RESEARCH RESULTS for NURSERYMEN

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I. IRRIGATION STUDIES

Efficient irrigation of container-grown woody plants involves determining the time moisture should be applied as well as distribution of water. Some aspects of these problems were studied in experiments during 1962.

Solar Energy and Irrigation:

Determination of the time to apply moisture to container plants generally has been on the basis of grower experience. Results from earlier experiments have shown that depletion of moisture from soil in the container (evapotranspiration) is correlated with the amount of solar energy. Studies were conducted in 1962 to determine whether this measure might be used on a practical basis.

The instrument to determine solar energy was a simple, photoelectric device constructed for less than $30. It was developed by Tukey, Fluck, and Marsh and is reported in Volume 75 of the Proceedings of the American Society for Horticultural Science, pages 804 to 810. With this instrument the amount of light energy is recorded on a counter as an accumulated total.

1. Under greenhouse conditions, a study was conducted at Auburn, Alabama, with plants of Azalea 'Coral Bells', *Camellia japonica* 'Pink Perfection' and Leatherleaf Mahonia. Control plants were irrigated when it was considered necessary by an experienced grower. Treated plants were irrigated after a definite amount of light energy was recorded. Three levels of light energy accumulation between irrigations were studied. At the end of 6 months, the weights of the tops of the plants were determined.

In all cases the largest plants were obtained when irrigation was based on light energy at the lowest (1x) level. The next largest plants were from the medium (2x) level of light energy for Azalea and Camellia and from the control treatment for the Mahonia plants. The smallest plants were from the highest (4x) light treatment in all cases.

2. Irrigation of container plants outdoors was also studied, using 1-gallon plants of Roundleaf Japanese Holly, Devilwood Osmanthus, Burford Chinese Holly, and Gardenia. This study was begun in August and continued through November. Two levels of light between irrigations were compared with control plants on the number of irrigations per month. When rainfall was 1 inch or more for a 24-hour period, the calculation of light energy between irrigations was reset to zero.

The number of irrigations at the lowest (1x) level of light was identical to that of the control treatments throughout the test period. While growth measurements were not taken, observations indicated that there was little if any difference in size and grade of plants in these two treatments. When light at the high (2x) level was used, its irrigation frequency was one-half that of the control treatment. These plants were smaller.

On the basis of these experiments, solar energy measurements can be used as a practical guide to determine the need for irrigation of container grown plants.

Irrigation Systems:

Irrigation of container plants has been depended on the use of overhead sprinklers of varying types. With overhead irrigation there is a waste of water since the water is spread over an area, only a small portion of which is occupied by the containers. Also, since the water falls onto the top of the plants, it is often difficult to get water through the dense crown of many plants and into the container soil. Wetting the tops of the plants also can lead to greater disease problems by creating conditions conducive to infection and development, by splashing spores to other plants, and by washing off applied insecticides and fungicides.

Several greenhouse pot watering systems have been developed. Essentially, all consist of plastic tubing to conduct water to each container from a header or distribution pipe. The systems have been developed so that there is fairly uniform distribution of water from each outlet. The size of the tubing determines the flow or volume of water, and consequently the time necessary for irrigating.

One of these systems, known as the Chapin Add-a-Header system, was studied under field conditions for watering container-grown woody plants. Conventional overhead sprinklers were used for comparison. Test plants included Roundleaf Japanese Holly, Llex cornuta rotunda, Burford Chinese Holly, Devilwood Osmanthus, Camellia japonica, Azalea, Pfitzer juniper, and Gardenia. The plants were potted in the spring, and growth observations were made in the fall.

On the basis of survival and growth of the test plants, there were no plant differences as a result of the irrigation systems. The pot watering system overcomes the difficulties of overhead irrigation as previously described. Other advantages of this system may be listed as follows: (1) The length of irrigation and, consequently, the amount of moisture applied can be programmed to be automatic by the use of suitable valves and electrical controls. (2) Because of the small volume of water needed for each tube, many plants may be irrigated at the same time. The exact number, of course, will depend on the volume of water available. (3) The cost of installation is quite low.

Some difficulty was experienced with this system. Because of the small tube opening, some stoppage of the tubes was experienced, particularly when a strainer was not used in the line to remove soil or other particles. There was also difficulty in being certain that the workers replaced the tubes properly after weeding. The life of the system under field conditions has not been determined.

Another disadvantage is that the pot watering system requires slightly more time in setting up the containers and placement of the tubes.

