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Irrigation Management©

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INTRODUCTION

Since man started production of cropping for food, irrigation and the addition of water to supplement the natural rainfall has endured evolution and innovation in both the harvesting of water and the application of water to the crop.

Water has been taken for granted for many years in that it has always been there and been in abundance, which in turn promoted wasteful techniques in the application of the water.

Water is shaping up to be one of the 21st century's greatest challenges due to climate change, coupled with the increased demand of municipalities, industry, horticulture, and agriculture and the new requirements of environmental flows required to sustain the environment. This is evident in Australia, with initiatives being put in place with the Murray/Darling River system.

We are currently in a cycle being referred to as a 1- in 100-year drought, with below average rainfall being experienced in a large portion of the Australian continent for the last 5 years. As primary producers we are going to be under increasing pressure to ensure that our application techniques and use of water in producing our crops is achieving best practise and undergoing constant continuous improvement. Otherwise we will face the prospect of justifying how we can access water and conduct our business in irrigated cropping.

Under the current water restrictions, which are gripping a large part of Australia, this is also important in demonstrating to the community surrounding our business that we are efficient in managing our water. A large proportion of water being applied on ornamental pot plant production and horticulture is still applied by conventional overhead sprinklers.

APPLICATION TECHNOLOGY

The traditional brass sprinklers look impressive when in operation, but brass is a high wearing compound and if not correctly maintained and managed will soon lose efficiency. Advances in sprinkler technology by the Israelis and the Americans using plastics, which are more resistant to wear than traditional brass sprinklers, has been a major breakthrough in efficient application techniques.

After experiencing 2 years of below-average rainfall and with water storages dropping rapidly, a strategy was developed to better manage this resource as follows:

- Upgrading above-ground spoon drains to capture and direct storm water runoff;
- Developing a linked subsurface drainage system to capture the daily return water from irrigation and direct it to a central pond;
- Trialing of new application technology of overhead sprinklers between the Nelson R 2000 and Namcad sprinklers;
- Looking at more efficient water harvesting.

In changing brass moss sprinklers which, at new, average 10 $L \cdot min^{-1}$ compared to new generation Nelson R 2000 sprinklers operating at 8 $L \cdot min^{-1}$, we were able to achieve a 30% reduction in water being applied to the crops. Other significant side benefits, such as improved crop quality and health, have become more apparent over time. For example, foliage production in Philodendron was experiencing bacterial leaf disease in the winter that, on closer observation, was starting directly under the sprinklers and spreading out through the crop.

On following through with catch can tests, as per the Nursery and Garden Industry of Australia Water Works guidelines, it demonstrated that we were literally flooding the crop under the sprinklers due to the nozzle wear, which in turn was the catalyst for the disease commencing. Since changing the sprinklers over to Nelson rotators in 2004 we have not experienced the same disease issue.

The addition of pressure-regulator nondrain valves has also had a major bearing on the efficiency of the system in two main areas. It ensures that the sprinklers operate at the optimum pressure, which in turn means that the droplet spectrum produced by the sprinklers is producing a more even application of water to the crop. It also prevents the draining of the lines at the completion of the irrigation which then needs to be refilled at the commencement of the next irrigation cycle.

At our Orchard Road property, which operates fully with pressure regulators, irrigation shifts were cut back by 5 min, which saved an additional 40,000 L of water per day. Setting pressure valves on all remaining taps/toilet cisterns at the optimum pressure at which the pumping system is designed to operate is another operational efficiency to be gained and will further save running costs.

Irrigation and water management is not just about applying water onto crops—it needs to be approached as a holistic system understanding the process and relationships and creating the correct balance.

It is best summed up in the following:

- Water requirements to promote crop growth;
- Correct water regime to prevent disease;
- Cost relationship of applying water in efficiencies in harvesting and applying water.

Irrigation is a key production process, and cost inputs should promote growth but can easily inhibit growth and financial success.

MEASURING AND MONITORING

There is a direct relationship between energy consumption and harvesting and applying water by pumps. Any efficiency gained in applying water creates a direct saving and cost benefit in reducing energy costs.

In using variable-speed-drive pumps with pressure starts, the pumps are designed to operate like a manual car and ramp up to the water demand, rather than traditional centrifugal pumps, which start and go to full operational pressure. We have found power consumption to be reduced with the initial installation, having a pay back period of 5 years. The gradual ramp up of water supply to match demand has the added benefit of not putting the system under additional pressure, reducing the risk of blowing up mains.

Having the irrigation pumps on pressure starts, as opposed to electric starts linked to open valves, has the added fail-safe in that if a short circuit or a valve fails to open, the pumps won't still be pumping, which also reduces the risk of blowing up water mains.

In installing pumps, matching the correct pump to the correct duty is important for operational efficiency and lowering operational costs. With the new technology pumps now available it is worthwhile to keep monitoring the performance and running costs of the equipment to understand the process. In an exercise that we completed in 2005 in upgrading a water harvesting pump, it highlighted how important this process was to keep monitoring. The example, the table below shows that the new technology pump is half the kilowatt size and has the ability to pump 20% more water, with a saving of 60% in running costs. The investment in the pump was $1,000 for a saving on running costs of $864 per annum.

Table 1. Orchard Road water-harvesting pumping upgrade April 2005.

Pump Size	Pumping capacity ($L{\cdot}h^{-1}$)	Aver. daily run time to harvest (150,000 $L{\cdot}h^{-1}$)	Electricity cost/day ($0–12 kwh)	Power consumption per annum based on ave. pumping (240 days/yr)	Estimated power saving per annum
4.0 kw	12,000	12.5	$6.00	$1,440	
2.2 kw	15,000	10	$2.40	$576	60%
					$864

GROWING MEDIA

The advances in growing media with composted barks have improved aeration in growing media along with readily available water for potted plants. The addition of wetting agents to assist in the rewetting of growing media assists in better utilising irrigation water.

Copra or coir peat is a useful product as an additive to growing media at up to 10% of volume. Coir fibre has a unique wicking ability with readily available water for the crop as well as good air-filled porosity. In trials conducted with potted product we have been able to achieve up to 10 days before wilting with flowering potted azaleas as opposed to 4 days prior to this.

On foliage production of *Philodendron* under 50% shade cloth in the winter of 2006, with the addition of coir fibre to the growing medium we were able to further reduce irrigation by 30%. This was a direct water saving, increased crop quality, and reduced foliar fungal or bacterial disease — all major benefits.

Coir fibre is a renewable resource; therefore it is also environmentally friendly. It is important, however, to monitor the coir fibre for salt contamination depending on where the it is sourced from.

THE FUTURE

The next stage of advanced technology, the development of field data stations, is exciting. These units will have the ability to measure the growing media moisture in the container and EC levels. Coupled to a weather station monitoring rainfall, solar radiation, temperature, and wind speed the information is then transmitted via GPRS (mobile phone chip) back to a dedicated web site where the information is collated and interpreted via interactive soft ware to then graphically represent what the real-time demand of the crop is at that point of time.

Advanced technology has been used in the intensive greenhouse industry in Europe for many years. This technology will give the ability for broad acre container production to use science to better manage irrigation cycling and, lower running costs and nutrient leaching.

This will produce a better crop that is not stressed, by either too much or not enough water, but importantly prevent a lot of potential disease issues, use less water, and reduce nutrient leaching from containers.

Triple bottom line and environmentally sustainable production is the way of the future in achieving better profitability, better outcomes for the environment and the community, and ultimately producing a better crop.