Dealing with Water Restrictions in Your Nursery©

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INTRODUCTION

In Spring 2001, the Water Management District that oversees water withdraws in the East Central to Northeast Florida restricted all irrigation of nursery stock to between 7 PM to 7 AM every other night in response to a 3-year drought. There was no consideration of water source (ground water vs. collection basins). The only exception was no restriction for microirrigation systems. Fortunately the restrictions were rescinded before warm weather and the region received near normal rains over the summer. However, this should serve as a wake-up call to all nurseries, even those that overhead irrigate from collection basins. Overhead irrigation is a visible practice that is noticed by those empowered to restrict water use.

Over the past 6 years, I, in collaboration with Tom Yeager, Gary Knox, and others at the University of Florida, have evaluated systems of growing plants with overhead irrigation. The research has focused on those systems that require less water than the common practice of containers on ground cloth, plastic, or gravel. The remainder of this paper summarizes the pertinent results of this research. All experiments were conducted using #1 containers and a fine pine bark, Florida sledge peat, and coarse sand substrate (7 : 3 : 1, by volume) amended with dolomite and micronutrients. These experiments were conducted from mid-March until early Dec. from 1997 through 2001 at the Mid-Florida Research and Education Center, about 33 km (20 mi.) from Orlando, Florida. Typically 50% of the normal 132 cm (52 inch) of rainfall occurs from mid-June through late September. Similar responses would be anticipated from these systems in up to #3 containers if similar substrates and conditions were engaged. Once plants reach #7 containers or larger, overhead irrigation should no longer be considered except in special cases.

SYSTEMS EVALUATED

Elevated Drain Holes (EDH). The most surprising positive effect was achieved by raising side drainage holes 2.5 cm (1 inch) up the container side wall. For three consecutive years, plants grown in these containers produced marketable-size plants comparable or better in quality, and with equivalent production times to the control treatment, with half the daily irrigation rate. The control treatment consisted of common #1 containers (010, Lerio Corp, Kissimmee, Florida) irrigated at 17 mm (0.6 inch) overhead irrigation daily. Production periods included both above and below normal rainfall years of 1997 and 1998 respectively. With an air porosity of 24%, the extra water contained in these larger pore spaces below the drainage holes was estimated to account for about a third of daily water transpired from the test plants (*Viburnum odoratissimum)* at marketable size.

Squat Containers. Squat containers are those with width to height ratios greater than 1.0. In this case, we compared plant growth and water saving when using 20 cm (8-in.) small mum pans (350, Nursery Supply, Inc., Chambersburg, Pennsylvania) compared to the same control used above. In the wet year of 1997, Squat containers produced plants comparable to the controls at half (7.6 mm, 0.3 inches) the irrigation rate. However the following 2 dry years, comparable or better quality plants were produced relative to the control with 30% the daily irrigation application rate (4.6 mm, 0.18-inch). This effect was achieved by increasing the surface area of the container to intercept the irrigation and by increasing the volume of water held in these containers by increasing the bottom area.

Funnel Containers. These consisted of standard containers like those of the control treatment above, but with a relatively flat, square funnel attached to the top of the container. The funnel was 28 cm (11-inch) on a side, with an upturned edge. The bottom was round, tapered and was held on the container by friction. In cooperation with Lerio Corp. (Mobile, Alabama), an improved prototype was evaluated each year. The last prototype evaluated resulted in plants better than the control with 30% (4.6 mm, 0.18 inches) of the Control application rate. Lerio declined to further pursue the funnel design. The University of Florida has a patent on the funnel concept.

