



## Monitoring and managing recycled water quality in nurseries

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Modern nursery production requires careful monitoring of water quality. A survey of water quality in dams and runoff around Australia found that regular analysis will be required for salinity, pH, nitrogen, phosphorus and other factors. Most of these can be done on site using simple equipment.

Good quality water is becoming more expensive in Australia, and much water is wasted by the nursery and cut flower industries. There is also growing pressure from government and the general public to prevent or minimise environmental pollution.

Nurseries are only minor users of water and fertilisers in Australia, however some operators have had their drainage water investigated by local government after complaints by neighbours. This, combined with the increasing costs of water led to the nursery and cut flower industries supporting a research program to investigate procedures which allow recycling of waste water. For a full report on this project refer to James *et al* (1995) (*see Further Reading*).

### Nutrients in recycled water

A survey of nutrients in dams and run-off from 29 nurseries and flower farms in 5 states has shown that useful levels of nitrate, phosphate, potassium, calcium,

magnesium, iron, boron, copper and sulphate occur in waste water, and could be effectively used in nursery production if water was recycled (*see Table 1*). These nutrients in recycled water may allow up to a 20-30% reduction in fertiliser application.

Nevertheless there can be risks with water recycling. Firstly, iron levels which were too high for optimum plant growth were encountered at several nurseries. Iron levels should be monitored at nurseries where it is likely to be problem. High levels of boron and copper were each only found at one nursery. Copper-based algicides and fungicides should be used with caution if recycling water.

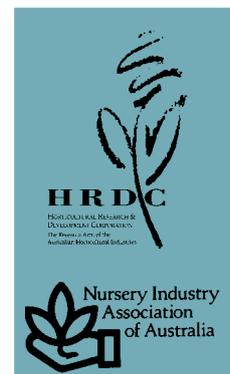
### Salinity

Salinity build-up can be a problem with water recycling. Nevertheless regular monitoring of Electrical Conductivity (EC), chloride and sodium levels can be done to keep these within safe limits. The mean EC levels of waste water in Australian nurseries was generally within safe limits, however individual nurseries had peak salinity levels which would have had a detrimental effect on plant growth. The level of salinity which is likely to be a problem also depends on the type of crops grown, as salt tolerance varies enormously between different plants, and irrigation management.

TABLE 1.

Summary of important water quality parameters over a 12 months survey period (means).

|         | Nitrate (mg/L) | Phosphate (mg/L) | Potassium (mg/L) | pH  | EC (dS/m) |
|---------|----------------|------------------|------------------|-----|-----------|
| Dam     | 22             | 7                | 13               | 7.4 | 0.51      |
| Run-off | 40             | 7                | 13               | 7.3 | 0.45      |



Chloride can be toxic to plants above 100 mg/L and this level was regularly exceeded at several nurseries. Monitoring of chloride and sodium levels at some nurseries will also be required when recycling. Nurseries recycling water need to have a supply of low salinity water to allow safe blending with recycled water.

### pH and alkalinity

The pH readings of run-off water from nurseries surveyed were generally alkaline, that is above 7. The ideal pH for most plant production is 5.5-6.0 as this provides a balance of availability of essential inorganic nutrients. The ideal pH will vary for different crops as some plants are acid loving eg. azaleas; whereas others prefer more alkaline media.

The pH of water also influences the effectiveness and persistence of some pesticides. Malathion for example has a shorter life at higher pH.

As pH rises above 7.0 the disinfecting properties of chlorination rapidly diminish. Although the disinfecting power of ozone is not reduced at high pH, it has a shorter life as pH rises above 7. Although only limited evidence is available, chloro-bromine and chlorine dioxide should be effective for disinfestation of plant pathogens at higher pH.

Water with a high pH which is not readily lowered, has a high alkalinity. This is because it contains calcium and magnesium carbonate and bicarbonate. Irrigation water with an alkalinity of above 125 mg/L of calcium carbonate will raise soil pH depending on soil type. The effect of irrigation water pH and alkalinity on the pH of soil and container media will depend on a number of factors, such as buffering capacity of the medium itself, the type of fertilisers in the medium, the waterholding capacity of the medium and other water sources such as rainfall. Irrigation water should thus be regularly monitored for both pH and alkalinity.

To overcome high pH and alkalinity, acidification may be necessary. However, hydrochloric acid (the safest acid in terms of corrosion) will increase salinity, phosphoric acid may create too high phosphorus levels and nitric acid is very corrosive and may add too much nitrogen. Acidification should only be done by a skilled operator using properly designed injection equipment. **Never add water to acid, always add the acid to water.** The amount of acidification of water required should be done after titration of water samples using the most appropriate acid by an accredited laboratory or an appropriately trained person.

### Herbicides and agricultural chemicals

Irrigation water should not contain significant levels of herbicides. We have found residual herbicides in

the dam water of a number of nurseries and flower farms. Be particularly careful with the use of persistent herbicides such as simazine, Rout® and Ronstar®. Check the label for the latest instructions and limitations on their use.

### Acknowledgments

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### Further reading

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