RURAL WATER USE EFFICIENCY INITIATIVE

Improving irrigation management for a profitable and sustainable future

# Improving Water Use Efficiency—A case study

Spring Creek Seedlings, a seedling production nursery supplying local vegetable growers, located on Queensland's Granite Belt south-west of Brisbane has made significant productivity and water saving gains under the Rural Water Use Efficiency Initiative (RWUEI). The production nursery was started 13 years ago by Peter and Lesley Burnell using two secondhand igloos and various pieces of secondhand equipment from other production nurseries. The turning point for the business came with the construction of a one hectare post and cable insect resistant structure (Shadehouse) installed to Peter's design.

When building this area, to minimise overall costs, the earthworks and structure were completed over the entire 1ha site and the concrete growing surfaces have been constructed as required, allowing for cost efficient and controlled growth of the business as part of an overall strategy for future expansion. Concreting the production area was considered a cost effective means of managing weeds and plant diseases, with the insect resistant structure seen as a way to significantly reduce infestations of insect pests as part of an Integrated Pest Management (IPM) plan.

While not all of the covered area is currently in production, this strategy for gradual expansion of the growing areas compliments a staged expansion of market share. This flexible approach to constructing nursery infrastructure has allowed different business opportunities to be capitalised upon, including the

contract growing of strawberries for use in the production of runners and the growing of Euphorbia spp. used for the production of pharmaceuticals.

Over the course of the RWUEI program a significant amount of time has been spent investigating ways of enhancing production capacity by improving water use efficiency. A keystone to these improvements has been the independently audited Nursery Production Farm Management System (FMS) comprising the Nursery Industry Accreditation Scheme Australia (NIASA), the nursery industry environmental management system - EcoHort, and the nursery industry biosecurity program - BioSecure *HACCP*. This has resulted in the business adopting, completing the requirements for and achieving NIASA accreditation. Furthermore Peter and Lesley are committed to becoming EcoHort certified in 2011. Biosecurity is a major concern for the business and many systems have been put in place to minimise the risks of introducing pests and diseases.

Water quality (often poor) is the major limiting factor to increasing plant production at Spring Creek Seedlings. Under the guidance of the RWUEI program the availability of appropriate technologies to improve water quality for a number of water treatment alternatives were discussed. The nursery water supply is provided by a spring which can vary significantly in salt levels depending on rainfall, with sodium being the major element of concern. As a means of supplementing and improving this source with better quality water, a reed bed system was initially considered as a means of extracting these salts. However, a number of site constraints, including the volume of water to be treated and the lack of a suitable area for reed bed construction, made this a difficult option to implement.

Peter and Lesley finally decided that a combination of ultra-filtration and reverse osmosis would overcome the irrigation water quality problems they faced. However, in order for this system to be installed, a method of disposal of the waste water produced needed to be devised. Investigations, with a number of companies, were conducted to determine the best alternative to manage the waste stream and through this process information was identified that avoided the installation of an inefficient water treatment system. Advice provided by some companies suggested that a reverse osmosis unit could be used without an ultra- filtration unit as a pre-filter. This would have resulted in much higher maintenance costs for the reverse osmosis unit due to more frequent replacement of membranes. Other information provided recommended that flow rates could be adjusted by means of a throttling valve on the reverse

osmosis unit to give appropriate filtration. This could have resulted in damage to the filter membranes. Incorrect advice given during this phase of development highlighted the importance of gathering information from as many sources as possible, allowing Peter and Lesley to make informed decisions.

The system eventually installed consisted of an ultra-filtration unit with a storage tank feeding into a reverse osmosis unit, from which water was stored in a holding tank until required for use in the nursery. The waste water from the water treatment system is collected in a holding dam allowing management of this resource through a combination of storage, recycling, blending with high quality water, and irrigating onto non-crop areas. Monitoring of incoming and outgoing water quality is a major part of the management of waste water disposal from this system and the knowledge gathered underpins all decisions on how the waste water is stored and disposed of.

