



SOUTH CAROLINA FAMILY AND COMMUNITY LEADERS

Affiliated with National Volunteer Outreach Network, Country Women's Council, U.S.A., Associated Country Women of the World and in partnership with Clemson University Cooperative Extension Service
SCFCL website: <http://www.scfcl.com>

Leader Training Guide

Less Toxic Insecticides

Objective: Audience will become familiar with ways to eliminate pests using less toxic insecticides.

Lesson Overview/Introduction:

Insecticides are pesticides which kill insects or affect their feeding, growth or behavior. Many are less toxic for several reasons. They pose less risk to human and environmental health than conventional insecticides. They break down rapidly and not accumulate in the body or environment. Some are very pest specific and do little or no damage to other organisms. Others, such as bait stations, minimize human exposure.

Lesson:

Soaps & Oils: Insecticidal soaps and oils lack toxicity to humans, other mammals and beneficial insects. They control common soft-bodied pests including aphids, mealybugs, thrips, whiteflies, mites, and scales. It is difficult for pests to develop resistance to them. They are readily available and relatively inexpensive. Both soaps and oils can damage plants if they are applied when plants are water stressed, when temperatures are above 90 °F, or if high humidity prevents rapid drying. Some plants are sensitive to oil sprays. Read and follow the label. Soaps and oils work on contact. An effective application must coat upper and lower leaf surfaces and stems and may require repeated applications.

Soaps: Insecticidal soaps damage and dehydrate the protective coats of soft-bodied insects. Do not use homemade soap recipes because they may cause foliage burn. Commercial insecticidal soaps have been tested on plants and are less likely to cause damage. Some common products are Safer Insecticidal Soap and M-Pede.

Horticultural Oils: Oil products smother soft bodied insects and are classified as summer oils or dormant oils. Dormant oils are heavier and are used on dormant plants to control overwintering insects (e.g., aphids, spider mites, and scales). Dormant oils damage plants if used during the growing season. Summer oils are lighter and more refined and can be applied to both actively growing and dormant plants. Do not apply summer oils when the temperature is above 90°F. Some readily available summer weight horticultural oils include Ortho Volck Oil Spray, Sunspray, Control Solutions Ultra Fine Oil, Green Light Horticultural Oil and Ferti-Lome Dormant Oil Spray.

Botanical Insecticides: Botanical insecticides are naturally occurring toxins from plants. Plant derived insecticides breakdown quickly in the environment, resulting in little risk of residues on food crops and less risk to beneficial insects. Some can be used shortly before harvest. Most botanicals are rapid acting and most, but not all botanicals are of low to moderate toxicity to mammals. Because most botanical insecticides must be eaten by the insect pest, they are primarily harmful to these pests and do little harm to beneficial insects. Disadvantages include rapid break down, which may create a need for precise timing or more frequent applications. Several botanical insecticides are quite toxic and should be handled accordingly. Some botanical insecticides can be difficult to find in local stores.

Neem is a relatively new botanical insecticide made from neem tree seed extracts. It is used to control many insects including leafminers, whiteflies, thrips, caterpillars, aphids, mealybugs, spider mites, scale crawlers, and beetles. It is most effective against actively growing immature insects. The active ingredient in neem has very low mammalian toxicity. Neem does not produce a quick kill, but stops insect feeding. The treated insect usually cannot molt and dies without reproducing. Commercial neem products include Azatin XL,

Neemix, SouthernAg Triple Action Neem Oil and Safer BioNeem. These products are labeled for use on ornamentals, foliage plants, trees, shrubs and food crops. Many are effective for controlling powdery mildew.

Limonene is produced from citrus oils extracted from citrus fruit peels. It is a contact insecticide against ants, cockroaches, palmetto bugs (smoky brown cockroach), fleas, silverfish and many other insects. Limonene has low oral and dermal toxicity to mammals, birds and fish, but can cause skin irritation in some people. Pesticide products containing limonene are used for flea and tick control on pets, insecticide sprays, outdoor dog and cat repellents, mosquito larvicides, and insect repellents. Many limonene-containing products are safe for use in areas near food. Limonene is the active ingredient in Ortho Home Defense Indoor Insect Killer, Concern Citrus Home Pest Control, Safer Fire Ant Killer, Citrex Fire Ant Killer and products made by Orange Guard.

