

30 to 50% of the original plants were lost to the same pathogens.

Reason: Recontamination of sterilized areas in the soil from contaminated areas that steam could not reach.

Solution: Use of raised beds in place of ground beds, where steam can completely sterilize all the soil in the bed. This resulted in construction of 8 miles of raised beds.

(c) In 1959 with the use of cultured cuttings from mother-block plants, planted in raised steam-sterilized beds, analysis at the end of 18 months blooming cycle showed that a very minute percent was lost to pathogens.

Today, the following procedure is followed to maintain clean cultural practice in raising carnations:

(1) All original cuttings procured from outside sources are cultured, even if they are from a cultured mother-block source. Mother-block plants are re-cultured. Culturing procedure described by James Tammen, R. R. Baker, and W. D. Holley, "Control of Carnation Disease Through the Cultured-Cutting Technique," 1956 Plant Disease Reporter Supplement #238: 72-76, is followed to obtain cultured cuttings for our mother-block plants.

(2) Mother-block plants are planted in August and discarded in July of the following year. Cuttings for our entire field plantings are taken from these mother-plants. Therefore, mother-block plants are handled separately and with the greatest precaution, not overlooking any detail which will re-contaminate the mother plants.

A very strict enforcement of the U. C. System of growing as described in University of California Manual 23 is used.

Once the plants are planted in the raised beds a good common sense sanitation is practiced to maintain the growing carnation plants for two years.

Never get over-confident and become sloppy once you have good clean culture practice. The minute you do, disease will spring up here and there to let you know. We know, because this has happened to us, more than once.

MODERATOR MAIRE: Thank you. Our final presentation in this section will be by Mr. Henry Ishida, who will discuss clean culture of foliage plants. Mr. Ishida.

PRODUCTION OF CLEAN CULTURED FOLIAGE PLANTS

HENRY ISHIDA

Union Nursery Company

Gardena, California

Perhaps the advantage of using clean culture, or better yet the U. C. System, in the production of foliage plants can be better shown by a relative newcomer in the foliage business such as myself, since I feel that we breezed into it without too many headaches or difficulties. I say the U. C. system, since it not only includes clean culture, that is, clean plant material and sterilization, but it also includes soil mixes, nutrition, mechanization and efficient practices.

I have been, and still am, primarily one of the larger bedding plant growers in this area. However, about two years ago with diversification in mind, we began the production of a limited variety of foliage plants. They are namely, pothos, grape ivy, other ivies, dracaenas, Chinese evergreen, palms, different varieties of philodendrons, varieties of ficus, and some dieffenbachias. Even before going into the foliage plant business, I had the opportunity of visiting many of the local growers on Farm Advisor tours and on other occasions. After deciding to go into this new line, I visited growers in Florida, Puerto Rico, and Texas with a few of my nursery friends and observed their different production methods. The growers there were all sizes, from extremely large operators to relatively small, and they used as many different methods as there were nurseries. In trying to evaluate the most practical, efficient, sanitary and economical methods, I discussed it at length with my friends, and finally decided to follow the method of a relatively small but very efficient local grower. It was necessary, to some extent, that this production system fit into our existing bedding plant facilities.

The bedding plant producers in Southern California are among the most progressive in the nation from the standpoint of clean production, mechanization and marketing. My nursery being as progressive as most, and having had the opportunity to work with the U. C. system since its inception in the early 1950s, this change-over of my greenhouse from bedding plants to foliage plants was not too drastic.

General sanitation practice in growing foliage plants is about the same as with our bedding plant operation. The soil mix is the same U. C. type "cake mix," except for the addition of 50% more humus, mixing and sterilizing in the same transit-type cement mixer, with the soil laboratory checking it out for nutrition. To fertilize, the existing constant-feed system is used with occasional supplemental feeding as with the bedding plants, following the recommendation of the soil laboratory. Pest control is taken care of by the commercial pest control operator who has been spraying our nursery for years. So, our main problem was the adjustment to the amount of water, humidity and the necessary shade. With the main headache of soil, nutrition and disease out of the way, it wasn't too difficult to learn the rest.

By using one of our main foliage plant item, Pothos (*Scindapsus aureus*), as an example, I'll take you through our production method. The cycle is from the propagating vine, cutting, rooting, potting, repotting for finishing, back to the propagating vine. Single leaf cuttings are graded very heavily for overall quality and color, since we feel that this is the cheapest stage to cull plants if it has to be culled at anytime. Cuttings are dipped in a solution of Panogen (or Morton's Soil Drench C) at the recommended dosage and rooted in a steam sterilized flat of a 60% perlite and 40% peat moss mix and placed on a copper naphthenated-treated bench in a steam-heated greenhouse. The plants are drenched periodically with a solution of Panogen through our 3/4-inch Smith injector for protective disease

*control. After rooting, the plants are again graded, then potted in sterilized 2½" clay pots filled with a mix of 75% humus U. C. type steam-sterilized soil, and placed in a sterilized flat on a copper naphthenated bench. The plants are constantly fed at every irrigation; a 2-inch Smith injector is connected to our water system. The soil laboratory checks the soil and plants at least once a month, with the fertilizer level altered according to their recommendation. All plants are protective sprayed for pests each week. A periodic drench of Panogen is applied for protective disease control, regardless of visible symptoms.

If for any reason, such as — by contamination — some plants are found to be diseased, the whole flat of plants is destroyed and the bench treated before any more plants are placed on it. The advantage of growing in flats is that it not only acts as a barrier against the spread of some diseases, but it also is easier to handle large quantity of plants at one time, when compared to growing plants individually on or in benches.

When the plants become ready for sale, they are again graded and sorted into different flats according to the length of the vine and the use of the plants. Pothos is sold as a single plant in the 2½" pot, repotted into a 3" pot as a double plant, triple in a 4" pot, four plants on a 16" pole in a 4½" pot, six plants on a 18" pole in a 5" pot, and eight plants on a 24" pole in a 6" pot, each plant fitting the size of the pot. Plants that are not salable, but have good characteristics, (but perhaps with a scratch or overgrown), are placed in a separate flat to be grown on as propagation material. These are moved to a separate house and grown in the flat on a clean bench in the original 2½" pot until they have from twelve to twenty-four or more leaves, depending entirely on the demand for the cutting. When cuttings are to be made, the whole vine from the base of the plant is cut off, the stub and the soil dumped, and the pots stacked in a flat for steam sterilizing and reuse.

By turning over our stock with each cycle instead of leaving a portion of the plants to regrow new vines, we feel that not only better quality plants can be grown, since older plants' tend to weaken, but it is also an easier method to control disease, salinity, etc., not to mention the ease in handling. The propagating material is a continuation of our production, not requiring the repotting of plants into larger container or the need to grow plants in beds to be grown solely for propagating purposes. However, all plants grown under this system must be handled under sanitary condition, as if it were all going into propagation. In some nurseries, propagating material is grown in grounds bed or benches where contamination is a problem, then lifted up on to clean benches and into sterile medias, whereas with our system, the propagating material never leaves a clean bench.

The advantages of a production method such as the U. C. system can be applied to different types of plants with little modification. It is a simple, sanitary, efficient, practical and economical system.