Monitoring the irrigation water quality produced by the system has highlighted the value of record keeping in managing the operation of the water treatment units. Therefore, a comprehensive water monitoring programme comprising daily pH and Electrical Conductivity (EC) testing and measurement of flow rates through the system is being maintained, allowing the early detection of changes in water quality, with early intervention minimising plant damage and other growth limiting problems.

As part of the irrigation benchmarking process various elements of the growing system were assessed including the performance of the growing media used in plant production. This assessment identified growing media quality as having a significant impact on water use efficiency across the production system. On-site tests of EC, pH, Air Filled Porosity (AFP) and Water Holding Capacity (WHC) were performed, and continue to be monitored, to ensure consistent quality of the growing media is being supplied.

Irrigation system testing, and analysis of performance of the irrigation system plus the growth performance of crops showed that regular irrigation system performance checks were essential. In seedling production, a high level of irrigation efficiency and uniformity is required, consequently, extensive catchcan testing was undertaken across the growing area's with results obtained showing the system was not performing to industry Best Management Practice (BMP) due to a large amount of variation in all parameters measured. Following the identification of the variable and poor irrigation efficiency of the system, a testing regime, measuring the flow rate from each sprinkler and overall system pressures was implemented to monitor sprinkler performance, and allow early detection of underperforming sprinklers. The changes made following this produced a significant improvement in system performance. See Table 1.

| Parameter | Average | Range | After Changes | BMP for an Existing System |
|---|---|---|---|---|
| Mean Application Rate (MAR) mm/hr | 10.5 | 8 - 12.6 | 9.7 | <15 |
| Coefficient of Uniformity (CU) % | 81.7 | 72.4 - 87.9 | 90.0 | >85 |
| Scheduling Coefficient (SC) | 1.5 | 1.2 - 2.5 | 1.3 | <1.5 |

*Table 1: Irrigation assessment results*

During on-site discussions with Peter and Lesley, various nursery industry and RWUEI tools have been used to determine current water and energy use plus estimate future efficiency gains. Resources such as the Waterworks calculator, iSpace sprinkler assessment, Wetland Economic Modeling tool, Knowledge Management System for Irrigation (KMSI – www.kmsi.nceaprd.usq.edu.au) and EnergyCalc have all contributed in guiding Spring Creek Seedlings to improve irrigation efficiencies and crop productivity.

From the on-site work conducted, through the RWUEI program, there has been an increased awareness of water use and its importance and impact on crop production across the production system. Consequently, irrigation scheduling has been given closer scrutiny, leading to reductions in irrigation system run times resulting in savings of 25% in water use and energy consumption in pumping and water treatment.

Closer attention to maintaining irrigation uniformity at a high level and improvements to, and monitoring of, water quality has led to significant improvements in crop productivity. In addition to the 25% saving in water and energy use, improving water quality has reduced costs associated with chemical use, particularly the use of fungicides, by approximately $4500/annum. An added benefit of the reduced chemical use is the reduction in contamination of runoff water therefore giving higher quality water for reuse if required. The improvements have also decreased the time to produce a crop from 8 to 7 weeks per cropping cycle - an increase in productivity of 12.5% equating to $43 000/ annum. An unexpected benefit of the improved water quality has been an improvement in the time from seeding to emergence and increased germination percentages of crops. The average germination improvement was approximately 5%, an increase in productivity valued at $17 500/annum from reduced losses
.
Overall, the clear measurable financial gains to the business due to implementing on-farm change under the RWUEI program total approximately $65 000 per annum.

Following on from these successes, the future focus of the business is now on further reducing water use through refining changes in irrigation scheduling and fine tuning irrigation layouts.

Peter has commented that the information and assistance provided by the Nursery Industry Farm Management Systems Officer and RWUEI field days have been invaluable in guiding them through the process of improving their production system, particularly in the area of water use efficiency. Peter strongly recommends that other growers make use of these resources provided under the Rural Water Use Efficiency Initiative.

For further information contact NGIQ on 07 3277 7900

Nursery & Garden Industry Queensland

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