HOME GROUNDS FACT SHEET

CORNELL Cooperative Extension
Nassau County

Nassau County
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Horticultural Oils

Horticultural Oils — Not Just for Dormant Treatments Anymore!

One of the oldest insecticides, petroleum oil, is still an effective means of controlling certain insect pests. Modern products provide much better insecticidal efficacy and greater safety to plants. At a time when people object to using synthetic chemical insecticides, oils are an acceptable alternative. However, a good understanding of their nature, mode of action, uses and limitations is necessary.

The many names may be confusing:

- spray oil
- petroleum oil
- mineral oil
- white mineral oil
- paraffinic oil
- insecticidal oil
- horticultural oil
- dormant oil
- summer oil
- superior oil
- miscible oil
- emulsive oil
- spray oil emulsion

Understanding the Nature of Oils

Horticultural oils are poorly understood by most users. The product labels give little information on the contents, and the label uses vary greatly from product to product. There has been little developmental research on pests of ornamental plants; most of our technology comes from research on tree fruits in New York, Florida, California and Texas.

Oils are complex hydrocarbons that vary greatly depending on geographic sources of crude and the refining processes used. Mineral oil is defined as any oil found in the rock strata of the earth. Petroleum oil is synonymous and a more common term of reference. Napthenic and asphaltic oils are aromatic, highly unsaturated and used for motor fuels, fuel oil and solvents. They are highly toxic to plants. The paraffinic oils are highly saturated, used as lubricating oils, and are the base from which horticultural oils are refined. They are safe to use on plants. Horticultural oils are those paraffinic oils refined especially for use on plants to control insects. The term white mineral oil refers to any of various colorless, tasteless oils from petroleum used for pharmaceutical or medicinal purposes such as laxatives, baby oil, hand lotions, and petroleum jelly (vaseline, petrolatum); these oils are completely saturated.

Horticultural oil technology advanced markedly from 1945 to 1970. Prior to that time, oil sprays were limited to use on plants before buds opened, hence the common term “dormant oil”. They were high in viscosity (heavy) and often called 100 second oils. Researchers using this knowledge of components that increase insecticidal action and safety to plant tissues, developed specifications for oil that could be used when foliage is present.

Its use on green plants led to the term “summer oil.” It can be used both in the dormant and growing season. Dormant oil and summer oil refer to timing of the application, not the type of oil product. Although some oils are intended only for dormant use, nowadays most horticultural oils can be used during both the dormant and growing seasons. Read the label.

When oils are applied to plants as a spray, they must be mixed with water. An emulsifier is essential and is added to the oil by the producer when it is formulated. It is included as an inert ingredient on the label, not stated separately. Some oil products are called “miscible oil” or “emulsive oil” to indicate they contain an emulsifier. Decades ago, suppliers provided ready-to-apply oil spray that was called a spray emulsion or white oil emulsion. This is no longer the case.

In summary, modern horticultural oils are derived from highly saturated paraffinic petroleum and refined to the following specifications:

- UR, percent (minimum - 92) 92-96
- Viscosity, seconds, Saybolt (maximum - 90) 60-90
- Gravity, degrees API 30-35
- Distillation range, degrees F. 412-468
- Flash point, degrees F. (*one example*) 345

The higher the UR, the safer the oil. The lower the viscosity and distillation range, the lighter the oil. All Cornell University Recommendations are based on the UR 92 minimum and 412-435 distillation range.

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Mode of Action

Oil acts as a contact insecticide until it evaporates. It interferes with respiration more physically than chemically. Insects and mites are affected in 3 ways:

1) prevention of gaseous exchange, disrupting respiration,
2) interference with membrane function and some toxicity to cells from oil penetration and
3) interference with feeding of certain leafhoppers and aphids on oil-covered surfaces.

Oil sprays are effective only against exposed eggs and insects that are coated with a layer of oil. The oil must be present long enough to suffocate the pest without doing the same to the plant. The heavier the oil, the more effective it is in control and the more likely it is to cause plant damage. One way to achieve effective results is to use the lighter oils for both dormant and summer treatments and use higher concentrations in the dormant season.

