Capillary Watering©

Ben Stocks
Stocks Native Nursery, PO Box 69, Harden NSW 2587

INTRODUCTION

It is important that the nursery industry find alternate methods of applying water to their plants to counteract the current problems of dryland salinity, groundwater contamination, disease spread, and water waste.

Australia is the driest continent on earth and as a broad-acre farmer with over 35 years experience in grain production, I have had closer exposure to the effects of salinity and drought than most.

The application of excess water to our soils raises the water table and brings salt deposits within reach of the root systems of soil-grown plants. Overwatering or overhead watering leaches nutrients out of containerised plants into the groundwater where it may build up to toxic levels as it has in Holland. In that country, run-to-waste hydroponic systems have been responsible for an unacceptable build up of nutrients and have been disallowed.

Disease may be spread between plants by droplet splash or by infected water flowing past clean stock. Water falling between plants, and poor spray patterns, are major contributors to water waste and if such water is recycled it adds to running costs by making sterilising necessary and increasing risk of disease.

THE SYSTEM

In 1996, we decided to use capillary watering in our Australian Native Plant Nursery, having tried a flood-and-drain system on a small scale and found it unsatisfactory.

We purchased 120 CapPlus® capillary trays from a hydroponic systems manufacturer in Melbourne. These were fitted to a steel bench system in our shadehouse, at waist height, in rows of 10 trays. The trays measure 1260 mm × 750 mm and may be clipped together, side by side, or end to end. The use of PVC pipe legs is an option with these trays, but we decided to go for an unobstructed floor area.

The system is fed with rainwater from two buildings, which flows into a 50,000-litre polytank. A pressure pump then transfers water to an underground tank to keep the water cool and give the option of adding liquid fertiliser (We currently mix our own potting mix and add low-P controlled-release fertiliser.). A float valve controls the water level in this tank.

A 12-volt diaphragm pump, with battery and back-up charger, supplies water to the trays at 10 psi, so that in the event of a power failure the pump continues to run. The pump runs in series with a pressure tank to avoid unnecessary cycling and is capable of supplying all the water requirements of 8000 to 10,000 native plants on a hot day.

As the water enters the capillary trays it is controlled by the Smart Valve® fitted into each tray. This allows water to flow until it reaches a preset level, whereupon the valve closes and remains closed until the water is used up. It then reopens and repeats the process.

A capillary mat is stretched across the top of each tray and folded down into two channels that carry the water. By a process of wicking up the water, the whole mat surface becomes damp. It is necessary to pre-wet these mats to start the capillary going as a dry mat will not suck up water and neither will a dry plant. The tray is finally covered with a film of weed mat and the plants sit on top.

RESULTS

To date the 50,000-litre water tank has been adequate to water 8000 to 10,000 plants during the summer period. From March to September it is also used in our home for domestic purposes. Obviously, periodic rains replenish the tank supply.

Because the system was designed for hydroponic use in a greenhouse, I have made some modifications to improve its operation in the more hostile environment outside. The trays have had a much more robust capillary mat fitted, this can withstand washing with a pressure-blaster. It also has an inbuilt weed mat on top and a plastic film underneath. This mat is easier to keep clean and prevents roots from growing through the mat.

The Marix that originally covered the capillary mat has been replaced with standard weed-mat that I cut with a hot soldering iron. This standard mat will withstand scrubbing, pressure blasting and sunlight. It also prevents root penetration, algal growth, and water evaporation.

As a precaution, during very hot periods, (up to 43°C), we hand water weekly to keep the moisture in the upper part of the pot.

The whole system is stripped and sterilised twice yearly between seasons and the mats sprayed with moss and liverwort killer. Valves do occasionally develop a slow leak, generally a regular drip, but they are easily cleaned and water loss is minimal. Discussion with the manufacturer could see improvements to this small problem.

We grow the majority of our 480 native species of plants in 67-mm, super-square native tubes. It has been necessary to have special weldmesh racks manufactured to my specifications in order to keep the tubes upright and ensure that the bases fit square on the mat. These racks have been extremely successful. Special capillary pots, with holes in the bottom, are used if we have to pot on.

BENEFITS

The benefits observed to date are:

- A robust root system that grows toward the moisture source at the bottom of the pot.
- Impressive plant growth and root development.
- High plant survival rates (client satisfaction).
- Disease cannot spread between trays as each tray has its own water inlet and reservoir.
- Apart from the semi-annual cleaning, there is no labour involved.
- Very cheap to run as water costs are minimal.
- No water waste at all.
- The plant uses all nutrients and none runs to waste.

CONCLUSION

There are alternative capillary systems available, but the few I am aware of have a run-to waste component or else recycling is necessary. The risk of root disease spread is much greater with these alternatives. My only other considered alternative was hand watering, but as my small operation is run by my wife, when she is available outside business working hours, and myself, the time required to hand water made my present system the only option.

Capital cost of my system is fairly high, but the running costs balance the equation. It also allows me the opportunity to do other jobs or take time out and, most importantly, it has no effect on the environment whatsoever!

Igloo Irrigation©

Chris Rolfe
NSW Agriculture, Wollongbar Agricultural Institute, WOLLONGBAR NSW 2477

INTRODUCTION

To achieve even watering in polyhouses many systems are installed with a single line of inverted sprinklers so close together that the application rates are well in excess of the potting media absorption rate. This leads to excessive water use and leaching of nutrients that both affect the bottom line.

When irrigating containers with overhead sprinklers in polyhouses it is important to:

- Select sprinklers that apply water at a rate that suits your crop.
- Match application rate to the absorption rate of the potting media.
- Select a layout and sprinkler that achieves even watering.
- Select a layout that eliminates dry spots.

What Crop Are You Growing? Small seedlings and plug trays are best watered at application rates less than 5 mm h^{-1}. General stock lines are better watered closer to the potting media absorption rate between 7 and 10 mm h^{-1}.

Potting Media Absorption Rate (MAR). Your application rate should match the absorption rate of your potting media. For most pine bark mixes MAR is between 10 and 12 mm h^{-1}. The new edition of *Managing Water in Plant Nurseries* details a simple field test to allow you to determine the water absorption rate of your mix.

Layout Design and Sprinkler Selection. When selecting a sprinkler layout always ensure that each plant/container receives water from four sprinklers matched to give an even coverage. This is the only way you can achieve even watering and reduce dry spots, overwatering, and excessive leaching. The Coefficient of Uniformity (CU) of the selected sprinkler and spacing measures how evenly water is applied to the area. It is measured as a percentage. Your selected sprinklers should have a CU higher than 85%.

Eliminate Dry Spots. Correct sprinkler selection, operating pressure, and layout should also eliminate dry spots in the polyhouse. To check that you have selected a good combination examine the Scheduling Coefficient (SC). This is used as a multiplier to determine how long to run the sprinkler system to apply enough water to the driest 2% of the area. Your selected sprinklers should have a SC value of 1.1 to 1.5.