



Neem

What is it?

Neem is the common name of *Azadiracta indica* A. Juss., a tree native to South Asia and a member of the mahogany family (Meliaceae). The insecticidal properties of neem were discovered long ago and for centuries have been relied upon for pest protection in India. Neem derives some of its insecticidal properties from a family of complex secondary compounds in seed extracts known as limonoid triterpenes, the most important of which is azadirachtin. Other components of neem extracts are insecticidal as well, such as neem oil which contains almost no azadirachtin or other limonoid triterpenes. Some chemicals in neem extract are also toxic to nematodes, snails, crustaceans, and a number of fungi.

Because the active ingredients in neem have very complex molecular structures, it is not feasible to manufacture them. Thus, all neem products on the market are based on extracts of the neem tree. Because azadirachtin is the predominant insecticidal chemical in the extract, extracts are standardized to this compound so that consistent commercial insecticides can be marketed.

What types of neem-containing products are on the market and how do they work?

There are several very different types of pesticides made from neem. The types of products, intended uses, and modes of action include:

Azadirachtin-based insecticides. These products contain a broad range of limonoid triterpenes with azadirachtin listed as the primary active ingredient. These are the only neem products that contain significant amounts of azadirachtin, the most potent of the neem-derived insecticides. Azadirachtin is most effective as an insect growth regulator, inhibiting the molting process of immature insects. Azadirachtin has no growth regulatory activity against adult stages, but does possess repellent activity, deterring some insects from feeding or laying eggs on treated plants. Other chronic effects include reduced fecundity and longevity as well as increased development time of immature insects. Azadirachtin content varies with the formulation; concentrates sold for commercial application typically contain 0.15 to 4.5% azadirachtin, whereas products intended for homeowner usage range from 0.05 to 0.2%. When diluted, however, the concentration of azadirachtin in the finished spray is similar, in the range of 0.001 to 0.01%, usually 0.002%. Although few products are labeled for this kind of use, neem extracts are also taken up from the soil by some plants. Systemic activity of neem is generally longer lasting than when applied as foliar sprays because the active ingredients are not as susceptible to degradation by sunlight or loss to rainfall.

Neem oil. Another group of neem products is made from the oil fraction of neem extract. The active ingredient is generally listed as "clarified hydrophobic extract of neem oil," and is labeled as a fungicide, insecticide, and/or miticide. Insects and mites susceptible to paraffinic (petroleum-derived) horticultural oil are likely to be controlled to some extent by neem oil products. The mode of action is probably similar to other oils, namely membrane or cuticle

disruption and/or interference with respiration. Note that the activity is distinct from that of azadirachtin-based insecticides.

Other neem products. In addition to products based on azadirachtin or neem oil, there are also other pesticides derived from neem. One such product, K+ Neem, is an insecticidal soap made from neem oil, listed on the label as potassium salts of fatty acids. Mode of action (membrane disruption) and efficacy against arthropods is probably similar to that of other insecticidal soaps since the product has no measurable quantities of azadirachtin.

What does neem control?

Although neem has a fairly broad spectrum of activity against insects, some insects are more susceptible than others, and results often vary from pest to pest. Many leaf-feeding larvae are susceptible to azadirachtin-based products; this list includes lepidopterous larvae (caterpillars), leaf-feeding beetle larvae, and sawflies. [NOTE: we have not seen significant efficacy against viburnum leaf beetle larvae.] Fluid-feeding insects such as aphids, leafhoppers, and plant bugs are also fairly well controlled by products based on azadirachtin, as are dipterous leaf miners and fungus gnats. Adults of a number of insect groups are also responsive to azadirachtin; Japanese beetles and grasshoppers reportedly avoid neem-treated foliage. Neem-oil products are reportedly effective against aphids, whiteflies, scale crawlers, and spider mites. Neem products are generally *not* effective against mealybugs, weevils, thrips, or adult scales. Use of neem products against pests not on the label is not advisable because efficacy against these pests has not been determined (or is inadequate), not to mention the fact that such uses are illegal in New York.

Neem as part of a pest-control program

Foliar-applied neem products are generally not very long lasting in the environment, and often need to be reapplied to maintain efficacy. Because of the relatively rapid breakdown, however, neem products pose a reduced threat to non-target organisms. Combined with low mammalian toxicity, this attribute makes neem products well suited to use in landscapes. Caution must be used with neem-oil or –soap based products because of potential phytotoxicity, especially following repeat applications. Owing to their several modes of action, neem products are less likely to promote resistance development in pest populations than most insecticides or miticides, which often rely on a single mode of action. Growth-regulatory effects of neem products are not instantaneous, however, so users must understand that they will not see immediate results when immature insects are the target stage, and must be willing to tolerate additional feeding damage because treated insects will continue to feed (albeit at a reduced rate) before the effects of neem are manifested.

In summary, neem-based insecticides have attributes that can be helpful in IPM programs for certain groups of landscape pests. Be sure to read labels carefully to ascertain that a particular product contains the desired active ingredient (azadirachtin, neem oil, potassium salts of fatty acids) for the target pest.

Every effort has been made to provide correct, complete, and up-to-date pesticide recommendations. Nevertheless, changes in pesticide regulations occur constantly, and human errors are still possible. These recommendations are not a substitute for pesticide labeling. Please read the label before applying any pesticide. The information given herein is supplied with the understanding that no discrimination is intended and no endorsement by Cornell Cooperative Extension is implied.

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