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JOERG LEISS: Did you compare lateral with apical cuttings?

FRED MILLER: Yes. Lateral cuttings were a problem because they continued to grow as lateral branches.

UTILIZING CAPILLARY IRRIGATION FROM THE PROPAGATION BENCH TO HARVEST

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The concept of capillary watering is an age old practice but its application to irrigation of container-grown nursery stock on ground beds outside is a new use in the U.S. This method of watering nursery stock had its beginning at the Efford Experiment Station in England and is now in widespread use in Europe (12) and New Zealand (7). Capillary watering has several advantages to overhead watering including reduced water consumption, water run-off, weeds, root (5) and foliar diseases. This procedure has been evaluated at The Ohio State University for the past several years and the following report summarizes several of these studies (10,11).

BED CONSTRUCTION

The capillary beds were constructed 5 ft wide by 50 to 100 ft long. Studies were conducted on a soil or gravel base with a slight crown along the main bed axis to provide drainage away from the capillary mat or base. A layer of white or black poly is placed over the soil or fine gravel which had been smoothed. Poly film of at least 4 mil. thickness retains the moisture and allows its distribution under the mat or base. The capillary mat or sand is placed on the poly. Two lines of Chapin twin wall trickle tubing were placed on the mat or sand and operated at a pressure of 4 to 6 psi for several hours per day. To eliminate labor the trickle tube was operated with a time clock and solenoid valve. The plants were placed on the mat or sand. Thus, a hydrant or source of water and an electrical outlet are necessary to operate the system as outlined above. No sideboards are necessary for a capillary mat bed; however, pressure-treated 2 × 4 inch side and end walls are required for a sand bed system.

RESULTS AND DISCUSSION

Studies with container types and capillary mats. The purpose of these studies was to evaluate growth of 'Royal Beauty' cotoneaster in two container types on several capillary mats.

Zarntainer No. 300 (1 gal) and No. 800 (2 gal) with holes along the base and one in the underside and Polytainer No. 1 (1 gal) and No. 2 (2 gal) with holes only along the base were used. The medium was Metro Mix 500, a pine bark-vermiculite mix.

The mats evaluated included Water Mat (Pellon Corp.), Vattex-P (U.S. Vattex), Weed-Chek (Certain-Teed), and Eddy-mat (I.R. Young Co.). All plants were irrigated from overhead at the time of placement on the mats to initiate capillary action. If rainfall did not exceed 1 inch every 10 days then the plants were watered from overhead to reduce salts buildup.

Plant growth in containers with drainage holes along the base did not differ from containers with holes in the underside. Different size containers and different types of containers can be adequately produced on the same mat. Subsequent studies indicated that the system works very well for plants produced in flats and in containers from 3 to 10½ inches in dia. (3 gal) including poly bags. In a separate study, growth of plants in poly bags was always equal to or greater than growth from plants in rigid pots.

Growth of plants was generally satisfactory for all mats evaluated. However, the best growth was obtained in plants produced on the Pellon water mat. Drying of the mats after the

water was turned off was more pronounced in the Weed-Chek treatment. The Pellon water mat, in follow-up evaluations, has proven reusable for at least 3 years and possibly more, while other mats are more likely to tear apart when lifting plants or due to animal pawing or mechanical separation. Multiple year use from mats has been obtained in studies in England (8).

Algae growth tends to accumulate on the mats over time but this can be reduced with Clorox (3) at the end of the season or with a direct spray from a hose between the plants during the season.

A new product which has proven successful for us is available as "Capillary Sheets" and is used as a mat overlay. It's a thin black polyethylene film perforated with tiny, nearly round holes spaced ½ inch apart. The water transfers from the mat through the tiny holes to the medium in containers placed upon it. Algae growth is almost eliminated, the mat stays cleaner and should result in a longer service life. Our studies with this product, available from Evert S. Green, 14 Kenneth Avenue, North Bellmore, New York 11710 are limited to one season but our results are similar to those found in Florida (4).