II. FERTILIZATION OF CONTAINER-GROWN PLANTS

Constant feeding, that is the application of a dilute fertilizer solution at each irrigation, resulted in excellent plant growth and quality. These plants were as large or larger than plants fertilized by other methods. Foliar feeding, biweekly applications of an 8-8-8, and monthly applications of urea-formaldehyde nitrogen and 0-8-8 were used for comparison.

At the concentration used of 1 ounce of a 20-20-20 fertilizer in 15 gallons of water, however, plants of Camellia japonica, Devilwood Osmanthus, and Pfitzer Juniper were killed by overfertilization of the small plants used for this study.

Applying urea-formaldehyde nitrogen plus 0-8-8 at monthly intervals resulted in excellent plant growth. Likewise, applying 8-8-8 biweekly to each container resulted in excellent growth. The quality of the plants in these two treatments were equal, but there was a slightly greater loss of plants from the biweekly fertilizer treatment, particularly camellia and juniper plants.

More plant growth occurred when overhead irrigation was used with foliar feeding. This suggests that considerable benefit was derived from the fertilizer being washed off the foliage and into the soil. It is also possible that frequent wetting of the foliage resulted in greater absorption of the nutrients through the leaf.

A concentration of 1 ounce of a 23-21-17 foliar feed fertilizer applied weekly was not as effective as soil applications of fertilizer, using plant size as a criterion. Survival of plants was excellent, and they did not show signs of nutrient-element deficiency.

III. CHEMICAL CONTROL OF GROWTH

Chemical treatment of cut camellia stems did not induce the flower bud to open. Chemicals studied alone or in combination included gibberellic acid (K salt), vitamins, chelating agents, kinetins, and auxins. There were indications that an auxin dip induced some development of the isolated flower bud, but the abscision layer formed and the bud dropped before complete development.

Application of CCC as a soil drench induced greater flower bud formation of small liners of Camellia japonica, varieties Professor Sargent and Mrs. Charles Cobb than untreated plants. Soil applications at the time growth began were more effective. Applications up to 4 weeks after grwoth began were also effective. Rate of application of 0.2 grams per plant, 1 plant in a 4-inch pot, was more effective than higher application rates.

The CCC treatment was more effective on plants of the variety Mrs. Charles Cobb than on the plants of the variety Professor Sargent.

Spraying large plants of Camellia japonica in 2-gallon containers every 3 to 4 days with the potassium salt of gibberellic acid resulted in earlier flower development than untreated plants. The plants that had been grown outdoors in the field and were reset in cans during the fall.

Spraying Auburn grown Azalea plants every 4 days with a 500-ppm solution of the potassium salt of gibberellic acid resulted in early flowering without cold treatment. This was true of the varieties Coral Bells and Jean Haerens that had been grown in pots and brought into a greenhouse in late October for forcing. Treated plants began flowering in early December.

Additional azalea plants from regular nursery production were obtained in mid-November and gibberellic acid treatment was begun November 20. These plants, (varieties Snow, Hino, Coral Bells, and Coral Bells Supreme) were in flower in late December and early January when sprayed with a 500-ppm solution of gibberellic acid (K salt). They were not fully developed for Christmas. In all cases, the 4-day treatment was superior to a 2 or a 7-day treatment.

The stage of development of the flower bud was important in determining the speed and degree of opening. The older, mature buds developed rapidly while younger, less mature buds on the same shoot did not develop or developed slowly.

IV. PROPAGATION

During the spring (April-May), long-day treatments by use of low intensity incandescent lamps increased the rooting response of softwood cuttings of Low Dense Pyracantha and Dawn Redwood. At the same time the rooting of Azalea and Ilex cornuta rotunda was reduced. The rooting of Burford Chinese Holly was not influenced. In all cases the stock plants had been outdoors under normal weather conditions.

V. STORAGE OF DECIDUOUS PLANTS

Deciduous woody ornamentals must have a minimum period of time in cold temperatures to ensure dormancy break of the vegetative and flower buds. Tests to determine chilling requirements for a group of deciduous plants resulted in the following minimum periods:

Eastern Red Bud	480 hours for flower buds, over 1200 hours for vegetative buds
Forsythia	240 hours for vegetative buds
Althea	480 hours for vegetative buds
Sweetshrub	480 hours for vegetative buds
Crapemyrtle	480 hours for vegetative buds
Magnolia soulangeana	720 hours for vegetative buds

Enriching the storage atmosphere with carbon dioxide delayed sprouting of plants in sealed containers at room temperature. Shoot growth after the plants had been removed from the containers and planted was also delayed.

Spraying dormant shrubs at the time of planting with a growth retardant generally had little effect on time of shoot growth. Certain concentrations of the retardants were stimulatory to total shoot growth with some plants. Higher concentrations resulted in reduced linear shoot growth.