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Insect Control: Horticultural Oils

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Quick Facts...

- Certain oils, diluted with water and applied as sprays, can be effective controls of many plant pests.
- Horticultural oils are usually highly refined petroleum oils combined with an emulsifiying agent. Some plant-derived oils also are used.
- Advantages of oils include safety, effectiveness and limited effects on beneficial insects.
- Do not use oils on certain sensitive plants. Plants under drought stress may have increased risk of injury.

Various oils have been used for centuries to control insect and mite pests. Oils remain an important tool to manage certain pest problems (e.g., scales, aphids, mites) on fruit trees, shade trees and woody ornamental plants. Several recently developed oils extend this usefulness to flowers, vegetables and other herbaceous plants. Oils also can control some plant diseases, such as powdery mildew. Oils used to protect plants have been called by many names, but perhaps horticultural oils best describes them.

Oils have different effects on pest insects. The most important is that they block the air holes (spiracles) through which insects breathe, causing them to die from asphyxiation. In some cases, oils also may act as poisons, interacting with the fatty acids of the insect and interfering with normal metabolism. Oils also may disrupt how an insect feeds, a feature that is particularly important in the transmission of some plant viruses by aphids.

Oils pose few risks to people or to most desirable species, including beneficial natural enemies of insect pests. This allows oils to integrate well with biological controls. Toxicity is minimal, at least compared to alternative pesticides, and oils quickly dissipate through evaporation, leaving little residue. Oils also are easy to apply with existing spray equipment and can be mixed with many

other pesticides to extend their performance.

The main limitation of spray oils is their small but real potential to cause plant injury (phytotoxicity) in some situations. Oils also can stain some surfaces, particularly dark-colored house paints. Some of the newer spray oils can largely eliminate these problems if they are properly applied.

Source of Spray Oils

Essentially all commercially available horticultural oils (e.g., Sunspray^{R}, Scalecide^{R}, Volck^{R}) are refined petroleum products also known as mineral oils. Impurities in the oil that are associated with plant injury, such as aromatic compounds and compounds containing sulfur, nitrogen or oxygen, are removed. Filtration, distillation and dewaxing complete the production of the finished base oil. Final formulations of horticultural oils are normally combined with an emulsifying agent that allows the oil to mix with water. This mixture usually is used at about a 2 percent dilution.

Vegetable oils also can be used as insecticides, although the type of oil can greatly affect its activity. Cottonseed oil is generally considered the most insecticidal of the vegetable oils. Soybean oil, the most commonly available vegetable oil used in cooking, has often provided fair to good control of some insects and mites.

Extracts from seeds of the neem tree (*Azadirachta indica*) have recently attracted attention as a source of pest management products. Several neem-derived insecticides have been developed. A number of compounds found in neem seeds, notably azadirachtin, have proven useful as insecticides. However, the oil fraction of neem seed extracts, which is mostly free of azadirachtin and related terpenoid compounds, also has demonstrated effects as a fungicide and insecticide. At least one product currently on the market, Trilogy^{R}, consists of a largely azadirachtin-free oil fraction of neem seed extracts. It is formulated with an emulsifier and mixed with water at a concentration similar to horticultural oils (0.5 to 2.0 percent). Many over-the-counter products sold in nurseries that mention neem contain the oils of neem seed extracts.

Insect and Mite Control

Historically, the primary reason oils were developed was because of their effectiveness on otherwise hard-to-control pest problems on fruit trees. They were used as a dormant-season application (before bud swelling and bud break) to kill mites and insects, such as scales and aphids, that spent the winter on the plant. Dormant oil applications also control certain overwintered shade tree pests.

Recently, improvements in refining have produced oils with increased safety to plants and thus expanded their potential uses (Table 1). Summer or foliar treatments are now possible for a variety of pests during the growing season. Oils also can be mixed with other insecticides, providing a broader spectrum and greater persistence of control. Spider mites, whiteflies and young stages of scales are common pests that can be controlled by oils during the growing season.

Oils are sometimes applied to prevent transmission of viruses. Many viruses spread by aphids (nonpersistent viruses), as well as some that are mechanically transmitted by people, can be inhibited by oil applications. Oils used to inhibit virus transmission are sometimes called "stylet oils," a reference to the piercing and sucking mouthparts (stylets) of aphids that transmit these viruses.

