Recycled water: how good should it be?

Focus on fit-for-purpose

Recycled water has become more accepted as water source for agricultural and horticultural production in the past decade. A number of schemes have been implemented that focus on the use of treated sewage effluent for irrigation of agricultural and horticultural crops, and other sources such as winery/dairy wastewater have been recycled for irrigation.

Quality guidelines

Traditionally, guidelines for the use of recycled water have focused on the human health aspects and have considered major contaminants such as microbial pathogens and chemical residues. Recycled water quality has been described in relation to the level of indicator pathogens in the treated water. For example, in Victoria E. coli is used as the indicator organism with objectives (org/100 mL) for the different classes as follows:

- Class A - <10 Class C - <100
- Class B - <100 Class D - <10,000

Other aspects considered for classification in the State-based standards include turbidity, BOD/SS, pH and chlorine residual.

Traditionally, lower class water (Class C) has been used in regional areas to irrigate pastures for dairy production. As well, over the past decade we have witnessed development of irrigation for amenity and production horticulture using Class A water. However, with dwindling water resources, increased competition for water in the last few years, and improved treatment processes the potential end users of recycled water have grown. As the water users have diversified, so have their requirements for a specific quality of water.

Fit-for-purpose quality

The Australian Guidelines for Water Recycling (www.recycledwater.com.au - guidelines menu) have tried to address this issue by focusing on fit-for-purpose quality of the recycled water. This approach implies that the quality of the recycled water is appropriate for its intended use and has moved away from the exclusive focus on health aspects. The guidelines (NRMMC and EPHC 2006) consider health and environmental components associated with using recycled water concentrating on particular parameters of concern.

The Australian guidelines have been through a risk assessment process and the key environmental risks for agricultural irrigation using recycled water identified. The primary hazards identified are boron, cadmium, chloride, chlorine disinfection residuals, hydraulic loading, nitrogen, phosphorus, salinity and sodium (taken from NRMMC and EPHC 2006). These hazards generally align with major agronomic management issues for irrigation of horticultural crops using recycled water that have been identified - salinity (sodium and chloride), soil sodicity, nutrients (nitrogen and phosphorous) and managing algae in on-farm storage of the water.

While the Australian guidelines promote a fit-for-purpose approach, there continues to be confusion when determining the appropriate quality of water for a particular end use. This uncertainty arises for two key reasons:

- The states continue to regulate the use of recycled water for irrigation based on a Class A to D system, which focuses on the health aspects. While the Class system is valid for health parameters it is potentially misleading when considering quality parameters such as salinity (i.e. recycled water may be Class A but can be of poor quality for irrigation with high salinity levels).
- The Australian guidelines focus on health and environmental risks. However, there is limited understanding of the agronomic implications of irrigation with recycled water of varying quality and the practical application of the risk assessment approach.

To ensure the adoption of recycled water for irrigation of production and amenity horticulture and its sustainable use, a range of parameters need to be considered by the recycled water provider and the end user. Unfortunately, the objectives of the provider and end user are often vastly different so they will, understandably, focus their attention on different parameters. For example, the greatest risks for the provider of the water are generally related to health, while the priority risks for the end-user are more likely related to production.

There have been a number of studies to explore the fit-for-purpose use of recycled water for the irrigation of production and amenity horticulture.

Vegetables. The key issues that have been identified are salinity (sodium and chloride), soil sodicity and nutrients (nitrogen and phosphorus). The significance of these parameters varies enormously depending on the soil type, the vegetable species, irrigation technology and management practices. The determination of fit-for-purpose will therefore vary from region to region based on the farming system in place and the salinity and nutrient levels of the source water.

Wine grapes. The major issues for irrigation using recycled water include salinity and nutrients. For high quality wine, it is critical that the water does not induce salinity stress or result in poor fruit quality from excess nutrient applications. Additional hazards such as potassium and bicarbonate will result in the water having an adverse impact on the resultant wine quality.

