

FOR INSECT AND DISEASE CONTROL

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This guide was developed as a quick reference to materials which are acceptable for use in organic vegetable gardens and landscapes.

GENERAL INFORMATION ABOUT PESTICIDES ACCEPTABLE FOR USE IN ORGANIC GARDENS

- All products in this guide are registered by the EPA. They are “approved” for use in organic gardens by promoters of organic techniques such as Rodale Press. The catalogues that sell these products advertise as being all organic. No efficacy guarantees are given. It is assumed that the grower who chooses to use organic techniques realizes that organic pesticides are just one small component of a program that emphasizes plant health as the best pest control. Materials such as baking soda (sodium bicarbonate), liquid dish soaps, sugar, and so forth, are not registered pesticides and so cannot be recommended by the University of Georgia Cooperative Extension Service.
- Products called “Garden Spray” or other generic terms generally include pyrethrins, copper, and sulfur. They are labeled for control of insects and diseases. “Garden Dusts” are similar and generally include copper, sulfur, and/or some sort of insecticide such as rotenone. These control insects & disease as well.
- **Azadirachtin** is a compound extracted from the **neem** tree (*Azadirachta indica*). It is a broad-spectrum pesticide, acting as a repellent, growth regulator, and a poison. Neem oil also has insecticidal properties. These materials control aphids, leafminers, looper caterpillars, mealybugs, thrips, whiteflies, foliar-feeding beetles, and mites.
- **Bacillus thuringiensis** (commonly called “B.t.”) is bacterial pesticide. Different strains of the bacteria control different pests. B.t. var kurstaki (also known as: B.t. var berliner) infect lepidopterous (caterpillars) pests and beetle larvae; B.t. var san diego infects beetle larvae; B.t. var israelensis infects fly larvae, including mosquitos; B.t. var tenebrionis infects Colorado potato beetle and elm leaf beetle larvae. *B. popillae* and *B. lentimorbus* infect Japanese beetle grubs in the soil. Bacterial pesticides are most effective against early instar larvae. Older caterpillars, beetle larvae, etc., are more tolerant of the bacteria. B.t. must be ingested by the insect in order to infect, therefore apply only when pests are feeding actively. Once applied, B.t. products do not last long in the environment; reapplication may be necessary.
- **Bordeaux mix** is a combination of copper sulfate and hydrated lime. It can be applied as a dust or mixed with water as a wettable powder to control foliar diseases. It also has insecticidal properties. The material is best applied just before leaves flush out in spring. Burning can occur at temperatures below 50° F and when humidity is high.
- **Chitin** is an organic amendment made from chitin extracted from shellfish waste, soybean meal, and urea. It works by increasing the soil composition of microorganisms that feed on chitin. Chitin is one of the primary components of the body wall of nematodes. To be effective, a large amount of product is necessary. Available as Hi-Yield Nem-A-Cide Nematode Control and Clandosan at your local retail locations. This product is NOT recommended for use on FRUIT TREES, USE ON LAWNS, TREES, and VEGETABLES. A single annual application is sufficient for control.
- **Copper** is an inorganic material used to control a variety of fungal and bacterial diseases on foliage. Apply when weather conditions will allow plants to dry quickly. Copper is toxic to fish and aquatic invertebrates. Apply as a preventive spray only. Repeated applications can cause stunting; copper is a heavy metal which doesn’t break down in soil over time.
- **Cryolite** is an inorganic formulation of sodium fluoaluminate. (Note: Inorganic simply means that the material does not contain carbon.) It can help suppress caterpillars and beetles. The material is toxic to fish.
- **Diatomaceous earth** is another inorganic material. It is composed of the crushed exoskeletons of microscopic marine organisms--diatoms. The microscopic particles are abrasive and scratch the surfaces of insects, slugs, and mites, causing the pest organism to desiccate. It is recommended that a mask be worn when applying this material; inhaling the material can be hazardous to your health.
- **Growth regulators** disrupt the maturation process of insects. Commercially available products usually are synthetic versions of insect hormones. Methoprene is one familiar, and effective, growth regulator used to control fleas. Kinoprene (Enstar) is used for whitefly control.
- **Horticultural oils** are hydrocarbons (petroleum-based compounds). At a 1% rate, phytotoxicity is rare. The material can be used to help control mites, aphids, scale insects, and other soft-bodied pests. Horticultural oils are contact pesticides. They work by coating the pest, suffocating it by blocking the openings through which the insect or mite takes in air. Thorough coverage of the affected plant or plant part is necessary to assure that pests are in contact with the oil. Depending on population levels and weather conditions, oils may need to be reapplied regularly. Application of horticultural oils when temperatures are high (above 85-90° F) and/or humidity is low may cause leaf scorch and interfere with plant respiration. Apply these products at cooler times of day when the sun isn’t shining directly on the foliage; water plants a few hours prior to oil application--this means soaking the soil deeply, not wetting the foliage. Dormant oils are applied only when plants are not actively growing--usually in late winter. Do not combine oils with sulfur. Check label before combining oils with other pesticides. Plants susceptible to injury from horticultural oils include: sugar and Japanese maples, beech, hickory, walnut, blue spruce and certain other conifers, ferns, palms, African violets, some cacti and succulents.
- **Insecticidal soaps** are contact insecticides specially formulated not to strip plant surfaces of their protective wax coating. Insecticidal soaps can control mites and soft-bodied insects like aphids and other sap-feeders. Like horticultural oils, thorough coverage of the plant is necessary to ensure contact with the pest(s) and reapplication may be necessary depending on weather conditions.
- **Sulfur** is an inorganic element that can help control mites, and is frequently used to prevent foliar diseases. Do not apply to plants that have been treated with oil within the last 4 weeks. Don’t apply at temperatures above 80° F. Corrosive to metal: use sprayer with plastic parts.
- **Lime and lime-sulfur** are inorganic compounds that help control mites, psyllas, and some sap-feeding insects. These materials also are used for foliar disease control. To avoid phytotoxicity, do not apply within 2-4 weeks after using horticultural oil. Don’t apply at temperatures over 85° F. Caustic material.