Oils also are useful against powdery mildew. Diluted horticultural oils, often mixed with a small amount of baking soda, can be an effective control for this common plant disease. The neem oil

products have been effective against several types of powdery mildew and rust.

Table 1: Some plant pests controlled by horticultural oils.

Dormant Season Applications

- Aphids that curl leaves in spring
- Caterpillars that winter as eggs on the plant (leafrollers, tent caterpillars)
- Mites that winter on the plant (e.g., conifer-infesting species)
- Scale Insects (e.g., pine needle scale, striped pine scale, Kermes scale, cottony maple scale)

Summer/Foliar Applications
Insects and Mites

- Adelgids
- Aphids
- Eriophyid mites
- Leafhoppers
- Scale Insects
- Spider mites
- Whiteflies

Diseases

- Powdery mildew
- Some aphid-transmitted viruses

Precautions

The following precautions are recommended whenever using an oil on a woody plant:

- Avoid using oils on plants that tend to be oil-sensitive (Table 2). Avoid drift onto sensitive plants.
- Do not apply when temperatures are excessively high (above 100 degrees F) or low (below freezing). High temperature limitations are primarily related to the drought-stress status of the plant. Plants under stress may be damaged. Those not stressed are much less likely to be damaged by an oil application. Dry conditions without plant stress generally reduce risk of injury by oil, because evaporation is more rapid.
- Do not apply oils during freezing weather. This can cause the emulsion to break down and produce uneven coverage.
- Do not apply oils if plant tissues are wet or rain is likely. These conditions inhibit oil evaporation. High humidity (above 90 percent) also may contribute to injury risk, while low humidity generally reduces it.
- Do not spray when shoots are growing.
- Avoid treating plants during the fall until after winter hardening has occurred. Fall treatments have sometimes caused increased susceptibility to winter injury.
- Do not apply oils in combination with sulfur or sulfur-containing pesticides such as Captan or Karathane. They can react with oils to form phytotoxic compounds. Because elemental sulfur can persist for long periods, label directions on most oils prohibit their use within 30 days of a sulfur application.

Table 2: Plants that tend to be sensitive to oils.

- Black walnut
- Cryptomeria

- Douglas-fir
- Hickories
- Junipers and cedars
- Maples (particularly Japanese and red maple)
- Redbud
- Smoke tree
- Spruce (particularly dwarf Alberta spruce)

The neem oil insecticides (Trilogy®) have been most widely used on greenhouse-grown ornamentals. They have shown good plant safety, but there are some precautions for use on impatiens, fuschia, hibiscus, some roses, ornamental olive and some carnation varieties.

Terms Used to Describe Oils

Dormant oil: An oil used on woody plants during the dormant season. This term originally referred to heavier weight, less well-refined oils that were unsafe to use on plants after they broke dormancy. However, these older oils have been replaced with more refined, light-weight oils that have potential application to plant foliage. Dormant oil now refers to the time of application rather than to any characteristic type of oil.

Horticultural oils: An oil used to control a pest on plants.

Mineral oil: A petroleum-derived oil (as opposed to vegetable oils). Narrow-range oil: A highly refined oil that has a narrow range of distillation. Narrow-range oils fall in the superior oil classification. The terms may be used nearly interchangeably. Spray oil: An oil designed to be mixed with water and applied to plants as a spray for pest control.

Summer oil: An oil used on plants when foliage is present (also called foliar oils). As with dormant oil, the term now refers to the time an application is made rather than to the properties of the oil.

Supreme oil: A term used to categorize highly refined oils that distill at slightly higher temperatures and over a wider range than the narrow-range oils. Most supreme oils meet the characteristics of a superior oil.

Superior oil: A term originated by P.J. Chapman in 1947 to categorize summer-use oils that met certain specifications. This included a high proportion of paraffinic hydrocarbons and purification that allowed year-round use without phytotoxicity. Since then, further developments have resulted in oils that distill over a narrow temperature range. Most superior oils are now better referred to as narrow-range oils.

Vegetable oil: An oil derived from the seeds of some oil seed crop (e.g., soybeans, canola, cottonseed).

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Go to top of this page.

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