OFFSETS AND CUTTINGS

The difference between offsets and cuttings is that offsets are broken at natural points from the parent plants while cuttings are cut to a desired length. It is important that all cuttings are taken with a sterile knife.

Soil, light, and heat. Both offsets and cuttings require a very light, well-drained soil. They both need about 50% shade and a greenhouse temperature of 56° to 100°F, preferably on the warm side.

Healing. Healing is required on both offsets and cuttings to greatly reduce possible loss to fungus. Offsets require 2 to 4 days to heal while cuttings need 2 to 3 weeks.

Rooting. Offsets and cuttings can be rooted in the same manner although offsets have an additional method that can be employed.

1. General rooting of offsets and cuttings: Healed plants are planted directly into flats. The soil should then be kept damp but not wet.

2. Air rooting of offsets: The offsets are stood in a flat, side by side and left until air roots form. They're then planted and watered lightly, increasing the water as roots develop.

PESTS AND DISEASES

Insects. Spine mealy and root mealy bugs are the major insect problems of seedlings, offsets and cuttings. Treatment consists of 1 tbsp/gal of 50% Malathion. Offsets and cuttings taken from the field must be watched carefully for scale.

Damping-off. Nearly all cactus are very susceptable to damping-off fungi, particularly as seedlings and when rooting. Damping-off is treated by reducing drastically the amount of water the plants receive and applying a suitable fungicide. Captain, Benlate, and Truban are effective choices of fungicides.

PROPAGATION AT MONROVIA NURSERY COMPANY: SANITATION

DENNIS CONNOR

Monrovia Nursery Company
Azusa, California 91702

CUTTING PROPAGATION

At Monrovia Nursery, we employ specific sanitation procedures in our propagation department to produce as healthy a plant as possible. I will discuss the propagation department at Monrovia with emphasis on our disease control program.

Most of our plants are grown from cuttings which are obtained from our own container grown stock or from planted out stock. Any pruning or cutting wood collecting of disease prone plants such as euonymus, pyracantha, Nerium, etc. must be sprayed 24 hours in advance with 200 ppm Physan. This is accomplished with the use of our spray trucks or portable hose proportioners, depending upon the size of the area to be sprayed.

Cutting wood is collected by a crew of men and/or women, and placed in plastic bags for easy transport back to the propagation department. New plastic bags are used to collect the cutting wood of disease prone plants. Bags that are re-used must be washed in 30 ppm chlorinated water prior to use. The bags can easily be cleaned at the chlorine sinks located in the propagation department. Pruning shears are dipped with every few cuts in 200 ppm Physan, also.

As the cutting wood is being collected, it is wet down with water in the bags, and hauled by truck to storage refrigerators in the propagation dept. The refrigerators are cleaned weekly of debris and washed down with 200 ppm Physan.

As the cutting wood is needed, it is taken from the refrigerators and dispersed to the women who will make the cuttings in the cutting shed. The cuttings are prepared with the women's shears or knives, which are dipped every few cuts into 1000 ppm Physan. As each cutting is made, it is stored in the woman's own individual moist plastic tub until she has prepared enough cuttings to stick several flats at one time. Before flatting, however, the cuttings must be rinsed in a solution of 5 ppm chlorine. This is accomplished by putting the cuttings into a wire basket and immersing them into the chlorinated water sinks. The chlorination rinse is a continuously flowing setup with diaphrams connected to a chlorine tank. The amount of chlorine in the water can be regulated if desired. Holes in the back of each sink allow the water to flow continuously, forcing debris out and down the drain. This keeps the chlorine rinse water relatively clean and minimized, totally draining the sinks, and replenishing them. The continuous flow system also keeps the chlorine at its proper concentration as organic debris in the water is minimal. The chlorine will break down quickly if too much organic matter is present.

From the chlorine rinse, the cuttings are immediately rinsed in a Physan solution in adjoining sinks. We do not use chlorine or Physan on azaleas, as it tends to burn them. A 600 ppm solution is used on euonymus, pyracantha, *nerium*, etc. as their disease prevelence is higher. Most cuttings will be rinsed in 200 ppm, however. The Physan sinks have to be drained and

replenished as needed during the work day. Physan does not break down as quickly as chlorine. We are not using a continuous flow system with Physan due to its cost, where as chlorine is relatively cheap and economical. But, Physan is a better pathogen fighter than chlorine.

After the chlorine and Physan dips, the cuttings can now be dipped in hormone and stuck in our propagation media. The hormone we use is indolebutyric acid (IBA). Our IBA contains a methanol alcohol volume of 55%. We use a 1000 ppm, 3000 ppm, and a 6000 ppm IBA, depending on the type of wood to be dipped. The alcohol in the hormone aids in killing pathogens that could still be on the cuttings.

The propagation medium is 90% coarse perlite and 10% fine peatmoss. It is mixed by tractor with the use of a shredding machine. As mixing occurs, calculated amounts of gypsum are added to each cubic yard of medium, to supply enough calcium for callus and root formation.

Once the medium is mixed, it is put into new plastic flats by a flat filling machine. No pasteurized media is used as long as the peat and perlite are clean.

