were taken and stuck on 1 March. Hormone treatment and bottom heat were identical to fall cuttings. The rooting was more spontaneous and after planting established much quicker with a more uniform stand. Both cutting times were planted within 2 days into the field. We will repeat this procedure in the coming year to determine if it is consistent year after year. We will undoubtedly reduce the number of fall cuttings considerably and concentrate on early spring. Although making cuttings in the spring may not be as convenient for us as in the fall, the extra effort will result in extra stock that establishes and grows better.

These are the methods we use for fruit tree rootstock production and they have served us well. We will continue to strive for increased production efficiencies both in numbers and labor in the future to continue to supply the understock necessary for the trees of the future.

Sanitation for Clean Liner Production

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HISTORY

Briggs Nursery produces 7 million plantlets from tissue culture on an annual basis. At any given time 2 to 4 million plants are either in rooting or in a production phase.

At Briggs Nursery plants are always being sold or moved and by utilizing facilities and personnel on a year-round basis the empty houses are continuously being refilled.

The threat or potential for diseases, weeds, liverwort, and/or mosses is always present. Some of the disease organisms that are a concern are: *Botrytis, Fusarium, Rhizoctonia, Cylindrocladium, Phytophthora, Theiophis*, powdery mildew, downy mildew, rusts, leaf spots, and mushrooms.

Where disease organisms originate, how they spread, and what causes flare-ups remains a mystery. The nursery has used consultants and research people to help pinpoint sources of contamination. Their recommendation is always the same: maintain cleanliness and use good water management.

WHY SANITATION IS IMPORTANT

Without good sanitation procedures disease problems are unavoidable. Sanitation needs to start at the beginning of the crop growing cycle and to be carried through to the end. Sanitation steps should be practiced on benches, flats, containers, soils, propagation areas, trailers, and all growing structures. All of the above, if not monitored for cleanliness, can cause the spread of disease and liverwort.

METHODS

All growing/propagation flats and pots should either be new or cleaned and sanitized thoroughly. Any soil particles left in flats or pots have the potential to harbor disease spores. At Briggs Nursery flats are reused only after being washed and sanitized. Pots are never reused because the possibility of leaving behind soil particles is too great.

Sanitizing agents that have been used have chlorine as the base. Greenshield Saniquat, Zero Tolerance, and Clorox are examples. The use of disease-free growing media is important, especially in liner production where plantlets are either rooting or have very fine root systems.

At Briggs Nursery peat moss, perlite, pumice, and bark in different combinations, make up the rooting or growing media. All these products are either steamed or come from clean sources.

A biological fungus is added along with fertilizer to the raw ingredients and blended together to make the soil media. After blending, flats and pots are filled and transported to either propagation or liner transplant departments.

At each of these departments, floors, benches, and tools are cleaned daily with a sanitizing agent. All trailers used to transport flats of liners are hosed off between loads. Propagation benches are cleaned and sanitized between crops. All sprinklers and riser pipes are taken off and put into a sanitizing agent and scrubbed to eliminate algae and disease.

After the benches have been cleaned and risers and sprinklers put back, a sanitizing agent is applied and a copper spray is used.

Liner houses are treated the same as the propagation area except for the following differences. The houses are emptied of plant material and the skiffs (which are 1-inch wooden frames used to keep flats off the ground) are removed. The houses are swept and washed out before clean skiffs are put into place. The walls, floors, and skiffs in each house are sprayed with a sanitizing solution and then a copper spray is applied. The house is then closed, allowing heat to build up until the new cycle begins.

When the house is needed the doors are opened and plants are put into place. The growing of these plants begin with watering, nutrients, and maintenance.

Disease organisms, liverwort, and mosses thrive in similar conditions, i.e., high humidity, nutrients, and an open wound to spread and grow. A prevention program using biological, chemical, and other methods is established and practiced.

Constant monitoring for disease is very important at Briggs Nursery. All growing crops are walked and monitored on a weekly basis, or more frequently, and any problems are promptly handled. To discourage chemical resistance build-up by organisms and to be caring of the environment, we prefer to treat smaller areas than to do a spray of all growing areas.

Liverwort and mosses have become a real problem in the last 2 to 3 years. Many chemicals along with top dressing materials have been tried, but all seem to have phytotoxicity or other problems.

It is very important that insects like fungus gnats and shore flies are controlled both to stop the spread of disease and to protect new roots. To accomplish this, both biological and chemical means are employed. Predator mites are released monthly, plus weekly sprays are used.

CONCLUSION

Cleanliness and sanitization at Briggs Nursery is one of the most important aspects of growing healthy, saleable liners. Constant monitoring by observant growers and the responsible use of chemicals makes Briggs Nursery liners disease- and problem-free, while protecting the environment.