

Assessing and managing the health risks of irrigation water in the lower Colorado River basins

Jorge M. Fonseca, Charles A. Sanchez and Sadhana Ravishankar, University of Arizona

The goal of this four-year project funded by USDA NIFA was to determine potential risks to the chemical and microbial quality of the Colorado River. Findings obtained during the first two years of the study identified management alternatives to reduce risks. The microbiological quality of the Colorado River was evaluated each week. Great variability was found in the bacteria indicators in the water, such as fecal coliforms, total coliforms, and generic *E. coli*, with low populations coinciding with the production season of leafy green crops in Arizona.



Plot watered with furrow irrigation.

Bacteria indicators increase during warmer months when no production or harvest is occurring in Arizona. No samples containing *Escherichia coli* O157:H7, a pathogen of great concern in the area, were found.

The risk posed by the different irrigation systems, including overhead sprinkle, furrow, and

drip irrigation, was assessed, and sprinkle irrigation was determined to be the method with the highest risk to deliver a contaminant to consumers. However, furrow irrigation produces the longest survival of *E. coli* in the soil, which may eventually serve as a cross contamination method at harvest. In survival studies using a non-pathogenic surrogate, the persistence of *E. coli* in commercial fields was found to be dependent on the time of the year. Factors such as temperature, moisture, and quality and intensity of light may play an important part in the survival of *E. coli*. Although the bacteria survived over two weeks in winter months, the persistence was not more than one week in summer months. In laboratory studies in Tucson, *Escherichia coli* O157:H7 and *Salmonella* sp. were subjected to survival studies in water collected from different sites along the Colorado River Basin. Survival was seen to possibly be affected by the concentration of salt in the water.

In studies surveying pharmaceuticals in the water, the treated Tucson wastewater effluent was found to contain the macrolide antibiotic azithromycin, the over-the-counter drug pseudoephedrine, the illicit drug methamphetamine, and an industrial compound, N,N-dimethylphenethylamine (DMPEA, an isomeric compound to methamphetamine). All contaminants evaluated were below detection in the control well water. No uptake

of the chemical compounds was found in any of the plant or root samples from field crops. Overall, the findings showed that highest risk is associated with potential microbial contamination when irrigation water is scheduled shortly before harvest.



Inoculation of water using a plastic container dripping onto the running water.

Growers have been informed and some have moved the schedule of the last irrigation as early as possible without harming final yield. Growers now know of a lower chance of having a pathogen

in the water during the coldest months. However, they also have learned that during the coldest months pathogens in commercial fields may survive longer than in summer months. More information is being generated on the impact of different survival rates in water collected from irrigation canals fed with the Colorado River water.



System connected to overhead sprinkle irrigation to inject *E. coli* in the water stream.