Studies of irrigation methods. The objective of this study was to compare plant growth and irrigation labor costs of watering by hand, overhead sprinkers, and capillary mats. All plants, including blue rug juniper, bigleaf euonymus, 'Royal Beauty' cotoneaster, and cranberry cotoneaster produced on capillary mats were larger than those produced under overhead and hand watering. Hand watering, such as is practiced in garden centers and landscape holding areas required 7 times as much labor to irrigate during the season as the overhead and capillary systems which were about equal in requirements. Water consumption was not recorded but studies in Massachusetts indicated that capillary irrigation used 1/5 the amount of water of an overhead system (2).

In a cost appraisal of watering systems in Florida, capillary mat had a higher initial investment than an overhead system but water consumption was appreciably less (6). Sand beds will be less expensive than matting and once installed should last many years.

Media comparison study. The purpose of this evaluation was to compare growth of plants produced in hardwood bark-sand (5:1 v/v) and soil-peat-sand (1:1:1 v/v) on capillary mats. 'Wiltonii' juniper, bigleaf euonymus, 'Royal Beauty' and cranberry cotoneaster all grew better in the soil-peat-sand mix than the bark-sand mix. The reason was that the bark-sand mix tended to dry faster than the soil-peat-sand. The more uniform moisture level of the soil-peat-medium is the probable

reason for the superior growth. Follow-up studies with other media, including pine bark, substantiate the need for approximately 20 to 25% peat moss in the medium to obtain the most ideal moisture level. Some of the packaged commercially prepared media, such as Metro Mix 500, which contains peat moss, wet extremely well with capillary watering.

The fertilizer used in most of these studies has been Osmocote 18-6-12 (8 to 9 months) incorporated into the medium at potting, or surface applied. The lower rate suggested on the label has been selected in most instances. Osmocote 14-14-14 at recommended rates was the best treatment in studies in Rhode Island (1). If surface application is selected, overhead watering or an inch of rainfall every 7 to 10 days is desirable to bring the fertilizer into the root zone.

Mat vs. sand capillary comparison. The capillary mat beds were prepared as previously discussed. The sand holes were constructed with 1½ in. of sand over the plastic, and the bed levelled.

'Royal Beauty' cotoneaster grew best on capillary mat, weigela best on sand, and 'Wiltonii' juniper equally well on both. Growth of all three species was superior in the sand when the trickle tubes were placed below rather than on the top of the sand.

The weigela rooted into the sand and if left undisturbed the root system outside the container became extensive.

Root pruning on capillary sand beds. Sanitizing agents are used in England (9) for root pruning so a study with forsythia (Figure 1) was initiated to determine a non-phytotoxic root

