Some Problems in Water Recycling

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Strict water regulation by the Council of Australia Governments is imminent. Tight controls in water use will make us all more frugal with Australia's limited water resources — having to make do with a lot less. We will be forced to conserve water and use it without degrading the environment. The government plans to return rivers to their original flows.

At Alstonville we are blessed with an average annual rainfall of 1600 mm, mainly falling in the first half of the year. The creek flowing through the property is unreliable and the underground water supply also proved unreliable. Water recycling was the answer. It seemed to be very expensive at the time but should give us dividends in the future. Our system has minimal effect on the environment and gives us a secure water supply.

Ten years of water recycling has revealed a range of challenging problems. We chose a 12.5-ha site for our nursery. The production area is located on a gentle slope all running down to a catchment dam. We received considerable assistance from N.S.W. Agriculture in the design of our system (Fig. 1).

All production areas were leveled and graded to a 1-80 fall. Drains were formed with 200-pm plastic with agricultural pipe laid in drains, 7-mm blue metal was laid around the pipe. A 75-mm depth of 20-rum blue metal was then laid on plastic covered by weedmat. All areas were piped away commencing with 150-mm PVC underground in low volume areas, with the size increasing as volume increased to 225 mm into catchment dam. All drainage is in straight lines, with storm water pits

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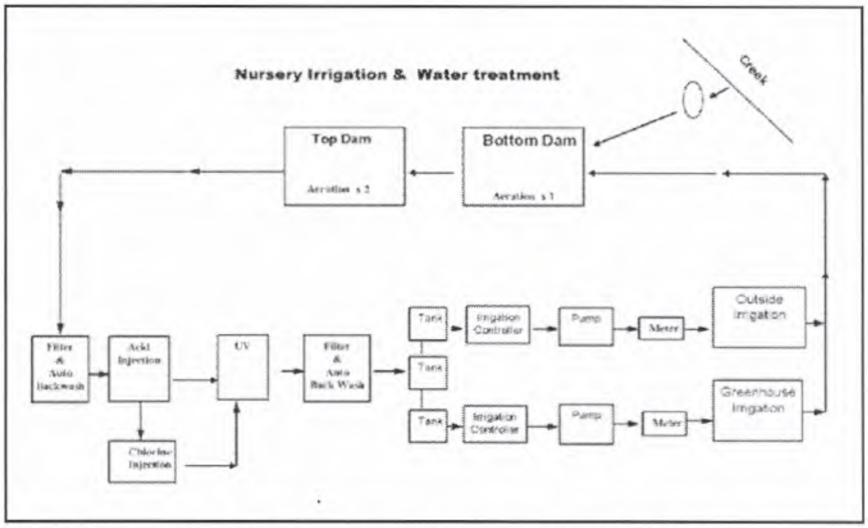

Figure 1. Schematic design of water recycling system at Alstonville Palms.

installed for change of direction and future expansion and maintenance.

Both dams are lined. One dam has 500-[im plastic and the other has polyweave. The lining is essential as the red basalt soil of Alstonville is extremely porous. This lining gives us the added benefit of no soil in the water and therefore a clean water supply to the nursery.

Apart from high rainfall adding to the system, water is reused many times. A total two-dam capacity of 17 megalitres (ML) allowed better water treatment options.

Last year (2004) our nursery used a total of 9 ML. Evaporation from darn capacity accounted for 30%-40%. Four to five megalitres of water was pumped from the creek.

Efficiency of use was paramount and we were fortunate in 1995 that our nursery was selected for a Horticulture Australia Limited research project (NY95025) looking at minimizing water use and nutrient runoff (Huett, 1999).

Considerable improvement in irrigation techniques and the addition of windbreaks have helped. The greatest single factor in achieving water saving was the use of an International Class "A Pan." An evaporation reading is taken on a daily basis to establish water requirements to which crop factors were added, i.e., a calculation of irrigation water to be applied based on the requirements of individual plants and prevailing environmental conditions.

