Rooting Cuttings Under Mist

species adaptable to mist propagation can be rooted rapidly and in high percentages while requiring but little attention

H. T. Hartmann and John E. Whisler

Certain varieties of peach, plum, apricot, cherry, pear, grape, olive and lemon—as well as many woody ornamental species—have been propagated by cuttings under mist in percentages high enough to make this method commercially feasible. However, there is considerable variation—among varieties within a species—in the ease with which cuttings can be rooted even under mist.

The recently developed practice of rooting cuttings under water mist sprays not only keeps the humidity around the cuttings at a high level, but the continuous film of water on the leaves lowers their temperature which aids in reducing the undesirable water loss from the leaves. Ordinary propagation beds can be used in setting up mist equipment, either in the greenhouse to be used in summer and winter, or out-of-doors in a lath house or in the open sun for use during the warmer months of the year. Nozzles placed over the beds are spaced to produce a fine, foglike spray that completely covers the bed.

Intermittent mist seems to be more satisfactory for most plants than continuous mist. It is only necessary to keep a film of water on the leaves. Applications of water in excess of this seem to be of no value while tending to reduce the temperature of the rooting medium to undesirably low levels. The best practice for most plants is to apply the mist only during the daylight hours and then just intermittently. The on and off intervals can be short, the mist wetting the leaves thoroughly, then shutting off until the leaves start to dry. Various automatic devices are used for controlling the water.

Cuttings of fruit species rooted under mist. All treated with indolebutyric acid at 4,000 ppm by the concentrated-solution-dip method. *Top left:* Fay Elberta peach; *right:* Santa Rosa plum. *Bottom left:* Tilton apricot; *right:* Bartlett pear.

Two basic types of spray nozzles are available, the oil burner, whirling action type, and the deflection type. The oil burner nozzle is inexpensive, produces an evenly distributed fine spray and uses a relatively small amount of water. The mist is produced in this nozzle by water passing through small grooves set at an angle to each other. This type tends to clog easily and drip excessively when the water is shut off.

The deflection nozzle develops a mist by a fine stream of water striking a flat surface. The larger aperture used in this type greatly reduces clogging but uses considerably more water. This nozzle usually covers a greater area than the oil burner type so that fewer need to be used. It also operates on a low water pressure more effectively than the oil burner type.

There are several methods of placing the water pipes to which the nozzles are attached. One is to lay the main feeder pipe down the center of the bed below, at, or above the surface of the rooting medium, with the nozzles at the end of risers from this pipe. Another method is to place the feeder pipe well above the cuttings—either one pipe down the center of the bed or two pipes, one along each side—with the nozzles directed downward into the bed. Whatever arrangement is used the nozzles should be placed close enough together and the water pressure should be high enough so that the entire bed is completely under the mist. Rooting is likely to be unsatisfactory unless the mist actually wets the leaves.

In outdoor installations some type of protection is usually necessary around the bed to prevent strong winds from blowing the mist away and drying out the cuttings.

The frequent operation of the water line to supply an intermittent mist requires the use of an electrically operated solenoid valve, preferably the nor-

Concluded on page 12

Mist beds in use for rooting leafy cuttings. *Left*—Bed in open sun; and *Right*—Bed in a lath house.

APHID

Continued from preceding page

tions is partially a matter of experience. It is difficult to base applications on aphid numbers because of difficulties encountered in making accurate counts and because of large variations in numbers from day to day and place to place within a field. Seedling plants are especially susceptible to injury and although one aphid will not kill a very tiny plant, treatments must be made when the population averages one—or more—aphid per seedling.

Damage can be prevented in hay fields by basing applications on the general appearance of low quantities of honeydew. This, plus an increasing aphid population, indicates the need for prompt treatment.

If aphids are counted, treatment is necessary when the count over the field averages approximately 20 to 40 aphids per stem. At times a lower population, which persists, even though not increasing rapidly in numbers, will have to be eliminated to prevent the gradual accumulation of honeydew. This pest seems to do better on the more succulent hay alfalfa than it does on seed alfalfa. It must not be allowed to defoliate or gum up seed alfalfa plants unduly with honeydew. The same general rules governing need for treatment on hay fields apply to alfalfa grown for seed production. When insecticides are needed, application must not be delayed.

The alfalfa grower must keep aware of aphid development within his field. During critical periods, frequent inspections—preferably at two-day or, at the most, three-day intervals—are required. The plants must be examined gently because of the tendency of the aphid to fall or jump off the plant. The aphid prefers the lower leaves of the plant so they should always be observed.

