Solutes and Viruses in Soil Subirrigated with Reclaimed Wastewater

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BACKGROUND

Wastewater reuse for agriculture and managed landscapes will aid in meeting growing water demands and conserve current potable supplies in arid regions such as the upper Rio Grande floodplain. Opportunities exist to use alternative water supplies for irrigation such as treated municipal wastewater. However, wastewaters often contain microbial and chemical contaminants that may affect public health and environmental integrity. Wastewater pretreatment strategies and advanced irrigation systems may limit contaminant exposure to crops and humans. Subsurface drip irrigation (SDI) shows promise for safely delivering reclaimed wastewater. The closed system of SDI subsurface pipes and emitters minimizes the exposure of soil surfaces, above ground plant parts, and groundwater to reclaimed wastewater. However, the persistence and movement of waterborne viruses are of growing scientific and public concern with the recent increase in wastewater reclamation efforts.

OBJECTIVES

- Determine the feasibility of subsurface irrigation of a crop with a blend of untreated and treated wastewater effluents.
- Assess the movement of salts, nutrients, and bacteriophage (viruses of bacteria) as a surrogate for human viruses introduced into soil using subsurface drip irrigation with reclaimed wastewater.

Sampling irrigated spinach

Above: Reclaimed water tank. Below: Research team members with subsurface drip irrigation soil columns

FINDINGS AND BENEFITS

- There is potential to reclaim both untreated and treated wastewater effluents as an irrigation blend. The wastewater blend can be pretreated to reduce fecal coliforms to meet Texas Type I wastewater reuse guidelines for edible crops.
- Subsurface drip irrigation prevented the virus movement onto spinach leaf surfaces.
- Bacteriophage persisted in both sandy and clayey soils for a 28-d period after the last irrigation. Our results suggest that human viruses could also persist in soils for extended periods using SDI. Therefore, virus inactivation strategies may need to be an integral part of treating reclaimed wastewater, regardless of irrigation delivery system.
- The potential for salt and sodic hazard in soils increased with wastewater irrigation and with subsurface drip irrigation. In this study, pretreatment did not remove wastewater salinity or sodicity.
- Beneficial and safe use of reclaimed wastewater for subsurface drip irrigation will depend on management strategies that focus on irrigation pretreatment, virus monitoring, field and crop selection, and periodic leaching of salts.
- *For details see* Assadian, N. W., G. D. Di Giovanni, J. Enciso, J. Iglesias, and W. Lindemann. 2005. The transport of waterborne solutes and bacteriophage in soil subirrigated with a wastewater blend. Agriculture, Ecosystems and Environment 111:279-291.

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