ORGANIC PESTICIDE GUIDE (continued)

- **d-Limonene** (commonly sold as Orange guard) is the major component of the oil extracted from citrus rind. It destroys the wax coating of the insect's respiratory system. When applied directly, the insect suffocates. Orange Guard is a water-based insecticide. Orange Guard is 100% biodegradable and water-soluble. The EPA calls d-Limonene a broad-based insecticide. It can be used for aphids, ants, mealybugs, gnats, ants, silverfish, roaches, fleas. Do not spray when plants are under stress. Avoid spraying in direct sunlight or the heat of the day. Avoid spraying flowers or flower parts.
- **Pheromones** are compounds that act as chemical signals between like organisms. Some have been synthesized by man and are used mostly as attractants to monitor insect emergence. Saturation in a small area can confuse the target organism and disrupt mating.
- **Pyrethrum** is the dried flower heads of pyrethrum daisies. The material has broad-spectrum use, controlling flying pests, aphids, beetles, caterpillars, thrips, and mealybugs.
- **Pyrethins** are extracted compounds from **pyrethrum** daisies. **Pyrethroids** are synthetic pyrethrins that are more toxic to insects than either pyrethrum or pyrethrins. Pyrethroids may not be used for organic production.
- **Rotenone** also is a plant derivative (a botanical pesticide). It acts as a contact insecticide, as well as a stomach poison. Rotenone is a slow-acting control for beetles, weevils, slugs, looper caterpillars, mosquitoes, thrips, flies, and mites. It is most effective against pests with chewing mouthparts, like beetles, although early instar caterpillars, which also are foliar feeders, are less affected than older caterpillars. Rotenone is short-lived in the environment and frequently available in formulations containing pyrethrins (synthetic versions of pyrethrum). Rotenone is not toxic to honeybees. Rotenone is no longer sold as an insecticide, but on-hand supplies may be used.
- **Ryania** is a plant derivative frequently found in combination with pyrethrin and rotenone. It can help control codling moth, thrips, and European corn borer. It is toxic to fish and other aquatic life, as well as mammals. Protective clothing should be worn when applying this material since exposure can be hazardous to your health.
- **Sabadilla**, a plant derivative, is available as a dust or wettable powder. It acts as a contact insecticide, as well as a stomach poison. Sabadilla can be used to control sap-feeding insects, caterpillars, and thrips. It is toxic to honeybees.
- **Streptomycin** and **terramycin** are fungally-derived antibiotics. They are used to control bacterial diseases of plants.