Capsaicin makes chili peppers hot. It can be used on ornamentals outdoors and indoors for control of aphids, spider mites, thrips, whitefly, lace bugs, leafhoppers, and other pests. Capsaicin containing products primarily are used to repel insects, not to kill them. Products containing capsaicin include Hot Pepper Wax Insect Repellent and Bonide Hot Pepper Wax.

Pyrethrum is made from the finely powdered flowers of a species of chrysanthemum. The word "pyrethrum" is the name for the flower dust; the term "pyrethrins" refers to the insecticidal compounds extracted from pyrethrum. Pyrethroids are synthetic pesticides that are very similar in structure to the pyrethrins. Pyrethrum is a contact insecticide and must be applied directly to insects. Pyrethrum rapidly paralyzes pests but may not kill them. Pyrethrum and pyrethrins are often formulated with another insecticide to ensure that paralyzed insects do not recover. Because pyrethrum has low toxicity to mammals it can be applied to food crops close to harvest. Pyrethrum has high contact toxicity for common beneficial insects. Pyrethrum and pyrethrins are marketed under several trade names including Concern Multi-Purpose Insect Killer and Natural Guard Natural Insect Spray.

Garlic is marketed in several products intended to repel insects. Products repel a wide variety of pests on ornamental plants but may also repel beneficial insects. Products containing garlic or garlic oil include Garlic Barrier and Mosquito Barrier.

Rotenone is one of the most toxic of the commonly-used botanical insecticides. Rotenone is a nervous system poison, is highly toxic to fish and aquatic life, can be toxic to mammals through inhalation and may cause skin irritation. Rotenone will also kill many beneficial insects and should only be used to control severe insect infestations. In most cases, other, safer pesticides should be used instead of rotenone.

Essential Oils:

Pesticides based on essential oils are available. Essential oils are volatile, highly concentrated substances extracted from plants. In 1996 the EPA ruled that certain ingredients posing minimum risk to users no longer require EPA approval to be marketed as insecticides. Many are essential oils and include oils of cedar, cinnamon, citronella, citrus, clove, eugenol, garlic, mints, rosemary, and several others. They work as contact killing agents only, so re-treatment may be needed. Most pesticidal essential oils work by disrupting insect nerve transmission and thus do not affect people, pets, or other vertebrates.

Eugenol, a component of clove oil, is a fast acting contact insecticide effective against many household pests such as cockroaches, ants, dust mites, flies, wasps, spiders, crickets, and fleas. It is also used on some ornamental plant pests such as armyworms, thrips, aphids and mites. Eugenol has little or no residual activity, although the scent of cloves will linger. Products based on eugenol are considered minimum risk pesticides with very low risk of damage to the environment or user. Products that contain eugenol include Bioganic Brand's Flying Insect Killer and Bioganic Lawn and Garden Spray.

Microbial Insecticides: Microbial insecticides contain microorganisms (bacteria, fungi, protozoa, or nematodes) or their by-products. Microbial insecticides are especially valuable because their toxicity to nontarget animals and humans is extremely low.

Insecticidal products comprised of a single species of microorganism may be active against a wide variety of insects or group of related insects (such as caterpillars) or against one or a few species. Most are very specific. Since they kill such a narrow range of insects killed, they spare beneficial insects entirely.

Bacillus thuringiensis products are the most widely used microbial insecticides in the United States. They are commonly known as *Bt*. Different subspecies of *Bt* are effective against different groups of insects or their larvae.

You will achieve the best results with *Bt* products by following a few guidelines.

- Make sure the *Bt* product you have chosen lists the specific insect you want to control.
- Make sure the insect is at a stage where it is susceptible to control by *Bt*. Most *Bt* products are effective against young larval stages but will not kill adults.
- Thoroughly spray plant parts on which insects are feeding; include the underside of leaves.
- *Bt* products must be eaten in order to be effective.
- Treat with *Bt* in late afternoon or evening, or on a cloudy day as *Bt* breaks down in sunlight.
- *Bt* does not kill immediately, but poisoned insects will stop feeding almost immediately.