Our biggest problem was algal blooms. A chelated copper product was sprayed on the surface of the dam, which killed the algae and solved the problem in the short term. Algae create high pH levels. This can produce difficulties in some forms of disinfestations, e.g., chlorine injection (which is the most popular form of disinfestation). In soilless potting media we should aim for pH values in the range of 5.5-6.3 (depending on individual plant requirements). If continually irrigating with water at a high pH level, the pH in media will also drift upwards. High pH water is also likely to clog the irrigation system by depositing calcium on irrigation equipment.

Our next major problem was a build up of broken down organic matter in the catchment dam. After 3 years we had 1.2 m of organic residue on the bottom. Organic particles of potting mix breakdown in the layer of blue metal under plants to a very fine size. Silt traps were considered expensive and too labour intensive to maintain. Therefore this technology was not implemented. We were worried that the dam would become full in the years to come.

Around March and September each year the dam was inverted bringing up lots of sediment. This added to the algal bloom problem making filtration very difficult. Investigations of this silt showed an anaerobic condition — evident by foul-smelling sulfur. Anaerobic conditions were very bad when dam water levels were low and could prove unsatisfactory for plant growth with low levels of oxygen.

The Answer. Aeration equipment was then installed and concentrates of microbes were added to the water. These concentrates contain billions of microbes. The aeration equipment brought all organic residues to the surface. The microbes consumed the entire residue m 8 weeks. This treatment was also of assistance in minimizing algal blooms and assisting these friendly microorganisms to stay healthy and breed. I have since established that with sufficient aeration, each of our units produces 3.3 kg of oxygen per hour so in our case two aerators were required; algae is now almost completely eliminated. Now pH levels close to neutral are easily achieved and only a small correction is required. We still correct pH to 6-6.5. We can save money because very little hydrochloric acid is needed. Aeration eliminates layering, stirring up the strata and maintaining a more consistent quality. Aeration need not be a 24-h per day exercise and should take place preferably at night.

We have since dispensed with chlorination and changed to ultra violet. (UV) treatment for disinfestation, with great cost savings. Cost to install and maintain UV treatment would be comparable with slow sand filtration.

Some recent research in the U.S.A. indicates that anaerobic conditions of some recycled water can be detrimental to plant growth due to low levels of dissolved oxygen. The method of irrigation application and air filled porosity of potting mixes all play a part in plant health and growth. My latest indications are that with the assistance of aeration and microbes we can emulate nature to achieve the equivalent of rainwater.

ADDITIONAL BENEFITS OF RECYCLING

Environmental. A very important environmental point — our system utilizes only 12% of rainfall as our production areas cover 12% of land and our nursery now has a known water source that is excluded from all water charges within the Water Act 2000.

Improved Profitability. Our recycling system necessitated efficiency of water use, which in turn led to improved plant health and savings in production costs, i.e., fertilizer, pesticides, labour, etc.

Self-sufficient. Information gathered indicates that a containerized production nursery with 1400 mm of rainfall per year or even lower could be self sufficient for water providing all aspects of recycling are carried out, and dams are covered with an evaporation barrier.

SUMMARY

Although recycling involves establishment costs, monitoring of oxygen and pH, careful disinfestation, etc., which is more work, the benefits gained from the effort far out-weigh any costs or inconvenience incurred in the setup process.

Once the system has been established the additional upkeep is non-existent or negligible.

The Council of Australia Governments has stated for many years that water from the environment will be given to the most profitable use. Top nurseries are reporting \$60,000 gross sales per megalitres of water. However, when a nursery recycles water and procures only 2 ML of water from outside, the payback on the water can easily be as high as \$250,000 per megalitres.

LITERATURE CITED

Huett, D.O. 1999. Improved irrigation and fertiliser management strategies for containerised nursery plants through commercial demonstrations and further research. Final Report NY95025. Horticulture Australia Limited.