You can find more information at www.ams.usda.gov/nop

APPLE & PEAR Organic Pesticide Guide for Disease and Insect Control

Note: Various products simply called "garden spray" are labeled for organic control of insects & diseases on apples & pears. These are not included in the table below. See General Notes for information regarding specific materials.

Insect or Disease	Pesticide	Remarks & Precautions
Insect & mite eggs	ultra-fine horticultural oil	Dormant or delayed dormant to ½" green
Aphids	insecticidal soap pyrethrin sprays	24 hr. pre-harvest interval
Beetles	sabadilla WP or dust pyrethrin sprays	Dust: apply to wet plants 24 hr. pre-harvest interval
Bitter rot, Black rot, Powdery mildew	copper (Cu) spray or dust	Dust - cover with a thin film on both sides of foliage spray - mix 1 tsp/1 qt of water
Bugs (Hemiptera: stink bugs, etc.) adults and immatures (nymphs)	sabadilla WP or dust	WP: re-apply every 5-7 days & after rain; Dust: apply to wet plants
Immatures (nymphs):	pyrethrin or ryania (packaged separately or combined) insecticidal soap ultra-fine horticultural oil	24 hr. pre-harvest interval See General Notes caution
Caterpillars	B.t. var. berliner or kurstaki pyrethrin or ryania	Apply only when insects are feeding.
Codling moth	ryania B.t. var. kurstaki	Apply at 10-14 day intervals; 1st application at petal fall. 24 hr. pre-harvest interval. Effective only when insects are actively feeding
Fire blight	streptomycin sulfate Bordeaux mix	Apply at bloom; every 3-4 days during bloom; every 5-7 days after bloom until fruit is visible Can burn foliage at temperatures below 50° F & when humidity is high; apply before bud break

ORGANIC PESTICIDE GUIDE (continued)

Insect or Disease	Pesticide	Remarks & Precautions
Exposed thrips	pyrethrins spray	24 hr. pre-harvest interval
Fruit tree leaf roller	ultra-fine horticultural oil B.t. var. kurstaki	See General Notes caution Apply when insects are actively feeding
Leafhoppers	pyrethrin/ryania (packaged separately or combined)	
Mites	ultra-fine horticultural oil pyrethrins spray insecticidal soap	Summer or post-harvest 24 hr. pre-harvest interval 2 applications @ 7 day intervals
Pear psylla	ultra-fine horticultural oil	Do not apply after waxy bloom forms on fruit.
Scale insects	ultra-fine horticultural oil	Target crawler stage.

**PEACH & NECTARINE
Organic Pesticide Guide for Disease and Insect Control**

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Insect or Disease	Pesticide	Remarks & Precautions
Insect & mite eggs	ultra-fine horticultural oil	Dormant or delayed-dormant spray.
Aphids	insecticidal soap pyrethrin spray	24 hr. pre-harvest interval
Beetles	pyrethrin sprays	24 hr. pre-harvest interval
True bugs (Hemiptera)	sabadilla (to control adults) ultra-fine horticultural oil insecticidal soap	See General Notes caution.
Caterpillars	B.t. var. kurstaki	Apply when insects are feeding.
Peach leaf curl	Bordeaux mix	Can burn plants when temperatures are below 50° F and humidity is high.
Leaf curl, shot hole, blossom brown rot	liquid copper	7-10 tsp/gal water; DO NOT apply after pink bud
Peach twig borer	ultra-fine horticultural oil	See General Notes caution
Scale insects (adult) (immatures)	ultra-fine horticultural oil insecticidal soap	Summer or post-harvest application Target crawler stage.

**SMALL FRUITS (Blueberry, Grape, Strawberry)
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Insect or Disease	Pesticide	Remarks & Precautions
Aphids	ultra-fine horticultural oil insecticidal soap pyrethrins spray	See General Notes caution. 24 hr. pre-harvest interval
Caterpillars	B.t. var kurstaki	Apply when insects are feeding

ORGANIC PESTICIDE GUIDE (continued)

Insect or Disease	Pesticide	Remarks & Precautions
Downy mildew & black rot-grapes strawberry	Copper (liquid, spray, or dust)	Some vinifera & French hybrid varieties may be sensitive to copper-make a test application to a few leaves
Fruit worms	B.t. var kurstaki pyrethrins spray	Apply when insects are feeding 24 hr. pre-harvest interval
Mealybugs	ultra-fine horticultural oil	Dormant spray. See General Notes caution
Mites	ultra-fine horticultural oil	Foliar spray- see General Notes caution
Scale insects	ultra-fine horticultural oil	Dormant spray- see General Notes caution
Strawberry leafroller	B.t. var kurstaki pyrethrins spray	Apply when insects are feeding 24 hr. pre-harvest interval
Thrips	ultra-fine horticultural oil	Foliar spray. See General Notes caution.

