

# Microinjection: small package, big impact

*Broaden your treatment options by including microinjection in your treatment program.*

By TERRY A. TATTAR, Ph.D.

**P**roblem: your client has two large elm trees being defoliated by elm leaf beetles. Solution: spray to control the beetles. Problem solved!

But what if the trees are overhanging a school yard directly beside the client's property? Or what if your client is a senior citizen's home? How do you treat a problem and also address the concerns that people may have? Microinjection is one method that might fit into your program.



Spraying street trees is not wise in all cases.

Microinjection's contained delivery system gives you an environmentally friendly alternative to spray applications, as well as low initial investment. Properly used, microinjection has tremendous potential to benefit trees while also providing added value to landscapes.

#### **Spraying can cause concern**

You can treat some pest problems, and even nutrient deficiencies, with a foliar application. But spraying community shade trees requires specialized, expensive equipment. It may not be appropriate either. What if a hospital, nursing home, school, pond, stream or river is nearby? What if your clients or their neighbors have pets, wildlife concerns or chemical sensitivities? Spraying may simply not be a suitable tree health care option.

Microinjection, however, allows the introduction of materials such as antibiotics, fungicides, insecticides and mineral nutrients directly into a tree without any contact with the environment.

Spraying, soil injection and trunk injection are the most common methods to apply tree health care treatments. Each of these techniques has a place in tree health care and each has advantages and disadvantages.

#### **Good enough for DaVinci**

Microinjection uses small amounts (approximately 0.1 ounce) of therapeutic chemicals contained in sealed capsules which are introduced into shallow trunk

## **SPRAYING**

### **Pros**

- quick application of materials
- rapid response to treatment

### **Cons**

- accurate timing needed for some pests
- height of the tree can impact the level of coverage
- weather must be suitable for spraying

## **SOIL INJECTION**

### **Pro**

- allows combinations of fertilizers and pesticides
- causes no trunk wounds

### **Con**

- timing of delivery is important since there can be some time delay in the uptake of the materials by the tree

## **TRUNK INJECTION**

### **Pro**

- injected materials rapidly available within the tree
- no environmental contact with pesticides can be performed under most weather conditions

### **Con**

- must consider tree response to trunk wounding
- uneven distribution in crown may occur

*No treatment method is ideal for all situations. Remember, you can combine these application systems in IPM programs for shade trees. Each situation is different, so use the best delivery systems to address the problem.*

wounds around the base of a tree. The injected chemicals are distributed systematically by sap movement within the tree to



Training session on the correct use of microinjection at Cypress Gardens, Florida.

## Microinjection may be a suitable:

- ▶ For use against difficult-to-control insects (e.g. bronze birch borer, scale, gypsy moth, aphids, birch leafminer etc.)
- ▶ When drift becomes a problem, such as in crowded urban areas
- ▶ In environmentally sensitive areas, such as near playgrounds, camp sites, water or wildlife areas
- ▶ As part of an IPM program, minimizing chemical usage
- ▶ For very tall trees or in poor weather conditions (wind, rain, etc.)
- ▶ To protect nontarget pests
- ▶ For difficult to control diseases
- ▶ For applying micronutrients

the branches, leaves and even roots within a few hours after injection.

Although the first reports of trunk injection of trees date to studies by Leonardo DaVinci during the Renaissance, it is often misunderstood. Materials in liquids can be injected into the woody tissues of trees (xylem), because the pressure within the xylem is below that of atmospheric pressure on the outside of the tree. Under this

condition of negative pressure, liquids introduced into healthy xylem through a fresh injection wound are taken into the xylem and distributed within the tree in the sap stream. Actually, this is not so much injection as it is the accessing of the transport tissues of the tree and allowing them to transport the chemicals up into the tree. More like infusion therapy, if you will.

You don't have to use high pressures to

"force" liquids into the tree. High-pressure injection can actually damage tree tissues and may not place the injected materials into the outer xylem where most systemic transport occurs. Low pressures sufficient to empty the injection reservoir are most effective for transport with less impact on the tree.

Trunk injection of several gallons of ma-

*continued*

## Tree Injection 101

1. Make wounds as small and as shallow as possible. Deeper and larger wounds under higher pressures cause greater injury to the tree. Ninety percent of all conduction in the tree takes place in the current growth ring of most trees.

2. Make clean-edge wounds by using a fully charged drill and a sharp bit. The more ragged the edges of a wound, the greater the injury. Disinfect drill bit between injection sites.

3. Inject on root flares. Do not inject in the valleys between the flares where cambial growth is narrow.

4. Never place injection holes in vertical alignment; wounds directly above or below other wounds cause further injury to the tree, while uptake is poor or not possible.

When several injection periods are needed, create patterns to avoid vertical alignment.

5. Monitor previously injected trees. Do not reinject a tree if the wounds from previous injections are not closed after one year or if fluxing has not stopped. If cracking occurs at the injection site, do not inject this tree again. Not all trees can tolerate injection wounds and chemicals.

6. Do not use injection sites from the previous year.

—Marty Shaw, certified arborist, certified nursery professional and president of TIPCO Inc., Knoxville, TN. [www.treedoc.com](http://www.treedoc.com)



The placement of microinjection capsules containing mineral nutrients on a shade tree is a simple process.

materials per tree, or macroinjection, has been used to treat trees with vascular diseases, such as the Dutch elm disease. Unfortunately, most tree species do not have porous xylem like the American elm and cannot accept large volumes of liquids by trunk injection. In addition, macroinjection systems involve complex tubing and reservoir systems which are labor intensive and are not practical for rapidly treating several trees.

A breakthrough in injection technology occurred in the 1960s when the systemic insecticide Bidrin, in microinjection capsules, was injected into trees and shown to

control a variety of chewing and sucking insect pests. Large volumes of materials did not need to be injected into a tree to control a problem. The Bidrin research showed that a small volume of concentrated systemic chemical in a microinjection capsule could be effective.

Since that time, microinjection research has focused on developing systemic formulations of antibiotics, insecticides and fungicides that are effective in low volumes. Re-

## Wounds that don't heal

Most trees are strong compartmentalizers and close injection wounds very quickly. However, some individual trees may be weak compartmentalizers (whether due to genetic characteristics or compromised health) and should not be injected. Know the danger signs of weak compartmentalization:

- ▶ delayed wound closure
- ▶ vertical cracks above or below the wound
- ▶ prolonged fluxing from the wound with discolored or odorous discharge
- ▶ expansion of the wound or canker formation around the wound

cently, combinations of an insecticide and a fungicide in a single capsule have been developed to treat both insect and disease problems with a single injection.

### Before you begin

Microinjection can only be effective if applied by trained applicators who have correctly diagnosed a tree health problem. An incorrect diagnosis will likely result in the use of an ineffective material.

Improper application can harm a tree. Companies that sell microinjection products usually require training before using their products. Both the J.J. Mauget Co. and Tree Technology Systems Inc., for example, require a training program before sale and use of their products. In addition, microinjection capsules must be applied in strict adherence to the guidelines of the manufacturers. Improper techniques, such as using too many capsules on a tree, using an incorrect application depth or carelessly inserting or removing capsules can cause damage or inhibit wound closure.

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## Maximize injection impact

Uptake increases with:

- ▶ soil temperature ( $\geq 50^{\circ}\text{F}$ )
- ▶ soil moisture (pre- and post-water)
- ▶ wind
- ▶ sunny day

Uptake decreases with:

- ▶ humidity
- ▶ dry soil
- ▶ high air temperatures ( $>90^{\circ}\text{F}$ ) can cause leaf burn