Auditing and Modelling Water Usage in Your Nursery©

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INTRODUCTION

The Australian nursery industry decided in the early 1990s that it should take the initiative in regard to water usage, storage, and waste in both production and retail nurseries. This call to action was prompted first by some forward thinking members of the industry who realised that urban encroachment, the cost of water in metropolitan areas, runoff issues and storage, combined with the fact that Australia is the driest continent on earth, would eventually place pressure on our industry to conserve water and limit potentially contaminated runoff.

This foresighted action led to the development of a handbook published in 1994, *Managing Water in Plant Nurseries: A Guide to Irrigation, Drainage and Water Recycling in Containerised Plant Nurseries*, covering a wide range of topics on system design, layouts, and operating efficiencies. Following publication, the Nursery and Garden Industry Australia and its Industry Development Managers championed a series of workshops that travelled the country with some of the handbook authors making the presentations. These seminars were named "WaterWorks" and were, and still are, one of the most successful and timely initiatives the industry has undertaken. Hindsight has shown that all of the concerns regarding water and its usage that we believed would affect our Industry have come to pass.

This paper attempts to present just an overview of part of this program which covers five workshops in all including:

1. Fundamentals of irrigation systems,
2. Management and design,
3. Site assessment, drainage, and recycling,
4. Water supply, treatment, and disinfestations, and
5. Fertigation for production nurseries as well as hands-on training.

THE PROCESS

It cannot be stressed strongly enough, the importance of understanding:

- The details of your irrigation system performance,
- What information is required to complete a water audit,
- Actions to take after the audit, and
- Assessing return on investment.

A National survey of nurseries in 1999 asked a series of questions of producers:

- Average water use,
- Water costs,
- Pumping costs, maintenance costs, and
- And in particular hand watering costs.

This was followed up in 2006 with a further national survey of both retail and production nurseries from which a series of benchmarks were set regarding water use, source of water used, cost of hand watering, and non-nursery use.

As predicted, water reform legislation has now been put in place and asks water users to detail how efficiently they are using this limited resource. To this end it is important for nurseries to carry out regular water audits and ensure that the information is at hand should it be required by the authorities and that the audit can identify any shortcomings.

ASSESSMENTS

So how much do you know about your production nursery irrigation system? If you have never undertaken an audit and just run on the basis of "it seems ok" then it is time to have a closer look, it could save you time, money, and perhaps a fine from a local or federal

authority.

At the beginning, if it is possible, you should meter your water usage and build an historic record of that usage over a 12-month period. The installation of a meter will allow you to also diagnose water leaking from the system but it will also help demonstrate just how much water your business needs should you suddenly find yourself under pressure from an authority, who wants you to reduce the amount of water you draw say from a reticulated supply. This data will also allow you to calculate how much water is worth to your business and what you could afford to pay in dollars per megalitre and what you can produce in dollars per megalitre.

YOUR IRRIGATION SYSTEM

An efficient irrigation system will help you:

- Save water and labour,
- Maintain plant quality,
- Reduce the volume of discarded plants,
- Provide a shorter production period, and
- Most importantly it will save you money.

If you are able to recycle your irrigation runoff it is possible, given the particular site you are growing on, that you could reduce consumption by up to two thirds. An efficient drainage and storage system could allow the collection and use of rainfall runoff as well. However, whether you are capturing your runoff water or not, it is important to monitor the quality of that runoff to ensure that you are not polluting waterways in your immediate areas with nitrates, pesticides, or other unwanted chemicals.

Ask yourself the questions:

- Which plants that I produce need the most water?
- Which plants require the most frequent water?
- Which require the least amount?
- How can you meet these demands and are they on separate systems?

The knowledge you accumulate on plant water usage will help you minimise the amount of water you are using and at the same time allow you to more accurately predict irrigation scheduling should you find yourself the target of watering restrictions. Remember one of the only mechanisms a water authority has to reduce consumption is by placing restrictions on watering times.

THE AUDIT PROCEDURE

An audit report should cover the following:

- Water sources,
- Water quality,
- Production requirements,
- Irrigation system,
- Drainage and recycling systems,
- An action plan, and
- Training and staff awareness.

An assessment of just how much water you have available should entail, access rights and restrictions, adequate storage to meet your needs, how reliable is your supply, can you collect runoff and what other sources of water might be available. The quality of the water that is available is equally important and may entail having that water analysed for its suitability to grow your range of plants, determine its suitability for reticulation through nursery sprinklers or drippers and the disinfestation limitations it may have. Limiting factors that you may have to deal with will include the timing of irrigation, plant disease susceptibility, staff working schedules, off-peak power periods or water restrictions, leachate containment, and excessive drainage.

A full system evaluation should be undertaken including checking, pumping systems, filters, sprinkler and dripper performances, and system hydraulics. Each pump should be reviewed for its efficiency along with shut off pressures, suction losses, and the

maintenance schedule for all pumping units. Filtration units should be properly matched to pump capacity and a record of back flushing frequency and the maintenance cycle recorded.

Actual sprinkler and dripper performance should be regularly measured and recorded for each particular production block using beakers, measuring cylinders, catch cans, and a reliable pressure gauge. Sprinkler and dripper emission rates can then be used to calculate the mean application rate (MAR), coefficient of uniformity (Cu), and the scheduling coefficient (Sc) for each block. The operating pressure of each block should be monitored and adjusted as necessary to ensure continuity of application rates.

A schedule of irrigation on a block by block basis should be drawn up and preferably displayed in an area where it is visible to all staff and should include seasonal variations and timings. A strict maintenance schedule should also be instigated along with a record of system performance, pressure, output, etc.

An evaluation of the current drainage and recycling system and current drainage management practices is as important as auditing the irrigation system. Does it minimise downstream pollution, match the slope, soils and rainfall intensity, and meet state and federal regulation? What are the recycling options available to you and how can they be properly managed? Your drainage storages should be managed to optimise water retention and minimise the return of any pollutants in the water to surface and ground water systems.

Once you have completed your auditing process it should highlight limitations and opportunities for optimising water efficiency and utilisation in your nursery. The changes will fall into two categories, management and technological. Management changes might include reorganisation of your irrigation schedule to match your assessment of actual water needed and better maintenance of you irrigation equipment and drainage systems. If your irrigation and drainage systems need significant upgrading as a result of your findings then list out the requirements for modification or replacement.

Finally as a part of your completed audit, an action plan should be prepared prioritising the changes you need to make and how you intend to implement those changes, along with a timetable. Obviously some of those changes will be made on an economic assessment of your circumstance and a cost benefit analysis may need to be carried out.

ECONOMIC ASSESSMENT

A template for the calculation of a cost benefit analysis is available at <http://www.watertoolbox.ngi.org.au/> and will give a discounted cash flow analysis and cash flow summary that demonstrates the impact of an investment in upgrading your irrigation system and storage.

Suggested Reading

Danelon, M. Waterworks series of programs. Nursery and Garden Industry Australia. <http://www.ngia.com.au/MainMenu>.

Rolfe, C., Currey, A. and Atkinson, I. 1994. Managing water in plant nurseries: A guide to irrigation, drainage and water recycling in containerised plant nurseries. NSW Agriculture, Wollongbar.