treated with copper sulfate and it appears to be holding up very nicely

I checked back with the nursery where we had first seen the concrete benches, built in 1974, using polyethylene tubing instead of copper tubing. I was told that the polytubing has disintegrated to a point where the benches are totally inoperative. They looked so beautiful and had inspired us to build ours. I think we had good advice. It seems that the high initial cost of concrete benches containing copper tubing with circulating hot water would appear to provide us a propagation facility which is durable, safe, sanitary, low maintenance and economical to operate. While more costly to install initially than electric heating cables, they can be operated with an energy cost that is about ¼, using natural gas, than would be the case using electricity. As energy costs seem destined to continue to rise, we will consider use of solar panel boosters.

We are able to produce disease-free plants which come out at 80 to 85%. We've had these benches in operation now through three crops and have put through almost 375,000 trees, bringing the capital cost per cutting down to only about 2½¢ each in only three years. In considering that these benches will probably last 25 or 30 years, the investment appears to be warranted.

Thursday Afternoon, December 10, 1981

The Thursday afternoon session convened at 2:30 p.m., with Hugh Steavenson serving as Moderator.

COMMON SENSE IN PLANT PROPAGATION

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It has been 20 years since attending my first Plant Propagator's meeting in Washington, D.C., and, after attending some 16 IPPS meetings and over 100 nurserymen's short courses, nursery tours and trade shows, the same question always asked is "what's new?" Plant propagators and nurserymen are always looking for that new chemical which gives 100 percent rooting, or the new fertilizer or pesticide that solves all problems, or the machine that ends all labor. One hates to disap-

point the inquirer, but the magic chemical or the magic machine still has not been found The successful propagator must continue to rely on "common sense" to solve plant propagation problems.

Prior to propagating any plant, there are questions or things to consider in the planning stage. First, what plants to propagate? Then, how many to propagate, how much propagation space is required, equipment and supplies needed, and the time involved? After these questions have been answered, then one has to decide if it is to their advantage to propagate or to buy seedlings, cuttings, liners or grafts. Only the owner or nursery manager with input from the plant propagator can answer these questions If the decision is to propagate, then more and more planning is required as to when to propagate, and what propagation medium and growth regulator to use

Knowing when and how to propagate a given plant can be found in various plant propagation books, IPPS publications, scientific and trade journals, and from other nurserymen and plant propagators. In gathering information, get all the available facts, and don't try to take short cuts. Any one change in procedure can affect other parameters and the result may be failure. Next assemble a list of supplies and chemicals needed for propagation and be sure they are on-hand before starting to propagate.

Another aspect that requires common sense is selection of propagation material Is the propagation material coming from stock plants, plants grown for sale, or from other nurseries or botanical gardens? In all cases, the plants must be properly identified; healthy, growing under proper nutrition, and disease, insect and weed free. Only quality plants and not left-over plants should be used for propagation. A common problem of many small greenhouse or bedding plant growers is propagating from plants not sold instead of selecting from the best plants When a grower does this over a couple of years, the entire crop may be of poor quality and the grower wonders why. If a stock block is developed, it should be near the propagation area where it can be properly cared for and not miles away

The propagating structures, greenhouse, cold frames, or outside beds should be properly constructed to make maximum use of the propagation space. The misting equipment, heating and ventilation controls should be all checked out to insure that they function properly. If bottom heat is used, is it working and is there uniform heat throughout the propagation medium? Use a thermometer to check the temperature in several places Cleanliness is a must, and this includes freedom of insects, diseases and weeds. Prior to propagation, the

medium and containers must be sterilized or disinfected. Clorox makes an excellent disinfectant when mixed 1 part Clorox to 9 parts water

The propagation medium should have all those desirable characteristics you already know such as: well-drained, holds moisture, porous, uniform, readily available, free of disease, insects and weeds, pH compatible to plant propagated, and one that can be sterilized without changing composition. Lack of a well-aerated or porous medium can be a major problem especially if very fine sand or other fine inert material is used. Water remains on top of the medium and contributes toward an abundance of algae.

The use of chemicals, rooting substances, fertilizers and pesticides are required for successful propagation In selecting a rooting hormone, a commercially prepared material may be purchased or one can buy the active ingredient, such as IBA and make their own solutions Select a rooting hormone that has been used successfully and at the recommended strength. A common problem is trying to use a concentration which is too strong and which injures the cutting Fertilization may not hasten root initiation, but will improve the subsequent growth of the rooted cutting. Fertilization may be by injection through the mist system or by using a slow release fertilizer in the rooting medium If used in the mist, remember that fertilizer is extremely corrosive to metal Perhaps it is human nature, but there is a tendency to believe that the more chemical used, the better the results. This is not so, as more cuttings, seedlings and liners are killed from too much fertilizer than from too little.

The propagation of cuttings using benches versus ground beds and flats versus pots depends upon the individual nursery. All methods have advantages and disadvantages. The decision depends on space, labor, costs and the overall method of production It appears that more nurseries are going to flats for rooting and growing liners as it is easier and therefore, cheaper to handle large numbers of plants as a unit. A critical point in inserting cuttings and potting of rooted cuttings, is not to put them too deeply into the medium. Results of planting too deep are readily seen by the development of a second root system near the surface.

Successful plant propagation does not come easily. It requires the knowledge of the why and how of plant propagation, knowledge of how plants grow and reproduce, and constant evaluation and re-evaluation of propagation practices. The most successful propagators are the ones who are the most careful about details and observe "common sense" in the propagation.

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PRODUCTION OF CONIFER SEEDLINGS

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There are many different things to consider in the production of evergreens from seed. I believe one of the more important is the source of the seed you buy For example, Douglas fir seed from the Rocky Mountain area of Colorado is hardy and has a medium growth rate. Seed of the same species coming from Oregon and Washington at elevations of 500 to 600 feet is much less hardy and has a far more rapid growth rate

Juniperus virginiana from mid western sources will be crossed with *Juniper scopulorum* and will not resemble the true eastern red cedar. White pine is available from New York the lake states and the south, for planting in northern areas New York and lake states seed is the most desirable.

A seedling business that is going to be successful should provide a continuing supply of seed selections each year. This can be a problem if you buy seed on a year to year basis and there is a no crop situation on one or more plants. To prevent this problem a grower should provide himself with some sort of refrigerated storage, then he can keep a year's supply of seed on hand to prevent shortages. Conifer seed in dry refrigerated storage of 34°F will retain its viability for several years.

Soil type is a very important consideration in conifer production. A well drained, light sandy loam soil is best for most conifers. This soil type provides for rapid drainage during wet periods and encourages the development of a more fibrous root system, an essential for survival when transplanting.