IRRIGATING WITH RECLAIMED WATER: IMPACT ON SOIL MICROBES UNDER GRAPEVINES

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INTRODUCTION
Predictions of lower rainfall as a result of climate change means grape growing will become more dependent on alternate water sources for irrigation. Reclaimed water is potentially a major water source for irrigation within the viticultural industry. Use of reclaimed water alleviates pressure on valuable water resources and reduces the amount of discharge of nutrients from sewage into the sea. One of the main concerns in the widespread adoption of reclaimed water is the impact on the soil environment and influence on soil pathogens. Enzyme assays are used to measure total microbial populations of soil. The enzyme β-glucosidase, involved in microbial degradation of cellulose to glucose, is a useful biological indicator of changes in the soil environment. The objective of this study was to investigate the influence of reclaimed water on (1) soil microbial activity and (2) soil pathogens to support its use as a safe and viable alternative water source.

MATERIALS AND METHODS
Extensive soil sampling was conducted under drip-irrigated vines (cv. Shiraz) at McLaren Vale, South Australia. Vines were planted in 1998 and selected rows irrigated with either reclaimed or mains water. Soils were collected directly from 5 vines per treatment under the dripper with a 7.5cm core at 4 distances away from the trunk (0, 20, 40, 60cm) and at depths of 0-5, 0-10, 10-20, 20-30 and 30-40 cm at various times of the season (budburst, flowering, veraison and harvest).

In the first season, bulk soil was collected; in the second season rhizosphere soil was isolated from grapevine roots. Microbial activity was assessed by measuring the enzyme β-glucosidase, expressed as the amount of p-nitrophenol (2). Roots were washed and small root pieces were placed on selective media for fungal identification.

RESULTS
Initial assessment of bulk soil indicated microbial activity under both reclaimed and viticultural was low (ca. 30 mg p-nitrophenol). However as expected, greater microbial activity (ca. 85 mg p-nitrophenol) was observed in rhizosphere soils. Microbial activity declined with soil depth in both treatments (Figure 1). There was significantly greater enzyme activity at 0-5cm at other depths. Although it appeared microbial activity was higher under vines irrigated with reclaimed water, there were no significant differences between the two irrigation treatments.

Fungi isolated from soil and roots included Pythium, Rhizoctonia, Cylindrocarpon, Fusarium and Verticillium. High levels of Fusarium were detected (30-60% of roots tested) throughout the season, with a greater incidence of root infection in vines irrigated by mains water. The incidence of Pythium was more prevalent at budburst than at other times but there was no difference between irrigation treatments. Irrigating with reclaimed water did not cause more root infection by soil-borne pathogens than irrigating with mains water.

Figure 1. β-Glucosidase activity at various soil depths as expressed by p-nitrophenol released per hour per gram rhizosphere soil collected under vines (cv. Shiraz) at harvest (March 2007) and irrigated throughout the season by mains or reclaimed water.

DISCUSSION
Reclaimed irrigation water did not adversely impact microbial activity of soils. Sampling highlighted the variability in microbial activity under the vine and between vines and the importance of assessing rhizosphere soil. Rhizosphere soil showed higher levels of microbial activity than bulk soil, even though bulk soil is usually collected for general physical, biological and chemical testing of soil. Soil depth was the most significant factor in microbial activity, which indicated less soil organic matter was oxidised down the soil profile.

Reclaimed water did not enhance infection by potential root pathogens. Although Fusarium was frequently isolated from roots, it is a commonly occurring polyphagous soil-borne pathogen and in most regions is not considered a serious pathogen of grapevine.

Reclaimed water appears to be a viable means of alternate irrigation but information on the long-term effect on grapevine productivity will be valuable for future water management.

ACKNOWLEDGEMENTS
We thank Robin Coles for fungal identification and Kirsty Neaylon for technical assistance. The Grape and Wine Research and Development Corporation (GWRDC) funded this project with matching funds by the Federal Government.

REFERENCES