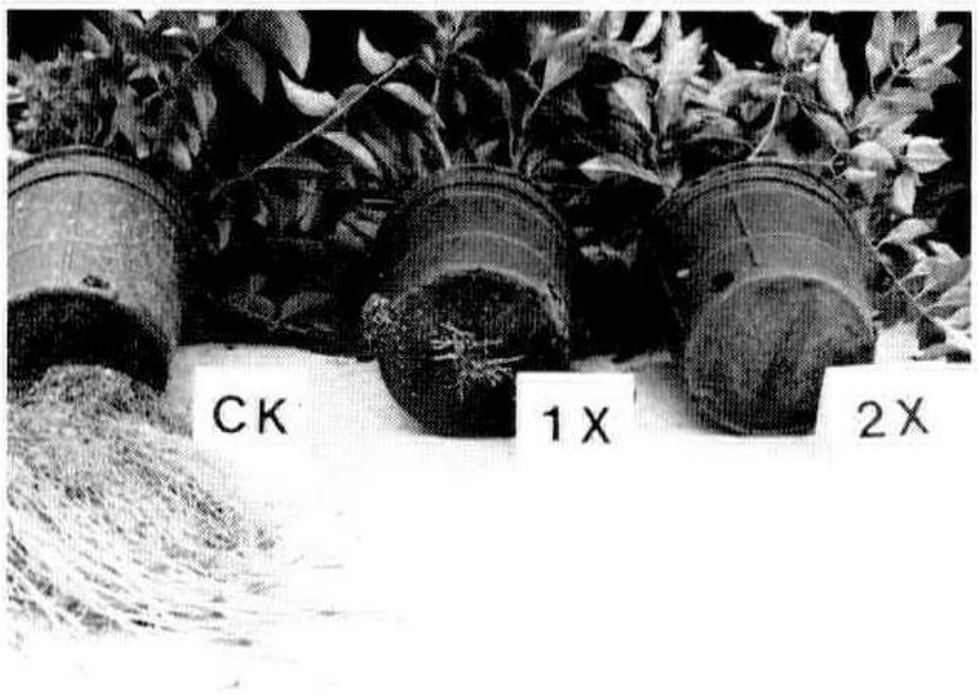

Figure 1. Forsythia container plants produced on sand capillary beds treated with Gloquat C. Left to right: Control, 1× (5⅓ oz/100 sq ft), and 2× (10⅔ oz/100 sq ft)

pruning agent for container plant production on sand beds. After many trials the only satisfactory material found was Gloquat C, the material described by Scott (9) and used in England but with limited availability in the U.S. The only source of Gloquat C is Aceto Chemical Company, Inc., 126-02

Northern Boulevard, Flushing, New York 11368. This firm acts as the distribution agency in the U.S. for the basic manufacturer. In addition to root pruning, this material supresses both algae and annual weed growth. One application lasted the entire growing season in our trials when used at 5⅓ oz/100 sq ft of bed area.

SUMMARY

In summary, capillary irrigation offers a substitute to overhead watering, particularly if water is in short supply or excess runoff poses a concern. Both matting or a sand base are acceptable for containers up to 10 to 10½ in diameter. Different size containers can be used on the same mat. To improve wetting of bark mixes approximately 20 to 25% peat moss should be incorporated into the mix. Root pruning on sand beds is necessary for vigorous rooted plants, such as deciduous shrubs. Gloquat C applied prior to placing plants on the sand is a satisfactory root pruning agent.

Capillary watering may have application in commercial container production and in retail garden centers. We suggest that this method of irrigation be given a trial if it is necessary to reduce overhead watering.

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DWIGHT HUGHES: You mentioned that there might be a problem with containers larger than 2 gal. Would you address that issue?

ELTON SMITH: The system has worked well up to 3 gal containers. Larger than that you get into plants that require a lot of water and there is just not enough draw.

JIM CROSS: Have you tried perforated black poly on top of the sand.

ELTON SMITH: No, however, that system is also available from Evert Green.

PROPAGATING SHADE TREES BY CUTTINGS AND GRAFTS

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Growing shade and ornamental trees from cuttings is no startling new development on the horticultural scene. For many centuries trees like willows and poplars have been grown from hardwood cuttings. With the development of mist propagation and rooting hormones it was discovered that many more genera could be successfully grown from softwood cuttings. Tree hybridization and the selection of superior clones of natural species has given much impetus to research in rooting tree cuttings and expanding the list of cultivars which can be propagated in this manner.

There are many advantages to cutting propagation over grafting, budding, and other methods of vegetative propagation. One very important factor is cost. In general it is much cheaper to make up and root a cutting than to buy or grow an understock, then pot it or plant it out in the open ground, and finally graft or bud it. After that there are the inevitable losses and the subsequent expenses of cutting out suckers and staking the shoots or scions. In general, a skilled propagator can make several cuttings in the same time that would be required to make a graft or clean, bud, and tie an understock tree in the field.

Rooting cuttings also avoids the problem of scion-understock incompatibility. This problem varies widely depending on the genus or even species of the plant to be grown. In