

TREE INJECTIONS SYSTEMS

USE OF INJECTION SYSTEMS
FOR DELIVERING PESTICIDES
AND NUTRIENTS

USES OF TREE INJECTIONS

- **Effective method for treating trees for:**
 - Vascular wilt diseases (DED, OW)
 - Phloem-feeding insects
 - Flat-headed borers (EAB)
 - Foliage-feeding insects
 - Insect-vectored diseases
 - Micronutrient deficiencies
- **Good for treating large trees**
- **Used where sprays are prohibited**
- **Compatible with client's desires**



BENEFITS OF TREE INJECTION

- Quicker uptake of product
- Less exposure to applicator and environment
- Better distribution of product
- Greater treatment window



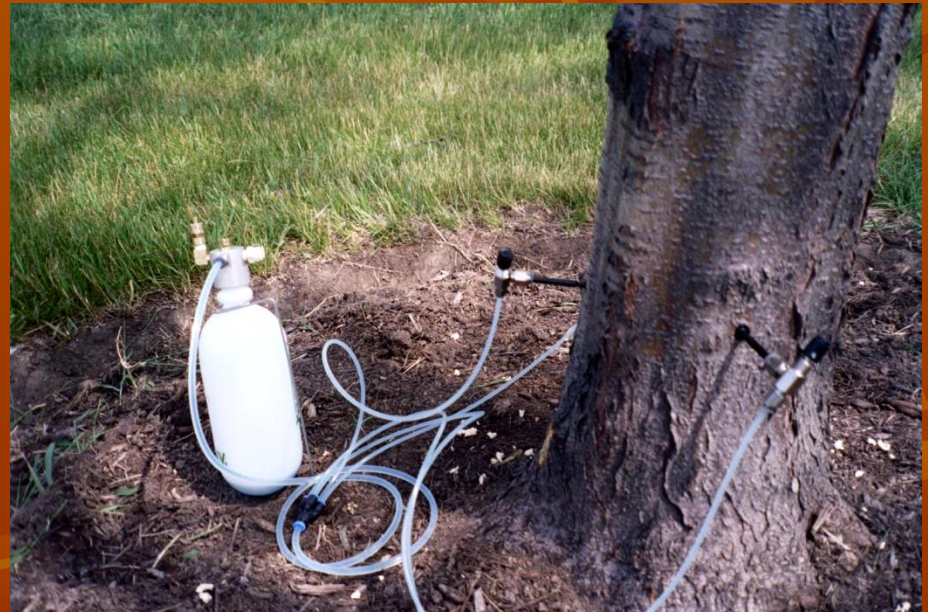
DISADVANTAGES OF TREE INJECTION

- Requires wounding the tree
- Dry soils can limit uptake
- Lack of transpirational pull can slow down or limit uptake



DISADVANTAGES OF TREE INJECTION

- Within tree distribution may vary by species
- Can be time consuming
- Requires monitoring



TYPES OF TREE INJECTIONS

■ MACRO-INJECTION

- Deliver large volumes (i.e. quarts or gallons)
- Use multiple injection ports from a common source
- Pressurized by pumps/compressed gas canisters



■ Advantages

- High volumes can be injected
- Helpful for large trees
- Helps reduce vascular tissue damage with high concentrations



MACRO-INJECTION

■ Disadvantages

- May give uneven distribution within the tree
- Uneven distribution may result in chlorotic areas, less growth regulation, or variable insect and/or disease control
- Not appropriate for injection of undiluted materials



USES OF MACRO-INJECTION

- Dutch elm disease (DED)
- Oak wilt
- Foliar diseases
- Chlorosis



MICRO-INJECTION

- Small volumes (i.e. ml. or oz.) for delivery directly into xylem
- Preferred method for concentrated materials with low phytotoxicity
- Allows for resetting micro-injectors
- **Equipment includes:**
 - **Capsule injectors** (single-use prefills or re-usuables)
 - Injection system with multiple ports
 - Pumps/compressed gas container

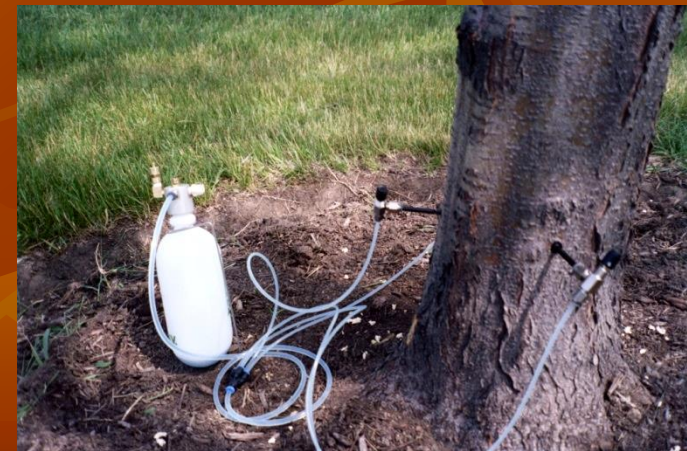


MICRO-INJECTION



USING MICRO-INJECTION

- Closed system of treatment for delivering nutrients or pesticides directly into plant vascular system
- Curative or therapeutic
- Involves drilling 1/64 inch holes into tree's root flare and inserting nozzle of plastic or metal unit fill with injection material



