in current use.

Introduction

When we think of organic gardening we often conjure up the image of a crop grown free of any pesticides. However, the concept of organic gardening is much more broad, and believe it or not, many types of pesticides are permitted. We should be aware that these pesticides can be included in pest management programs in home landscape situations.

Pesticides, as defined by the Colorado Organic Certification Act (COCA), are substances and/or organisms intended for preventing, destroying, repelling, or mitigating a pest. Normally when we think of pesticides we think of synthetically produced pesticides (e.g. carbaryl/Sevin, Malathion, and 2,4-D); these pesticides are prohibited when producing organically grown commodities. There is nothing wrong with these pesticides when used as necessary and only according to label directions. However, they are also the types of pesticides that have been misused as well overused by urban gardeners. Alternative controls that can be used in place of the more common synthetic pesticides are mentioned below and can give the home gardener a satisfactory way to control pests while eliminating the great potential for pesticide misuse.

The types of pesticides allowed in organic production under COCA include microorganisms (*Bacillus thuringiensis*, Dipel, etc., see fact sheet 5.556, *Peach tree borers*), microbial products (Avid), and materials derived or extracted from plants, animals or mineral-bearing rocks. Exceptions also exist for certain synthetic pesticides such as soap, oil, and lime sulfur. As a general rule, pesticides approved for use in organic production break down rapidly and often are less destructive to natural enemies and other organisms. However, just because the materials are natural does not mean that they are always less toxic than the synthetic pesticides. Some botanical, mineral-bearing and other alternative pesticides are considered below.

Botanical Pesticides

Sabadilla. Sabadilla is derived from the seeds of the sabadilla lily (*Schoenocaulon officinale*). The active ingredient is an alkaloid known as veratrine and most commonly sold under the trade names “Red Devil” or “Natural Guard”. Sabadilla is considered among the least toxic of botanical insecticides with an oral LD50[2] of 4,000 to 5,000 mg/kg. Sabadilla dust can be highly irritating to eyes and can produce sneezing if inhaled. No residue is left after application of sabadilla because it breaks down rapidly in sunlight.

Sabadilla acts as a contact and stomach poison and has been effective against caterpillars, leaf hoppers, thrips, stink bugs, and squash bugs. The insecticide is labeled for use on many vegetables.

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[2]LD50 is the dosage lethal to 50% of the test population. The larger the LD50, the safer the chemical.

Pyrethrum/Pyrethrins

Pyrethrum is the most widely used botanical insecticide in the U.S. The active ingredient, pyrethrin, is extracted from the chrysanthemum plant, *Dendranthemum* (*Chrysanthemum*) *cinerariaefolium*, which is grown primarily in Kenya, Rwanda, Tanzania and Ecuador.

Most insects are highly susceptible to pyrethrum at low concentrations. The compound acts rapidly on insects, causing immediate "knockdown." Flying insects drop almost immediately upon exposure. Pyrethrums also are highly irritating to insects, so they may be used as a "flushing agent" or irritant to "make them come out of hiding."

Fast knockdown and actual insect death don't always go hand in hand as many insects recover after the initial knockdown phase. For this reason pyrethrums are mixed with a synergist such as piperonyl butoxide (PBO) to increase insect mortality. Pyrethrums are primarily effective as a contact poison, which affects the central nervous system of insects.

Pyrethrum is non-toxic to most mammals, making it among the safest insecticides in use. In fact, it has more approved EPA (Environmental Protection Agency) uses than any other insecticide. Trade names include Pyrenone and Pyrellin. One caution, allergic skin reactions can be common when using pyrethrum/pyrethrins. Do not use products containing PBO when temperatures exceed 90 degrees F.

Pyrethroids are synthetic materials designed to imitate natural pyrethrum. Pyrethroids are not accepted by organic producer regulations. These synthetic materials have the basic chemistry of pyrethrins but are modified to improve persistence, insecticidal activity, etc. Pyrethroids are widely used in American agriculture under trade names such as Asana, Capture, Astro, Mavrik, Pounce, resmethrin, and sumithrin. Use caution when applying these products around water as they are toxic to fish.

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Interestingly enough, some synthetic pyrethroids are safer than the natural pyrethrins. The oral LD50 of Pounce (pyrethroid) is 4,000 mg/kg, while the oral LD50 of pyrethrin is 1,500.

Neem. Neem is a botanical pesticide derived from the seeds of the neem tree, a native of India. The neem tree supplies at least two compounds, azadirachtin and salannin that have insecticidal activity, and other, unknown compounds with fungicidal activity. While these uses of neem are new to us in the U.S., neem has been used for more than 4,000 years in India and Africa for medicinal as well as pest control purposes. It has low mammalian toxicity with an LD 50 of 5,000 mg/kg.

Neem-based pesticides have been developed and are sold under trade names such as Margosan-O, Azatin, and Bio-neem. Neem-based products have been shown to control gypsy moths, leafminers, sweet potato whiteflies, western flower thrips, loopers, caterpillars and mealybugs. The products are labeled for use on ornamentals, foliage plants, trees, shrubs and food crops. Neem works as an insect growth regulator. (The treated insect usually cannot molt to its next lifestage and dies.) It also may deter egg laying. Do not expect a "quick kill."

Research continues to look at the full activity of neem extracts against a wide range of pests and pathogens.

Mineral-based Pesticides

Sulfur is probably the oldest known pesticide in current use. Homer described the benefits of "pest-averting sulfur" 3,000 years ago.

Sulfur can be used as a dust, wettable powder, paste or liquid. It primarily is used for disease control as it is effective against powdery mildews, certain rusts, leaf blights, and fruit rots. However, spider mites, psyllids, and thrips are also susceptible to sulfur. Most pesticidal sulfur is labeled for vegetables such as beans,

potatoes, tomatoes, peas, and fruit crops such as grapes, apples, pears, cherries, peaches, plums and prunes.