Amenity trees. Recycled water has been used to irrigate established trees in the Werribee Park Garden. The major risks identified with its use water are salinity and phosphorous. While the water appears to be appropriate for this use, there are concerns as to the long-term health of the trees due to salinity. Trees vary enormously in their tolerance to salinity, which needs to be considered on a species by species basis. There is currently limited reference data for salt tolerance for a range of amenity species.

Golf courses. Recycled water is used extensively to irrigate golf courses. The grass species and the soil used for greens and fairways vary greatly resulting in different requirements for quality of recycled water. Salinity levels of provided recycled water may

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be appropriate for irrigating fairways but not for the more salt sensitive species grown on greens. The irrigator will need to consider management options such as shandying to ensure the water is fit-for-purpose in all instances.

The wash-up

The current regulation that is used in the states (Class A to D) can be misleading in the context of irrigation of amenity and production horticulture. This is an important issue because the use of recycled water for irrigation of horticulture is increasing. In addition, there is a need to more fully understand the impacts of parameters in recycled water on horticulture production. The following points highlight the major considerations for enhancing the use of recycled water for irrigation of horticulture:

- Providers and end users must fully understand the quality parameters of the water source (concentrations and variability). Class A does not necessarily mean that the water is good quality from the perspective of salts and nutrients.
- Providers and end users need to fully understand the sensitivity to specific parameters of the crop being irrigated considering species, farming system and management practices.
- To meet fit-for-purpose objectives, the water must be tailored to the needs of the end user from a health, environmental and agronomic perspective. Meeting these requirements may require additional treatment, increasing costs.
- Providers and end users need to undertake monitoring and manage the system accordingly.
- Providers and end users need to continuously communicate to understand each others' objectives, specific needs and their perspectives. ●

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Note. The article was developed as the result of a workshop session on recycled water held at the RainBird Intelligent Use of Water Summit, held in Melbourne in March 2009.

Save water, build smarter

Weather-sensitive sprinklers controlled by satellites. Instant water heaters near every faucet. Low-flow toilets with pressurized flushing. And a WaterSense seal of approval from the US federal government.

Welcome to the home of the future.

While most builders retreat to their offices to wait out an economy gone awry, those still seeking building permits are discovering that projects can live or die based on the availability of water.

Several builders already have been forced to change plans: one showerhead instead of several, less grass and more drought-tolerant plants.

Next on the horizon: using recycled water to irrigate landscaping of new homes.

Such a move already is under way in eastern San Bernardino County, where the Yucaipa Valley Water District requires that all new homes be dual-plumbed so water recycled from a sewage treatment plant can be used to irrigate landscaping.

Fred Bell, president of the Building Industry Association's Coachella Valley chapter, said his group is encouraging members to be aggressive in making new developments use less water.

"There's no question that in the last four years, water as a factor in development has become a bigger issue," he said.

When California required low-flow showerheads in 1980, the nation followed up with the same standard in 1994.

The state will require even more efficient toilets and showerheads plus weather-based irrigation devices in new developments starting in 2011.

The tougher government regulations, more conservation-savvy consumers, and increased pressure on the state's water supply have continued to make homes more efficient since then, Bell said.

Builders are beginning to realize that water-efficient fixtures, appliances and landscaping are just as important as double-pane windows, good insulation and solar power when seeking approvals for their projects and marketing the homes, said Justin Dunning, director of the California Green Builder Program, which certifies homes that reduce energy and water consumption.

The program has certified about 2,000 new homes statewide since 2005.

The aim is that each home will save 20,000 gallons of water annually with low-flow showerheads, water-efficient toilets, and irrigation systems that cut water consumption by an average of 25 percent compared to "nongreen" homes, he said.

A typical home uses 120,000 gallons of water a year.

Other builders are seeking the WaterSense label from the U.S. Environmental Protection Agency.

The program, similar to EnergyStar for appliances, certifies home products that reduce water use 20 percent -- more than 10,000 gallons a year -- compared to conventional products.

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In Indio, a median is landscaped with tough plants that require little water. But the area has numerous housing developments with manmade lakes and lush lawns. Indio officials and water agency representatives say rising water rates could make such amenities prohibitively expensive in the future.

Image: The Press-Enterprise