VEGETABLES

Organic Pesticide Guide for Diseases and Insect Control

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Insect or Disease	Pesticide	Remarks & Precautions
Aphids	ultra-fine horticultural oil insecticidal soap pyrethrins spray sabadilla dust or WP	See General Notes cautions 24 hr. pre-harvest interval Dust: apply to wet plants
Bacterial blight (bean, tomato, pepper)	Copper (liquid, dust, or spray)	Preventive spray- apply 2 weeks before disease usually appears. Repeat every 7-10 days.
Bacterial wilt: Control insects like cucumber beetles which transmit the bacteria	see beetle controls below	
Beetles: larvae adults (bean, Japanese, tortoise, etc.) Japanese beetles Cucumber & flea beetles weevils Colorado potato beetle larvae	ultra-fine horticultural oil pyrethrins spray sabadilla dust or WP B.t. var kurstaki B. popillae or lentimorbus pyrethrins spray B.t. var san diego or kurstaki	See General Notes caution 24 hr. pre-harvest interval Dust: apply to wet plants Apply when insects are feeding Causes milky spore disease in Japanese beetles 24 hr. pre-harvest interval repeat applications every 5-7 days to treat later-hatching larvae.
Black leg (potato)	streptomycin sulfate 21.2 WP	Soak cut seed pieces for 30 min & plant
True bugs (Hemiptera- incl. stink bugs, lygus bugs, etc.)	pyrethrins spray sabadilla dust or WP insecticidal soap	24 hr. pre-harvest interval Dust: apply to wet plants
Caterpillars	ultra-fine horticultural oil pyrethrins spray B.t. var kurstaki sabadilla dust or WP	See General Notes caution 24 hr. pre-harvest interval Apply when insects are feeding Dust: apply to wet plants
Cercospora leafspot- peanuts, vegetables	copper fungicide (liquid, dust, or spray)	Preventive- apply 2 weeks before disease usually appears. Repeat every 14 days.
Downy mildew: beans, beets, collards, cucumbers, lettuce, onions, peas, spinach, turnips	copper sprays or dusts	1st application when disease appears. Repeat @ 7-10 d intervals. 24 hr. pre-harvest interval.

ORGANIC PESTICIDE GUIDE (continued)

Insect or Disease	Pesticide	Remarks & Precautions
Early blight (<i>Alternaria</i> sp.) & Late blight (<i>Phytophthora infestans</i>): tomato, potato	Copper (liquid)	Preventive- apply 2 weeks before disease usually appears. Reapply every 7-10 days
Leafhoppers	ultra-fine horticultural oil sabadilla dust or WP	See General Notes caution Dust: apply to wet plants
Leafminers	ultra-fine horticultural oil sabadilla dust or WP	See General Notes caution Dust: apply to wet plants
Leafspots (incl. anthracnose)	sulfur Top Cop w/ Sulfur	1st application when disease appears. Repeat @ 7-14 d intervals.
Mites	ultra-fine horticultural oil	See General Notes caution
Powdery mildew	liquid copper sulfur- spray or dust	1st application when disease appears & repeat @ 7-10 d intervals until signs disappear.
Rust: beans, peas, spinach	sulfur- spray or dust	1st application during early bloom
Stem anthracnose (bean)	Copper	1st application @ early bloom or when disease is evident. 1st application when plants are 5" tall. Repeat at 5-7 d intervals.
Thrips	ultra-fine horticultural oil pyrethrins spray	See General Notes caution 24 hr. pre-harvest interval
Whitefly	ultra-fine horticultural oil	See General Notes caution