***Bacillus thuringiensis var. kurstaki* (*Btk*)** products are toxic to larvae of butterflies and moths and are used to control many common leaf-feeding caterpillars, including caterpillar pests on vegetables, bagworms and tent caterpillars on trees and shrubs, and European corn borer larvae. *Bacillus thuringiensis var. kurstaki* products include Dipel, Javelin, Thuricide, Safer Caterpillar Killer, and several others.

***Bacillus thuringiensis var. israelensis* (*Bti*)** formulations kill mosquito, black fly, and fungus gnat larvae. *Bti* is most effective for mosquito or black fly control when it is used community-wide. For most homeowners, eliminating standing water sources is more effective than applying *Bti* or other insecticides. Floating products sold as dunks or pellets can eliminate mosquito larvae in ornamental ponds and other areas that cannot be drained. Commercially available *Bti* products include Mosquito Dunks, Vectobac, Teknar, and Bactimos.

***Bacillus thuringiensis var. tenebrionis* (*Btt*)** products are used to control Colorado potato beetle and elm leaf beetle adults and larvae. They are not toxic to some other key beetle pests. Bonide Colorado Potato Beetle Beater, and Novodor are products containing *Btt*.

Milky Spore products contain *Bacillus popillae* and *Bacillus lentimorbus*. They are applied to turf and watered into the soil below to control the larval (grub) stage of the Japanese beetle and, less effectively, some other beetle grubs.

Spinosad is an insect toxin derived from a soil-dwelling bacterium. It kills primarily by ingestion and is used against fire ants, caterpillars, thrips, whiteflies, aphids, leaf miners, scales, plant bugs and fruit tree borers. This product poses less risk than most insecticides to mammals, birds, fish, and beneficial insects. It is toxic to bees, and should not be applied to flowering plants. Affected pests stop feeding within minutes but may remain on the plant for up to two days. Ferti-lome Borer, Bagworm, Leafminer & Tent Caterpillar Spray contains spinosad. Fire ant baits formulated with spinosad include Conserve Fire Ant Bait, Justice, Payback Spinosad Fire Ant Bait and Eliminator Fire Ant Killer Bait.

Beneficial Nematodes Nematodes are microscopic, worm-like parasites. Some nematodes are pests of turf grass and other plants but others are beneficial and are parasites of harmful insects. Beneficial nematodes cannot develop in vertebrate animals and are very safe for use in pest control. Beneficial nematodes can be used to control a variety of plant pests, including larvae of black vine weevil, clearwing borers, cutworms, sod webworms, mole crickets and white grubs. It is important to select the proper nematode species when trying to control a particular pest. Nematodes can be difficult to use for most home gardeners. They must be shipped, stored and used under specific temperature and moisture conditions, and generally must be used very soon after shipping. They are best ordered from suppliers immediately after a pest problem is observed. A number of nematode products are available by mail order. Be sure the product you are ordering is specified for the pest you have and that you are able to provide proper environmental conditions for the nematodes. In general, nematodes require moist conditions, high humidity, and temperatures between 55 and 90°F with little direct sunlight.

Minerals:

Diatomaceous Earth is a nontoxic powder composed of fossilized, one-celled organisms called diatoms. It is used to control slugs, millipedes, sow bugs, cockroaches, ants and soft-bodied insects like aphids. It has low mammalian toxicity. Use the "natural grade," not the type used as a filtering agent in swimming pools. Prolonged exposure to diatomaceous earth irritate lungs and other tissues of people or pets. It kills honeybees so avoid applying the product to flowering crops. Commercial products include Concern Diatomaceous Earth and Natural Guard Diatomaceous Earth.

Kaolin Clay products act as a barrier that irritates insects and disguises the host plant by coating it with a ghostly white film. It is used against a various pests on apple and pear trees. It can be used to control Japanese beetles, tarnished plant bugs, thrips, leafhoppers, cucumber beetles and Colorado potato beetles on vegetable crops. Kaolin must be applied as a preventive to be effective and cannot control a pest that is already established. Kaolin clay can be applied up to the day of harvest and is non-toxic. Kaolin is sold as Surround Crop Protectant.