Often the question is asked about spraying in the fall when the leaves have dropped or in winter when the weather turns warm for extended periods. Generally, in the northeast, oil should not be applied after early September. In the fall, plants have not "hardened off" and injury often results. In the fall and winter when insects are in hibernation, the metabolic rate is very low, as is the demand for oxygen. Oils evaporate before the insects are killed and poor control is the result.

Primary Targets for Horticultural Oils

Oil sprays are effective for a relatively limited number of pests, but they are some of the more difficult to control with synthetic chemical insecticides: spider mites, rust mites, scale insects, mealybugs, aphids, adelgids, psyllids, whiteflies, a few caterpillar pests and certain bugs, a number of which are on fruit. Dormant treatments are directed primarily at mites or mite eggs, scale insects and eggs of overwintering aphids. Summer treatments are effective against other stages that are present. Gypsy moth tent caterpillar egg masses are not affected.

Phytotoxicity

Plants appear to have inherent variability in sensitivity to oil sprays. Little is known about which is which, since there are so many kinds of ornamental plants and so few studies to obtain quantitative data. Generally, modern oil products are very safe to use on plants, and many of the older cautions for plant injury still on the labels may not be valid. Limited studies where more than 130 plants were treated with summer oil showed little or no injury. Some arborists have used oils continuously, according to surveys, without problems.

Many factors may contribute to phytotoxic effects of oils on plants; some are well known from fruit tree research. They include moisture deficit in leaves, high humidity, high temperature, treating very young foliage and genetic variability in the plants.

There is very little documented evidence that proper applications of oil result in phytotoxicity. Avoid spraying oil when temperatures and humidity are high or when plants are under drought or other stress.

Plant damage may also result if material is sprayed after it is allowed to sit and separate in the spray hose. Recirculate the spray through the tank to restore the emulsion before applying.

Oils should not be applied in combination with, before or after certain other pesticides. Check labels carefully for precautions. If in doubt, test by spraying a small area first and watch for injury after a few days. However, it is well known that improper application can cause damage: overdosing, wrong timing, oil emulsion breakdown, using oil with incompatible materials, (especially any sulfur compounds) and other misuses. Plant injury may be twig dieback, leaf burn and killing of new growth.

At the present time there is some indication that the following are oil sensitive: maples, hickories and black walnut (dormant sprays); smoke tree and azalea (certain varieties) (summer sprays); and cryptomeria (both).

Plants showing a tendency toward sensitivity include: beech, redbud, spruce and douglas fir (dormant); savin junipers and photinia (summer) and Japanese holly (both). Oil sprays will remove the bluish bloom from needles of conifers, especially blue spruce and similar types. It may take 1 to 2 years for new growth to return the natural bloom to the trees.

Applying Oil Sprays

The proper concentration for spraying varies since there are differences between oil products in terms of lightness (viscosity), distillation rate and intended use. There are also differences among insect groups and species in sensitivity to oils.

In general, the lightest oils should be used at the rate of 3-4% for dormant spraying and 2-3% for summer sprays, using the higher rate for hard-to-control pests; 1% less is suggested if oil-sensitive plants must be treated. A simple rule of thumb is to use 2% for summer treatments and 3% for dormant, but remember this is oversimplification. The safest approach is to follow the label directions explicitly. Dosage rates for oils are based on volume; thus, a 1% spray is 1 gallon of oil in 100 gallons of water (2.66 Tablespoons per gallon.)

In general, armored scales, such as oystershell, obscure, calico and euonymus scales, are more difficult to control with dormant applications of oil than soft scales, such as European fruit lecanium, Fletcher and cottony soft scales. Addition of insecticide to the oil may improve control of armored scales, but for serious infestations, best results will be obtained with oil or other labeled insecticides directed at the crawler (newly-hatched) stages.

Proper timing can be determined through observations or use of Growing Degree Days (GDD).

Oils with insecticides added are more hazardous to handle, since oil enhances skin penetration.

Horticultural oils have the advantages of safety to the applicator and the environment, minimal effect on natural enemies, effectiveness against inactive scales and eggs of insects and mites. They can be applied to extend the spraying season in early spring and are an acceptable alternative for people who do not choose to use chemical insecticides.

Reference: "Horticultural Oils," Virginia Tech Insect Notes #174, by John A. Weidhaas, Jr., Extension Entomologist, and edited by Dr. Warren T. Johnson, Department of Entomology, Cornell University, May 6, 1988.

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