Water Saver Trays. Another concept evaluated was using shallow trays under containers to catch the water falling between containers and make it available to the substrate through subirrigation. Two systems have been evaluated. One is the commercial product by Landmark Plastics (Akron, Ohio) called Water Saver Trays. In this experiment, plants in Lerio 010 containers were placed three on a tray to allow for canopy growth. Four species, *V. odoratissimum* (sweet viburnum), *Ligustrum sinense* 'Variegatum' (variegated *sinense*), *Rhododendron* 'Mrs.George G. Gerbing' (Mrs. George G. Gerbing azalea), and *Juniperus chinensis* 'Parsonsii' (Parsonsii juniper) were used. Plants in the trays were irrigated at 40% of the Control treatment (0.6-inch [17 mm]). All species in the trays obtained >90% marketable size faster than the controls. Actual irrigation volumes to obtain 90% marketable size were 28 to 72% less than the controls. This suggest the Water Saver Trays could have been irrigated at a lower rate than that applied. There was no indication of root decay after 8 months in the trays.

Subirrigation Trays. Water Saver Trays were small and allowed limited flexibility for container spacing. In 2001 we evaluated larger trays (Better Plastics, Apopka, Florida) designed for subirrigation on greenhouse benches. These were 1.05 m × 1.54 m (42 inches × 60 inches) with drainage holes drilled 9.5 mm (3/8 inches) above the bottom. With an irrigation rate of 4 mm (0.15-inches). daily, *L. japonicum* plants obtained >90% marketable size in 5 months and were visually larger than control plants spaced on ground cloth receiving 15 mm (0.6-inches) daily. Similar, though not as rapid growth occurred with *V. odoratissimum*. With these trays, there were some decaying roots at the bottom of the root ball, but more live, white roots. Dead roots appeared to be from anaerobic conditions rather than disease.

Flat Containers. These were originally small trays 15 cm × 23 cm (6 inches × 9 inches) used in circuit board etching. We drilled drainage holes at the bottom of each side wall. When irrigated at 6 mm (0.25-inches), equal to the same volume of water per flat container as the #1 conventional round control containers (010, Lerio Corp.), plants in these flat pots achieved 90% marketability in 5 months and were visually larger than the Control plants in round containers irrigated at 15 mm (0.6-inches) daily. Again suggesting the potential for further reductions in irrigation application rates. There are no comparable container designs currently on the market.

Capillary Mats. In 2001, we evaluated a capillary mat prototype designed for outdoor container production. Compared to greenhouse capillary mats, these mats have a second, top layer to decrease evaporative losses about 75%. Due to system constraints, we irrigated the areas containing these mats with 4 mm (0.15-inches) twice nightly, about 1 h apart. While not yet complete, plant growth on these mats is larger than similar plants in the same containers growing on ground cloth and irrigated with 15 mm (0.6-inches) nightly. Theoretically, irrigation rates could be reduced to 40% (6 mm, 0.25 inches) of the Control or less. Plans are underway for this product to become commercially available early in 2002.

Failures. Some systems evaluated have not been successful. Water Collectors (Landmark Plastics), made from recycled 1.9-liter (64-oz) drink bottles, inhibited growth up to 25 mm (1 inch) of daily irrigation and resulted in plant mortality if irrigated at less than 15 mm (0.6-inches) daily. Growth was also inhibited using 15-liter (4 gph) micro-irrigation spray stakes in #1 containers. The equivalent volume of water from a 15-mm (0.6-inch) overhead application was applied in 1 minute or less with these spray stakes. In two experiments over 2 different years, plants receiving microirrigation were stunted and demonstrated nutrient deficiencies within 3 months after potting.

SUMMARY

In summary, there are several systems currently available that nurseries can use to reduce the amount of overhead irrigation applied by half or more. Other more efficient systems have been evaluated but are not being advanced commercially at this time. Plant responses to these systems will depend on location and more importantly substrate components. The substrate used generally has an air porosity of 24% and total porosity of 70% using the Australian Standard Method with 15-cm (0.6-inch) high cylinders. There are several additional strategies nurseries can employ to remain productive under water restrictions. These can be found at <http://mrec.ifas.ufl.edu/rcb/drought>.

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