Sodium Fluoaluminate is a mineral that forms sharp, glass-like particles that puncture insect gut cells if ingested. It only affects insects that have eaten treated leaves and does not hurt beneficial predators and parasites. It is effectively used against leaf feeding caterpillars, sawflies and beetles. Sodium fluoaluminate is sold as Kryocide.

Boric Acid acts as a stomach poison and causes insects to die from starvation. Boric acid is available in powder, paste, aerosol, tablet, and liquid forms for use against cockroaches, ants, and other insects. Most boric acid products are available as ready-to-use products. Boric acid is sold under a number of brand names, including Roach Prufe, Terro Ant Killer II and Borid.

Silica Gel is an inert, nonabrasive material that is effective in absorbing moisture. It absorbs the waxy coating on the insect's body and causes death by dehydration. Silica gel products are often used by professional pest control operators to control cockroaches, silverfish, and other pests.

Sulfur is probably the oldest known pesticide in current use. It can be used as a dust, wettable powder, paste or liquid, and is primarily for disease control. However, mites, psyllids and thrips are also controlled by sulfur. Sulfur is nontoxic to mammals, but may irritate skin or especially eyes. Sulfur is also used as a fungicide to control powdery mildew, rusts, brown rot and leaf spots on fruits, vegetables and ornamentals. Sulfur has the potential to damage plants in hot, dry weather. It is also incompatible with other pesticides. Do not use sulfur within 20 to 30 days of applying spray oils to plants as it reacts with the oils and is more likely to cause damage to foliage. Do not apply sulfur when temperatures are above 80°F.

Insect Growth Regulators (IGRs)

Insect growth regulators (IGRs) are chemicals related to insect juvenile hormone. They interfere with egg development and molting of various immature insect life stages. They have little to no effect on adult insects. Because of their mode of action, they are very safe for vertebrate animals. IGRs are among the safest pesticides for application in homes. They are primarily used in homes for flea control. More information is available in [EISS/HS-2](#), [Flea Control](#). Two commonly available IGRs are methoprene (Precor) and pyriproxyfen (Nylar).

Safer Insecticide Formulations

Bait Stations deliver an insecticide through a sealed plastic or metal chamber that insects enter. This gives bait stations the advantage of decreasing both the amount of insecticide used and the likelihood of exposure to it. Bait stations are particularly suitable for use in situations where the safety of children is a concern, or in areas where food is prepared or stored. Numerous brands of bait stations are commonly available to control cockroaches and ants.

Pesticide Safety

Always read the pesticide label and follow its directions exactly. Use the pesticide **only** on sites or crops or commodities listed on the label. Observe all special precautions listed on the label. Wear protective clothing or equipment as listed on the label when mixing and applying pesticides. Mix pesticides at the rate recommended for the target site as listed on the label. Never use more than the label says. Follow all label directions for safe pesticide storage and disposal. Always remember to read and heed the six most important words on the label: "**KEEP OUT OF REACH OF CHILDREN.**"

Unwanted Pesticides

Unused and unwanted pesticides should be disposed of by wrapping in paper and placing in the trash.

Lesson Summary:

Multiple less toxic insecticides are available for use. Always read the pesticide label and follow its directions exactly.

Suggested Activities:

1. Insecticide Reporting

Write one insecticide on a notecard or piece of paper. Participants will draw one card from a basket. Allow time for each person to list examples of applications, cautions and products for each insecticide and report to the group. If the group is large, they can work in teams to report back to the group.

2. Fill in the Blank

The leader can review the lesson by repeating a detail about an insecticide and leaving out key words which the group will fill in. For example, the leader might say "The most widely used microbial insecticides in the United States are commonly known as ____." Group fills in with the word "Bt".

Suggested Materials:

Bring samples of products for display.

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Sources/References:

Summarized from HGIC 2770. Less Toxic Insecticides. Prepared by Karen Russ, HGIC Information Specialist, Clemson University. (New 08/05.) *This information is supplied with the understanding that no discrimination is intended and no endorsement by the Clemson University Cooperative Extension Service is implied. All recommendations are for South Carolina conditions and may not apply to other areas. Use pesticides only according to the directions on the label. All recommendations for pesticide use are for South Carolina only and were legal at the time of publication, but the status of registration and use patterns are subject to change by action of state and federal regulatory agencies. Follow all directions, precautions and restrictions that are listed.*