One the drawbacks of sulfur is its potential to cause plant injury in hot (+90° F), dry weather. The element also is incompatible with other pesticides. Sulfur should not be used within 20 to 30 days on plants where spray oils are applied since it reacts with the oils to make a more phytotoxic combination.

Sulfur is non-toxic to mammals but may be irritating to the skin and especially eyes. It has an LD 50 of 5,000 mg/kg.

Lime sulfur is made by boiling lime and sulfur together. This mixture is used as a dormant spray for fruit trees to control such diseases as blight, anthracnose, powdery mildew, and certain insects such as scales, eriophyid mites, and spider mites.

Horticultural oils *are highly refined so that compounds toxic to plants are removed. Considered effective and safe, they can be used to control insects as well as diseases.*

Lime sulfur's drawbacks include smelling like rotten eggs, burning exposed skin and eyes and causing plant injury if applied when temperatures exceed 80 F. Lime sulfur has an LD50 400 - 500 mg/kg.

Bordeaux Mixture (NOT APPROVED FOR USE BY ORGANIC GROWERS) is a product of the reaction between copper sulfate and calcium hydroxide (lime). First used in Bordeaux, France, as a control for downy mildew, this mixture is primarily used as a fungicide, to control bacterial leaf spots, blights, anthracnose, downy mildews and cankers. It also acts as a repellent to many insects and is labeled for use on many vegetable, tree fruit, and nut crops.

Bordeaux, as with sulfur and lime sulfur, also can be phytotoxic to plants. It may cause burning of leaves or russeting of fruit when applied in cool, wet weather. The LD50 is 472 mg/kg.

Other (Synthetic) Alternatives

Horticultural oils are highly refined so that compounds toxic to plants are removed. Considered effective and safe, they can be used to control insects as well as diseases. The types of oils available for pest control include dormant oils and summer oils.

Dormant oils are used during the winter season when plants are dormant to control overwintering stages of insects such as aphids, spider mites and scales. An oil applied during the dormant period will suffocate the overwintering eggs of aphids and spider mites, or suffocate the adult, in the case of scales.

Summer oils are a lighter version of the dormant kind and can be applied to actively growing plants. In terms of insect control, summer oils can be used to control aphids, mites, thrips, scales, mealybugs - and their eggs.

The use of oils to control fungal diseases is on the rise. Research currently is being conducted on the use of oils to control powdery mildew and rust diseases on a variety of ornamentals (including roses).

Oil phytotoxicity (damage to a plant) can occur if the product is not used properly. Plant damage can occur when: 1) too much is used; 2) plants are under water stress; 3) temperatures are over 90 F; and 4) when dormancy is mistaken (i.e. spraying too early in the fall). Wait until December to February to apply dormant oils. Temperatures must be above 45 F. The LD50 of oil is 5,000 mg/kg.

Soaps have been used for 200 years or more and are effective against soft-bodied insects such as aphids, some scales, psyllids, whiteflies, thrips, mealybugs, and spider mites. How soaps kill insects is poorly understood. It is thought that they work by removing the protective oils and waxy covering of the insect. They are strictly contact insecticides and must be applied directly to the insect to be effective.

Certain plants may be sensitive to soaps resulting in leaf burn. To avoid phytotoxicity, always test a soap spray on a small area of the plant first. Soaps can be purchased commercially or you can make your own by mixing 3 to 6

tablespoons of dishwashing liquid with 1 gallon of water. Commercially produced insecticidal soaps have an LD50 of 16,900 mg/kg. For more information refer to 5.547, *Insect control: soaps and detergents*.

Baking Soda (sodium bicarbonate) has been found to have fungicidal properties. Researchers at Cornell University discovered that a combination of baking soda and Sunspray horticultural oil applied to rose leaves infected with powdery mildew or black spot will significantly reduce the incidence of disease. Timing and rates of baking soda application are important as leaf burning can occur if the level of sodium bicarbonate is too high. No phytotoxicity occurs on roses with rates as low as 1 percent sodium bicarbonate (1 Tbl. baking soda + 2.5 Tbl. Sunspray horticultural oil in 1 gallon of water) but experiments are still being conducted on timing of applications. In spite of the fact that you can buy baking soda in the grocery store, it will be awhile before the chemical is legally registered for use as a fungicide. Until that time, Colorado State University cannot legally recommend the use of this chemical for disease control purposes. Applications must be treated as experimental upon the part of the user.

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Other

Diatomaceous Earth (DE) is a non-toxic insecticide mined from the fossilized silica shell remains of diatoms. Diatoms are single celled or colonial algae in the class Bacillarophyceae.

DE absorbs the waxy layer on the surface of insect skins, causing the insect to desiccate. It also can work as an abrasive, rupturing cuticle cells. The product is labeled to control slugs, grasshoppers, millipedes, and sow bugs as well as soft bodied insects such as aphids.

DE is formulated as a dust, either alone or in combination with pyrethrin. With a low mammalian toxicity, the LD50 ranges from 3,160 to 8,000 mg/kg depending on the formulation.

Another grade of DE is used as a filtering agent in swimming pools. Both swimming-pool grade and natural types of DE come from the same source but are processed differently. It is imperative that only the "natural" grades be used for insect control.

The concept behind an integrated pest management program (IPM) is to incorporate many different tools to control pests, not to rely on just one product or method. All the pesticides described above, whether old or new, should be included in integrated control programs whenever possible.

ALWAYS READ AND FOLLOW THE LABEL CAREFULLY.

Remember, the products mentioned above are still pesticides, even though they are natural, and should not be used indiscriminately, but with care and certain precautions.

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