Tree Injections and Implants

Mark Harrell
University of Nebraska-Lincoln

Tree care professionals have a variety of options available for controlling tree pests. Insecticide sprays have been a traditional approach, and soil treatments are sometimes used. But injections and implants that place insecticides directly inside trees are being used more commonly as people become more concerned about the effects of pesticides in the environment.

Tree injections and implants can be very effective against certain kinds of pests. They have several advantages over sprays and soil treatments: they use a much lower volume of material; the equipment needed to apply them is much simpler; they can be applied even during windy or rainy weather; and the chemical is put directly into the tree where it is picked up only by the insects feeding on the tree and where it is away from people, wildlife, beneficial insects, and other non-target organisms.

How they work

Tree injections and implants are applied to trees in ways that place the insecticide beneath the bark and into the tree's water conducting system. The insecticide moves upward with the flow of sap, and it becomes concentrated in the leaves and shoots where the water that carries it is lost by transpiration. Therefore, these treatments are generally most effective on chewing and sucking insects that feed on young shoots and leaves. Depending on how quickly the insecticide breaks down in the tree, it may continue to be effective in controlling pests in the leaves and shoots for several weeks or even through the entire growing season.

Insecticides injected or implanted into the tree's water-conducting system move passively with the flow of water and may or may not become evenly distributed in the tree's crown. As the insecticide moves upward from the point of injection, it spreads slowly sideways in a narrow spreading pattern. The amount of sideways movement is dependent upon the structure of the water-conducting cells of that tree. Broadleaf trees have long vessels that are very efficient in carrying water up the tree, but they allow less lateral movement than do the shorter conducting cells in conifers. This means that broadleaf trees are somewhat more likely than conifers to have branches that are missed by the injected or implanted insecticide, especially if the branches are small and low on the tree. Injecting or implanting low on the tree compared to high will reduce the chance that "skips" will happen by allowing more sideways movement to occur before the branches are reached.

Controlling borers

Tree-injected and implanted insecticides are often not effective in controlling wood-boring pests, because the borers are often not where the insecticide is and they commonly have overlapping life stages. Injected and implanted insecticides move through the tree only in the outer rings of the wood, where most of the natural flow of water in the tree occurs. As much as 90% of the total flow of water in oaks, elms, and ashes occurs in the outermost ring, with the next one or two rings able to transport only very small amounts. Other broadleaf trees use the outer two or three rings somewhat more equally, and conifers may move significant amounts of water in as many as five to seven rings. Since borers can be killed only if they come in contact with the injected or implanted insecticide, the number of conducting rings and how much water each one is able to conduct have a significant effect on the ability of the insecticides to kill these wood-boring pests.

Most borer species do not spend large amounts of time feeding in the outer one or two rings of the wood. They may stay in that area for a short time, but most pass through it fairly quickly as they move deeper into the tree. Most borers also do not have their generations well synchronized, meaning that if they are in the outer rings for only a short time, then at any one time some individuals may have moved beyond those rings and others may not have entered them yet. When an insecticide is injected, much or most of it moves up quickly from the injection site and into the crown of the tree. If borer larvae are in the outer one or two rings at that time, and if the insecticide is toxic to them, they will likely be killed. But any larvae that have already passed beyond the outer rings will not likely be affected by it, and larvae that have not yet entered the tree will be killed only if enough residual insecticide remains in those rings to kill them.

The insecticides first developed for injections tended to be very water soluble and did not remain in the trunk at concentrations great enough to kill borers over extended periods of time. Newer injectable insecticides are generally less soluble in water and have a greater chance of having residual amounts that can kill borer larvae that enter the tree after the injection is made. Some borers, such as the bronze birch borer and the Asian longhorned beetle, can be controlled fairly effectively with injections, because the larvae spend a large amount of time in or adjacent to the outer ring. Others, such as the lilac/ash borer, cannot be easily controlled by injections because of the unsynchronized manner in which the larvae pass through the outer rings.

How to inject and implant

Tree injections are most effective when the insecticide is placed only into the outermost one or two rings. If the product requires that a hole be drilled, avoid drilling deeper than indicated in the instructions. If the hole is too deep, the pressure of the injection will push some of the insecticide into the inner rings where it will stay and not be used. The same care should be taken with implants. If the hole for the implant is too deep, some of the insecticide that dissolves will be lost in interior areas where little or no water movement occurs.

Injections and implants are generally more effective when placed low on the tree compared to high. The lower placement allows a greater distance in the trunk for the insecticide to spread sideways before it is diverted into branches. If it is aimed at borers, placing the insecticide lower allows a larger area of the tree to be protected. Since the sap of the tree carries the injected material, it generally moves only upward, not downward. Movement downward occurs only when the water column in the tree is broken by air that is allowed into the tree during drilling, and when the insecticide is pressure injected into the cavities created by the air pockets. This movement downward is normally not extensive and should not be counted on to provide significant control below the injection site.