If not used properly malathion—and particularly parathion — may cause severe mortalities among pollinating insects. When no bloom is present in the field usually there is little hazard. However, when there is a shortage of normal bee forage, they are attracted to aphid honeydew and to weeds in bloom within the alfalfa field. Tests have shown that both insecticides will kill bees present in the field at time of application, and that parathion will continue to kill bees coming into the field for a few hours after treatment. Applications of either material should be restricted to the hours when the bees leave the field in the evening until they return the following morning.

Beneficial insects which feed on the spotted alfalfa aphid—lady beetles, green lacewings, hover flies, and several other kinds of insects—are important factors in the control of the spotted alfalfa aphid. In most areas when weather conditions are favorable for the aphid, the beneficial insects are not capable of holding the aphid in check. However, the beneficial insects help delay and will occasionally prevent aphid build-up. Proper timing of treatment, and use of minimum amounts of insecticide for good aphid control, reduce the hazard to beneficial insects.

Systox, when correctly used on seed alfalfa, is relatively safe insofar as beneficial insects—except lady beetles—are concerned.

Sprays are more effective than dusts and reduce the problem of insecticide drift. Sprays applied by either air or ground equipment are satisfactory providing a thorough job of coverage is made. Airplane sprays are generally applied at rates ranging from five to 10 gallons of water per acre and the swath width should not exceed 35 to 40 feet. The use of flagmen is essential. Sprays with ground equipment vary greatly in gallonage of water applied per acre, but excellent results have been obtained with rates ranging from 10 to 20 gallons per acre applied at pressures of from 40 to 60 pounds per square inch.

Harold T. Reynolds is Assistant Entomologist, University of California, Riverside.

Ray F. Smith is Associate Professor of Entomology, University of California, Berkeley.

John E. Swift is Extension Entomologist, University of California, Berkeley.

The above progress report is based on Research Projects Nos. 1330 and 1443.

CUTTINGS

Continued from page 7

mally open type. With this valve a power failure would simply mean a continuous mist. With a normally closed solenoid, on the other hand, a power failure would cut off the mist entirely, which—in a bed in the open sun—could soon result in the death of the cuttings.

An electrically operated timer—successfully used this past season—has two timers acting together. One timer turns the entire system on in the morning and off at night. The second timer operates the system during the daylight hours to produce an intermittent mist—at any desired combination of timing intervals—such as 40 seconds on and 60 seconds off. This type of control mechanism is relatively foolproof and while it does not automatically compensate for variations in humidity conditions, it can be adjusted closely enough to give entirely satisfactory results.

Various difficulties often arise in operating a mist propagating bed. One of these is the lack of sufficient water pressure to properly operate the nozzles. This can be overcome by installing a small electrically operated rotary booster pump between the water source and the solenoid valve. If there is much sand in the water it is advisable to install filters in the supply line which will reduce clogging in the nozzles.

In propagating cuttings under mist it is essential that a well drained rooting medium, such as sand or vermiculite be used. In addition the bed should be raised or equipped with drainage tile, to provide for ready removal of excess water.

Moving the cuttings, once they are rooted, from the very moist conditions of the mist to a drier environment must be done carefully. This is probably handled best by gradually withholding the mist—decreasing the on periods and increasing the off periods—until the cuttings are able to survive without the mist. The rooted cuttings may then be potted or left in the rooting medium until the dormant season when they may be more safely dug.

Mist propagation permits the use of soft, succulent, fast growing cutting material taken early in the season which is often more likely to root than more mature hardened wood taken later in the season.

In tests at Davis the use of root-promoting hormones—particularly indolebutyric acid—has been almost indispensable in obtaining satisfactory rooting of the species used, even under mist. Considering the ease of application and effectiveness in stimulating rooting, the concentrated-solution-dip method of application has been the most satisfactory to use. By this method a fairly concentrated solution, 4,000 ppm—parts per million—to 5,000 ppm of the chemical in 50% alcohol is prepared. The basal ends of the cuttings are dipped in this for about five seconds just before they are inserted in the rooting medium. If the cuttings have been prepared in advance it is advisable to make a fresh basal cut just before they are dipped.

An approximate 4,000 ppm solution of indolebutyric acid can be prepared by dissolving a level one fourth teaspoon of the pure crystals in three and one third fluid ounces of 50% alcohol. Rubbing alcohol can be used satisfactorily. This solution will keep indefinitely without losing its effectiveness but should be tightly sealed and stored in the dark.

H. T. Hartmann is Associate Professor of Pomology, University of California, Davis.

John E. Whisler is Laboratory Technician, University of California, Davis.