SETTING UP A MICRO-INJECTION SYSTEM

- Determine DBH of tree to be treated
- Divide DBH by 2 and place injection sites about 6 inches apart equally spaced around the root flare area
- Avoid damaged areas, included bark, diseased areas

ARBORJET
Revolutionary Plant Health Solutions

PROPER ARBORPLUG® REPLACEMENT

SET CORRECTLY

- Fastest rate of uptake
- Least chance of leakage
- Best protection of the cambium
- Fastest wound closure (growth over the Arborplug)

SET TOO SHALLOWLY

- Highest chance of leakage
- Higher chance of bark splitting
- Least protection of the cambium
- Slower wound closure (pushes the Arborplug out)

SET TOO DEEPLY

- Slowest rate of uptake
- Higher chance of leakage
- Deeper wound than necessary

This drawing is not to scale.

SETTING ARBORPLUGS

Below are guidelines to determine the number of plugs to use:

- While using the TREE I.V. (DBH/3) (Diameter at Breast Height)
- While using the QUIK-jet or Air Hydraulic (DBH/2)
- Optimal plug locations selected within 18" of soil line
- Choose healthy tissue, avoid damaged bark and/or compression wood or flat spots if possible.

ARBORJET INJECTION STEPS

- 1. DRILL**
Drill 5/8" - 2" deep into tree xylem (white tissue). * Drill hole perpendicularly, (straight in) not on an angle.
- 2. PLUG**
Insert and set Arborplug with set tool. The Arborplug surface should be just into the xylem.
- 3. INJECT**
Insert needle and inject.

* 9/32" bit for #3 Arborplugs or 3/8" bit for #4 Arborplugs

BEST ARBORPLUG INJECTION ZONE

USES OF MICRO-INJECTION IN PHC

- **Leaf feeding insects:**
Japanese beetle,
leafminers, leaf beetles
- **Sap feeding insects:**
plant bugs, aphids,
leafhoppers, mites
- **Wood-boring insects:**
emerald ash borer



INFUSION IMPLANTS AND CAMBIAL ZONE INJECTIONS

- **Tree infusion** can be done with either macro-injection or micro-injection with low or no pressure with material transported via sap flow
- **Implants** are dry materials (i.e. pills, powders, tablets) that are inserted into a drill hole in sapwood



INFUSION IMPLANTS AND CAMBIAL ZONE INJECTIONS

- **Cambial zone injectors** are unique micro-injection application using a blunt hypodermic-type needle pressed through the bark and into the sapwood



SOIL DRENCHES AND INJECTION

- Basal soil drenches for pesticides and nutrients
- Soil injection for pesticides and nutrients



BASAL TRUNK SPRAYS

- Spray is applied to the trunk and allowed to soak through the bark
- Used for wood-boring insects (i.e. EAB)



APPLICATION CONSIDERATIONS

■ Tree Species

- **Ring-porous** species (i.e. ash, oak)
 - Have large early-wood xylem vessels
 - Faster uptake
- **Diffuse porous** species (i.e. maple, birch)
 - Sap flow is fastest in outer most xylem (most recent growth rings)
 - Conifers – uptake is slower due to smaller diameter **tracheids**, resin flow plugging up injection sites
- Residual activity
- Application timing (most important!)

APPLICATION CONSIDERATIONS

- **Tree phenology:** most products applied in spring/summer
- **Pest biology**
- **Environment factors:** soil water, temperature, light, humidity, wind
 - **Temperate zones** temperatures below 50F or higher than 90F will reduce sap flow
 - **Transpiration greatest:** soil moisture, clear sky, moderate temperatures, low humidity, light breeze
- **Overall tree health**
- **Treatment formulations**
 - Water-based products are easier to inject

APPLICATION CONSIDERATIONS

- **Properly measure tree DBH**
- **Know the pH of your water supply**
- **Properly locate and install injection sites**
 - **Macro-infusion:** 1 site per 0.5 in. of DBH
 - **Micro-infusion:** 1 site per 4 to 6 in. of DBH
 - Evenly spaced around tree in root flares, if possible
 - Select healthy tissue and avoid cankered or decayed areas
- **Use the correct pressure and do not over pressurize the system**

PROPER (L) VS. IMPROPER (R) PLUG PLACEMENT



SUMMARY

- **Types of tree injection systems**
- **Advantages of tree injection**
- **Disadvantages of tree injection**
- **Macro-injection**
- **Micro-injection and micro-infusion**
- **Soil injection and soil drenches**
- **Basal bark sprays**
- **Uses of tree injection**

END OF PRESENTATION

The background of the slide features a repeating pattern of stylized, overlapping leaves in various shades of brown and tan. The leaves are rendered in a flat, graphic style, creating a textured, autumnal effect. The overall color palette is warm and monochromatic, ranging from light beige to deep chocolate brown.