Limitations

Tree injections and implants have several advantages over sprays and soil treatments, but they have disadvantages as well. Every injection or implant method causes an injury to the tree during application. These injuries may be significant, or they may have little effect on the tree, depending on the method used, the material injected and the tree's overall health at the time the injections or implants are done. To limit the damage caused by injections and implants and allow the tree to recover more quickly, use small holes, shallow holes, and holes low on the tree. If an injection or implant needs to be repeated on a tree at a later date, check to see if the holes from the previous treatment have completely sealed. If they have not, delay the second treatment, because the tree has not yet recovered well enough from the previous time and the new treatment may cause more harm than good. Trees should be injected or implanted no more than once a year, and it is best to inject no more than once every two or three years. Because injections do cause a disruption in the tree's water conducting system, a tree can be killed if treated more frequently than the tree can handle.

Products available

Four types of tree injection and implant products containing insecticides are commonly available (Table 1). Three require holes to be drilled into the bark and wood. One uses a needle that is pushed through the bark. Three inject liquids, which avoid the delay needed to first dissolve the solid material in an implant, but they need to be applied by trained professionals. The implant is simple enough to use that it is even sold to consumers through garden centers. Each method has its positive and negative aspects. Tree care professionals and consumers need to consider what is available to them, what is labeled for their particular problem, and what features of the product they consider most important.

Table 1. Tree-injection and Implant Insecticide Products Available.

Company	Insecticide products	Application method[1]	Pests controlled[2]
ArborSystems, LLC Omaha, NE 800-698-4641 www.arborsystemsllc.com	Greyhound (abamectin)	Liquid injection; no drilled hole needed; one injection every 4 to 6 inches of circumference	Elm leaf beetle, lace bugs
	Pointer (imidacloprid)	Same as above	Many pests, such as adelgids, aphids, borers, Japanese beetle, lace bugs, leaf beetles, leafhoppers, leaf miners, psyllids, sawfly larvae, scale insects, thrips, whiteflies

1. Refer to label for specific instructions.
2. Refer to label for specific pests included.

Table 1. continued on next page.

Company	Insecticide products	Application method	Pests controlled
Creative Sales, Inc. Fremont, NE 800-759-7739 www.acecap-medicap.com	Acecaps (acephate)	Solid implant; drilled hole needed: 3/8-inch diameter x 1 1/4 inches deep from cambium; one implant every 4 inches of circumference	Many pests, such as aphids, bagworms, borers, budworms, gypsy moths, leaf miners, pine tip moths, soft scales, webworms, whiteflies
J.J. Mauget, Co. Los Angeles, CA 800-873-3779 www.mauget.com	Abacide (abamectin)	Liquid injection; drilled hole needed: 11/64-inch diameter x 3/8-inch deep; one injection every 6 inches of circumference	Elm leaf beetle, fall webworm, leafminers, spider mites, sycamore lace bug
	Imicide (imidacloprid)	Same as above	Many pests, such as adelgids, aphids, borers, elm leaf beetle, Japanese beetle, lace bugs, leafhoppers, leaf miners, mealybugs, psyllids, soft scales, thrips, whiteflies
	Inject-A-Cide "B" (bidrin)	Same as above	Many pests, such as aphids, birch leafminer, borers, eastern tent caterpillar, elm leaf beetle, European pine sawfly, gypsy moth, leafhoppers, soft scales, spider mites
Tree Tech Microinjection Systems Morriston, FL 800-622-2831 http://treetech.net	Dendrex (acephate)	Liquid injection; drilled hole needed: 11/64-inch diameter x 1/4 to 1/2-inch deep; one injection every 4 to 6 inches of circumference	Many pests, such as aphids, bagworms, borers, budworms, cankerworms, elm leaf beetle, gypsy moth, Japanese beetle, leafminers, pine tip moth, scales, tent caterpillars, thrips, tussock moth, webworms, whiteflies
	Vivid II (abamectin)	Liquid injection; drilled hole needed: 11/64-inch diameter x 3/8 to 1/2-inch deep; one injection every 6 inches of circumference	Adelgids, aphids, browntail moth, elm leaf beetle, lace bug, lygus bug, mites, oakworm, soft scales, white pine weevil
	Harpoon (metasystox-R)	Liquid injection; drilled hole needed: 11/64-inch diameter x 1/4 to 1/2-inch deep; one injection every 6 inches of circumference	Aphids, bark beetles, cone moths, elm leaf beetle, engraver beetles