

A portable pressure-injection machine has proved to be an effective means of treating pear trees for pear decline and may also be useful for injecting other materials into other trees.



A pressure machine for injecting trees

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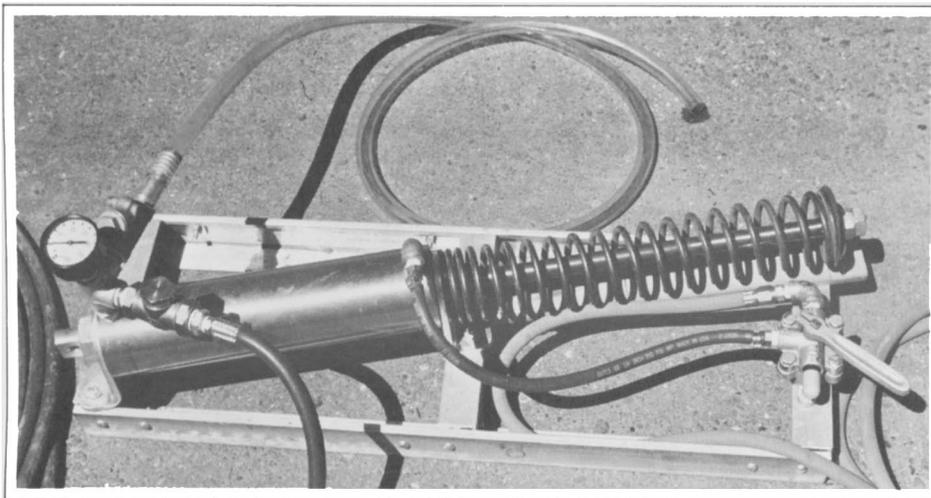
Pressure injection of an antibiotic into pear trees now can be accomplished quickly. University of California researchers have evaluated several types of injection equipment in three years of experiments, and a practical machine for field use is described in this article.

Injecting antibiotics and micro-nutrients into trees has been practiced for many years, and methods and apparatus used have been modified to suit the particular treatment. Early workers applying Terramycin for pear decline

developed the infusion (gravity flow) method, which uses two plastic 1-gallon jugs and six tubes per tree. The equipment was bulky, required several hours per tree to use, and sometimes leaked, thus reducing treatments to some trees. To overcome these problems, a machine was developed for pressure-injecting treatment material quickly and efficiently.

Injection machine

The portable machine consists of a 1-quart-capacity, two-way hydraulic cylinder, an air-pressure cylinder, a liquid storage tank, feed hoses, and a three-way valve. The hydraulic cylinder has a three-way air valve connected to the air-pressure source on one side. Two one-way check valves connect the base end of the cylinder to the supply tank and to the distribution hose. This hose is connected to the tree by hollowed wood screws. On the hydraulic ram, a shock-absorber coil booster spring is attached between the frame and the end of the shaft to recharge the system automatically with liquid (solution) after air pressure is released. Nitrogen gas or compressed air is used to deliver the desired pressure to the cylinder. (*Caution: Oxygen must not be used because of the chance of explosion.*) Tests have shown that 200-pound pressure can be used without damaging trees.



Cylinder, valves, and pressure gauge of injection machine.

A hollowed, tapered, wood screw (No. 24x3-inch) with a quick coupler attached has proved to be the most practical type used as an injection screw. The head is cut off and a $\frac{1}{8}$ -inch hole drilled down the length of the screw. The shaft is then threaded to a $\frac{1}{8}$ -inch pipe thread, and a $\frac{1}{8}$ -inch quick coupler is attached. The quick coupler should have a check valve to prevent backflow of material after treatment.

An injection machine costs about \$500 for parts, material, and labor. Nitrogen tanks are generally rented from the supplier. Several sets of injection screws are necessary so that the operator can continue working on additional trees while the pressure within the previously treated tree stabilizes. Approximately 2 to 5 minutes are required, depending on time of year, before the injection screw can be removed from the tree without any backflow.

Injection procedure

To get treatment material into the tree, injection holes are drilled $2\frac{1}{2}$ to 3 inches deep. The injection screws are inserted as shallowly as possible into the drilled holes, and the supply hose is coupled to the screws. A chamber is created in the tree wherein the liquid treatment material comes in contact with the water-conducting tissue (xylem) of the tree. Liquid material is transported much more readily in the newest woody tissues of the tree directly beneath the bark and cambial area.

