"– it recognizes that real progress in breeding relies on access to the latest improvements and new variation."

– and furthermore,

"Access is needed to all breeding materials in the form of modern varieties, as well as land races and wild species, to achieve the greatest progress and is only possible if protected varieties are available for breeding."

Water Recycling: How We Do It©

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Our family owns and operates a foliage nursery in subtropics on the east coast of Australia. We have been on a 10-year journey building a new nursery and learning how to recycle water. Our local agriculture department has given us a lot of support in water efficiency, but to a large extent, we were pioneers in setting up a water recycling system 10 years ago. During this presentation I'll take you through the steps we went through along the way. Quite a few things had to be added to solve problems that were unforeseen at the beginning.

The site we chose to set up our nursery is 12 ha. The production area is located on a gentle slope all running down to the catchment dam. 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 all water users in Australia and around the world are being forced to reduce water consumption and return rivers to their original flows. Our system has minimal effect on the environment and gives us a secure water supply.

Water is reused many times in our closed system. Water is added to the system when it rains and is lost through evaporation. In dry years we may top up our dams from the creek with 3 or 4 megaliters (ML). We have managed only on the bottom 6-ML dam. Between the two dams we have 17 ML of water storage. Water quality is much easier to manage with two. Water treatment is expensive so we decided we needed to use as little water as possible to water our plants so water efficiency was the first issue we tackled. We have also chosen a lot of low-water-usage crops. Initially, we began with one filter, a chlorine injection system, one tank, and a couple of small irrigation controllers. Over 10 years we have added a lot of extra pieces to make the system work (Fig. 1).

The main difference in our production areas is the way we have constructed the floors (Fig. 2). All beds are lined with builder's plastic. Over this, agricultural drainage pipe and 75 mm of blue metal was laid. We chose to cover the gravel with weed mat to minimize weeds and reduce the amount of organic matter getting into the system.

Extensive earth works were done to get the falls correct. Irrigation mains and electricals were all installed first. The builder's plastic all went down next using duct tape to seal all joins and seal up around mains and supports in the structure. Next came the 100-mm agricultural pipe that was installed in the drains that are in the middle of the roads. At the end of the shade house we convert this to large PVC pipes. Small lateral PVC pipes, risers, and supports for the irrigation risers were installed above the plastic. Boards (75-mm) were used to screed the gravel to a consistent depth. Last step was to fix the weed mat, which we have held down with gravel.

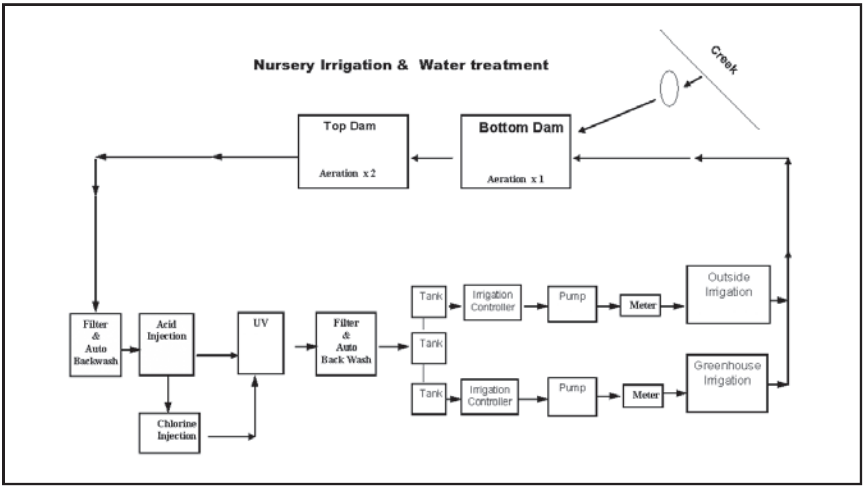

Figure 1. The recycling system at Alstonville Palms.

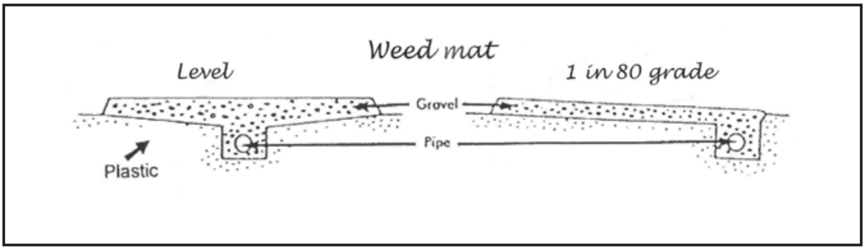

Figure 2. Floor construction in our production areas.

Large PVC pipes take the water down the hill to the catchment dam. Smaller pipes down to 100-mm were used in collection areas and up to 225-mm pipes were used in high flow areas at the bottom of the hill. Concrete junction boxes join up all the pipes. Later we started to use plastic junction boxes that were much cheaper. These were plumbed so that silt would gather at the bottom for easy cleaning. The whole system was designed to take rainfall of 100 mm in 1 h.

The dams in our area need to be lined because our volcanic soils won't hold water. We have used 500-µm dam liner plastic. We catch all our rainfall in our production areas, and the dam has only overflowed twice in 10 years. We try to limit the contaminants such as fertilizer, pesticides, herbicides, and organic matter getting into the catchment dam.

The biggest challenge for any recycling system is how to clean up the water suitable for irrigating. Algal blooms are the biggest enemy. They block irrigation, upset pH, and make it impossible to kill pathogens. We tried killing them with chelated copper, but we were treating them many times in hot weather. After about 3 years we ended up with 1 m of mud on the bottom. We discovered there were many layers in a dam. In early spring and early autumn, when temperatures in the dam were changing, the whole dam rolled over. The foul-smelling mud then came to the top making it almost impossible to filter out.

We were having so much trouble with algal blooms the decision was made to install aerators in the dams. Aerators combine with friendly microorganisms that like to eat algae and keep the population to a minimum. Extra oxygen improves conditions for the microorganisms, and the algae seem to dislike it. The layers in the dams were all stirred up. The dams no longer rolled over because the layers had disappeared.

Filters and automatic backwash have been installed both at the beginning and at the end of the cleanup process. Manual backwash was installed initially but we were not doing the backwash often enough so eventually we automated it.

The pH is corrected with the addition of hydrochloric acid. We try to keep it at 6.5. When we were having large algal problems the pH of the dams soared to 9.7, but with the aerators, very little correction is required.

UV treatment is an easy way to kill pathogens. The cost to run and maintain is very small although the initial cost is substantial. The only restriction is you need clear water for the unit to work.

After UV treatment we do a final filter of the water before it goes into the holding tanks ready for use. The final filter was necessary because algae was killed in the UV treatment and clumped together. These large clumps blocked our drippers. We have 60,000 L of clean water ready to use.

Pumps and irrigation controllers are used to irrigate in the morning for all overhead irrigation of smaller stock. Drippers are used mostly in the afternoons and evenings. We group plants with similar water requirements together and use the minimum amount of water.

TASKS

Daily Tasks: measuring rainfall, water usage, and evaporation pan. The reading is transferred to the irrigation controller. A crop factor is used to give the necessary amount of water to fill the containers in each station.

Weekly Tasks: pH, E.C, chlorine ppm when in use.

Annual Tasks: Water quality tested by laboratory with plant pathogen check.

Routine Maintenance:

- Flush irrigation lines with chlorine every 6 weeks in summer.
- Large containers on drippers fully checked at start of each crop.
- Each morning check UV, acid, and chlorine if in use.
- Check block pressures and sprinkler and dripper performances.

ADDITIONAL READING

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