WOODY ORNAMENTALS

Organic Pesticide Guide for Disease and Insect Control

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Insect or Disease	Pesticide	Remarks & Precautions
Adelgids	ultra-fine horticultural oil d-Limonene	See General Notes caution See General Notes caution
Aphids	ultra-fine horticultural oil pyrethrins spray sabadilla dust or WP neem oil or extract products Enstar (kinoprene) growth regulator d-Limonene	See General Notes caution Dust: apply to wet plants Do not use on hibiscus flowers, on new foliage, or in direct sunlight See General Notes caution
Bacterial wilts, galls	streptomycin sulfate spray	
Leaf beetles: adults Immatures	sabadilla dust or WP pyrethrins: dust or spray neem extract or oil products ultra-fine horticultural oil B.t. var san diego ultra-fine horticultural oil pyrethrin spray	Dust: apply to wet plants Apply when insects are feeding
Black spot	Bordeaux mix pyrethrins: dust or spray Rose Defense (neem oil)	Can burn plants when applied at temperatures below 50° F and humidity is high.
True bugs (Hemiptera)	ultra-fine horticultural oil pyrethrins sabadilla dust or WP	See General Notes caution Dust: apply to wet plants

ORGANIC PESTICIDE GUIDE (continued)

Insect or Disease	Pesticide	Remarks & Precautions
Caterpillars	ultra-fine horticultural oil B.t. var kurstaki neem extract (azadirachtin)	See General Notes caution Apply when insects are feeding
Eriophyid mites	ultra-fine horticultural oil	See General Notes caution
Lace bug	ultra-fine horticultural oil pyrethrins spray neem extract (azadirachtin) d-Limonene	See General Notes caution. Apply materials to underside of leaves. See General Notes caution
Leafminer	ultra-fine horticultural oil neem extract (azadirachtin)	See General Notes caution
Leaf spots	copper spray or dust Bordeaux mix lime-sulfur	See under Black Spot, above See General Notes caution
Mealybugs	ultra-fine horticultural oil neem extract (azadirachtin) Enstar (kinoprene) d-Limonene	See General Notes caution See under Aphids, above See General Notes caution
Powdery mildew	pyrethrins: dust or spray Bordeaux mix lime-sulfur	see under Black Spot, above Apply at bud break & 7 d later. See General Notes caution.
Rust	pyrethrins: spray or dust	
Scale insects	ultra-fine horticultural oil Enstar (kinoprene) insecticidal soap d-Limonene	See General Notes caution See General Notes caution
Spider mites	ultra-fine horticultural oil Rose Defense (neem oil)	See General Notes caution
Thrips	neem extract (azadirachtin)	
Whitefly	insecticidal soap ultra-fine horticultural oil pyrethrins spray neem extract (azadirachtin) d-Limonene	Repeat applications necessary to control heavy populations See General Notes caution See General Notes caution

HERBACEOUS ORNAMENTALS (not including houseplants)
Organic Pesticide Guide for Disease and Insect Control

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Insect or Disease	Pesticide	Remarks & Precautions
Aphids	insecticidal soap ultra-fine horticultural oil pyrethrins spray sabadilla dust or WP neem extract (azadirachtin) Enstar (kinoprene) d-Limonene	See General Notes caution Dust: apply to wet plants Do not use on hibiscus flowers, on new foliage, or in direct sunlight See General Notes caution
Beetles: adults adults & larvae leaf beetle larvae	pyrethrins sabadilla dust or WP neem extract (azadirachtin) ultra-fine horticultural oil	Dust: apply to wet plants See General Notes caution

ORGANIC PESTICIDE GUIDE (continued)

Insect or Disease	Pesticide	Remarks & Precautions
True bugs (Hemiptera)- immatures	ultra-fine horticultural oil sabadilla dust or WP	See General Notes caution Dust: apply to wet plants
Caterpillars	B.t. var kurstaki	Apply when insects are feeding
Leafminer	ultra-fine horticultural oil neem extract (azadirachtin)	See General Notes caution
Leaf spots- General	copper spray or dust Bordeaux mix	See General Notes caution
Mealybugs	insecticidal soap ultra-fine horticultural oil neem extract (azadirachtin) Enstar (kinoprene) d-Limonene	See General Notes caution Do not use on hibiscus flowers, on new foliage, or in direct sunlight See General Notes caution
Scale insects	ultra-fine horticultural oil d-Limonene	See General Notes caution See General Notes caution
Spider mites	ultra-fine horticultural oil	See General Notes caution
Thrips	neem extract (azadirachtin)	
Whitefly	ultra-fine horticultural oil pyrethrin spray neem extract (azadirachtin) Enstar (kinoprene) d-Limonene	See General Notes caution Do not use on hibiscus flowers, on new foliage, or in direct sunlight See General Notes caution