Three holes per mature pear tree are generally adequate for pressure injection and provide for even distribution of material throughout the tree. More injection holes must be drilled in extra-large trees or trees with multiple scaffolds, in which case, three holes can be treated each time until all holes are treated. Also, more leads can be added to the distribution hose from the cylinder to treat more than three holes at a time.

In the fall, 1 quart of fluid can be injected through three injection sites into a mature pear tree in less than 1 minute. Injection takes longer in early morning or at night than it does in the afternoon. Trees under slight water stress can be injected faster than those not under stress. A cloudy humid day also increases the time required for injection.

Pressure injection of Terramycin causes remission of pear decline symptoms comparable to remission achieved by the infusion method. In several tests,

no response differences between the two methods were observed. Trees injected by both methods generally showed good growth response after treatment. In the fall of 1975, approximately 70,000 decline-affected pear trees in California were pressure-injected with Terramycin by commercial applicators and growers using the injection equipment described. Results were comparable to those achieved by growers using infusion equipment.

Bactericides and fungicides have also been injected into cherry, peach, apple, almond, walnut, and olive trees with favorable results. Trees with hard wood (such as walnut or olive) require more time to inject than do trees with softer wood (pear or peach).

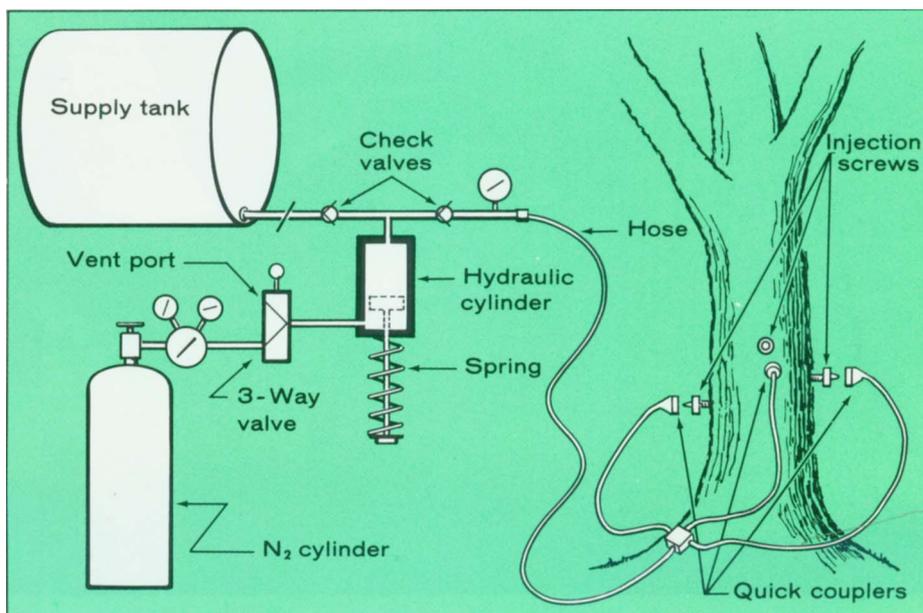
Treatment of minor nutrient deficiencies is another potential use for pressure injection, and most of the species mentioned above, plus plum, prune, pecan, liquidambar, and eucalyptus, have been injected with iron and zinc. In some trees, visual greening of chlorosis within the leaf occurred about 1 month after treatment with iron. However, additional experiments are needed to evaluate the long-range effect of nutrient correction through pressure injections.

Pressure injection of insecticides for control of sucking insects may also be useful. Many shade trees are attacked by aphid and scale insects, whose sticky exudate is highly objectionable. Spraying these trees is time consuming or im-

possible because of location, health hazards, and expense. Systemic insecticides injected into the tree could kill the insects without causing adverse environmental effects. This method would fit very well into an integrated pest control program in which only the insects causing tree damage are killed. Non-target beneficial insects living within the tree canopy are not likely to be harmed by this type of chemical treatment, and therefore, a buildup of insects predacious to pests could be encouraged.

Many of the ideas presented here need to be tested more thoroughly before specific recommendations can be made. Where pesticides are involved, residue levels and efficacy data are needed before permits for use can be requested from federal and state regulatory agencies. At the present time, the California Department of Food and Agriculture has granted a permit for pressure-injection treatment of pear trees using 1 quart of 600 ppm Terramycin to control pear decline.

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Essential parts for pressure-injection machine. Fittings necessary to connect parts are not shown; fittings vary, depending on brand or size of the components.