Now that the cuttings have been collected, prepared, washed, hormone-treated, stuck, and labeled properly, they are taken by vehicle to a waiting mist area located indoors and outdoors. The cutting shed is cleaned nightly of debris, and washed down with 30 ppm chlorine. All utensils, such as gloves, aprons, plastic tubs, etc. must be scrubbed as needed, including rinsing them in chlorine solutions and Physan solutions.

The mist propagating areas must be treated before new cutting flats can be set down on them. As rooted cuttings are removed to our hardening off area, beds and benches are cleaned before use again. Outside cement or gravel mist beds are cleaned of dirt and debris by washing them down with water, or by using rakes. Then 200 ppm Physan is sprayed on with hose proportioners. After that, a solution of Citcop 4E is applied. We use sprinkling cans and broadcast it across the surface of the mist beds. Citcop is a copper salt fungicide of fatty and resin acids, metallic copper, and inert substances. Cuprous oxide can also be used. Copper sulfate is good to control algae on walkways, as is chlorine.

Glasshouse mist benches are washed down with a steam cleaner. Monrovia's machine produces 500 pounds of pressure and heats water to 210°F. It will remove algae and slime from benches, walls, and mist lines. After steam cleaning is finished, the walls and benches are sprayed with 200 ppm Physan and copper naphthenate. New and existing wooden benches in all

glasshouses receive a paint job of copper naphthenate also. We use 1 part copper naphthenate to 5 parts paint thinner. The thinner will soak into the wood, taking the copper with it. Paraffin is melted into the copper thinner mixture to somewhat seal the copper into the wood.

POTTING DEPARTMENT

When cuttings are rooted, they are taken to the hardening-off area. This is also treated with Physan and Citcop. After the cuttings have been hardened off for at least 7 days, they are ready to pot. Most potting is done in our potting shed. Flats of rooted cuttings are loaded onto rack trailers in the hardening-off area, and then hauled by jeep to the potting shed. Here a separate crew of women pull the cuttings from the flats. Top growth and roots are pruned; pruning shears are kept in containers of 75% isopropyl alcohol and 25% water. New plastic flats are used to hold the pulled cuttings until they are potted by another crew of women. Pots must be new, or used ones must be fumigated. We use 45 pounds of methyl bromide in a 2365 cu.ft. fumigation chamber. Potting soils are also fumigated with 99.5% methyl bromide (with 5% chloropicrin included as an indicator) for 24 hours. The potting shed is washed down nightly of debris, and sprayed down once a week with 200 ppm Physan. Newly potted liners are taken to glasshouses or lath house. Lathhouse liner beds are treated with Physan at 200 ppm and Citcop also.

GRAFTING DEPARTMENT

Most of our grafting is done during the winter months. Almost all of the benches in the glasshouses are converted to grafting tents, made of new 4 mil plastic. The benches are treated with copper naphthenate before wax paper and a moist peat moss base is laid down. Captan is used when the peat moss is being mixed, and applied again on the surface of the peat moss after it is put into the tents. The tents are used mainly to graft junipers and Southern magnolias. Grafting knives are dipped every few cuts in Physan of 200 ppm and in isopropyl alcohol, 75% full strength. Scionwood is collected in the field, put into clean bags and kept refrigerated. Before use, the scionwood must be rinsed in 5 ppm chlorine water and in 200 ppm Physan. Grafting tents that are filled with grafted material are opened every morning and checked for disease, and to promote air circulation. Large fans and cooling pads are used also to circulate air in the grafting houses and most other propagation houses, as well as controlling the air temperature.

FERN PROPAGATION

Except for a few cultivars, our ferns are grown from spores. New wood or plastic flats, are filled with spaghnum moss then steam pressurized at 180°F for two hours. The spaohnum flats are then placed on Physan-treated benches and planted immediately with the spores. They are then covered with plastic lids to keep moisture in and minimize the settling of air-born fungal and bacterial spores on the surface. All potting soils in fern propagation are fumigated with methyl bromide, and only new or fumigated pots are used. Ferns grown from plantlets, as *Asplenium bulbiferum*, must have the plantlets washed in 5 ppm chlorine and 200 ppm Physan before planting.

SEED PROPAGATION

Most of our seeds are bought from other companies but any seed that we collect is cleaned and inspected for disease. All seeds, whether bought in or collected, are surface-treated before planting with Thylate, a fungicide. The seed planting medium is put into wood flats and steam pasteurized at 145°F for two hours. After the seeds have been planted, a thin layer of silica sand is put over the surface of the flat. The sand, being inorganic and quick drying when the flats are watered, minimizes surface fungal growth.

CONCLUSIONS

Monrovia is continuously researching new and better ways to control disease throughout the nursery. Insect control is important also, as insects may carry pathogens from plant to plant. Future research projects for the propagation department include a chlorinated mist system. Disease prone plants may have to be kept continuously immersed in Physan solutions from the time they are collected in the field to the flatting of the prepared cutting in the cutting shed.

NEW VISTAS IN PLANT PROPAGATION

HUDSON T. HARTMANN

Department of Pomology, University of California
Davis, California 95616

The plant propagator and the nursery industry are in the most fortunate position of being able to benefit from the result of research in many disciplines and many applied fields.

Plant breeders are continually developing new plant material, some of which eventually becomes important in the nursery trade. Plant introduction programs and arboreta often bring