

Projects Follow *Salmonella*'s Route Through Irrigation Water

A pair of research projects that focus on *Salmonella* and its relationship to irrigation water are designed to help Southeastern producers better understand associated risks and steps they can take to address them. The first one, led by George Vellidis, Ph.D. and a professor in the University of Georgia's Crop and Soil Sciences Department, looked at whether *Salmonella* moves through irrigation systems of Southeastern produce farms. Part of the project -- which included co-investigators Karen Levy, Ph.D., of Emory University's Rollins School of Public Health and Michele Jay-Russell, Ph.D., DVM and program manager with the Western Center for Food Safety at the University of California, Davis -- examined water sampling methods.

The second project was led by Vellidis and co-investigator Karen Levy. It looked at whether splash up from overhead irrigation could contribute to *Salmonella* contamination of produce.

Is Irrigating With Pond Water a Concern?

Previous research found low concentrations of *Salmonella* in Southeastern U.S. ponds used for produce irrigation. But Vellidis said the earlier work only involved four irrigation systems on one farm and wasn't large enough to be representative.

Vellidis and colleagues collected samples monthly from five Georgia ponds and found low concentrations of *Salmonella* in all five. Whether an individual sample tested positive for the pathogen depended on the time of year and whether it was collected before or after a rain. For example, 33 percent of samples collected before a rain were positive compared to 58 percent of samples collected after a rain. The concentrations of *Salmonella* in samples also were higher after a rain.

Under the Food Safety Modernization Act, agricultural water is considered safe if 90 percent of collected samples are below 410 colony forming units generic *E. coli* per 100 milliliters of sample or if the geometric mean of the samples is less than 235 colony forming units per 100 milliliters. Vellidis said they wanted to determine whether generic *E. coli* could be used as an indicator of *Salmonella*. But their work showed no correlation between the two organisms.

"The levels of *Salmonella* we found in these irrigation ponds were very, very low, so you wouldn't expect generic *E. coli* to be a good representation of that," he said. "What was surprising is we would find higher levels of *E. coli* and no *Salmonella*."

Collecting samples from downstream of pump intakes provides more accurate results than sampling along the edges of ponds, Vellidis said.

"If they sample the pond at different locations, they get a pretty good idea of what's happening in the pond, but there's a lot of variability from site to site because these are living organisms," he said. "We don't really know the factors that are contributing to the ponds, but we know the pathogens are not uniformly distributed in the ponds."

Vellidis and his colleagues also followed pond water through farm irrigation systems, including center-pivot, solid-set sprinklers and drip. They found *Salmonella* and *E. coli*, but at very low concentrations. Neither organism was detected in irrigation water originating from wells. The researchers also found *Salmonella* in two of 65 samples of produce irrigated with pond water. One was cucumber on raised plastic-covered beds with drip irrigation; the other was cantaloupe on narrow-plastic mulch with overhead sprinklers. Whether those *Salmonella* strains are commonly associated with human illness is the subject of current studies.

An ongoing research project is examining whether use of Accu-tab calcium hypochlorite chlorine tablets could further reduce *Salmonella* concentrations in irrigation water. Although Vellidis said he's still reviewing the data, he said the system reduced *Salmonella* levels "pretty dramatically."

Splash from Overhead Sprinklers

The second project looked at whether splash from overhead sprinkler irrigation systems could contaminate produce with *Salmonella* or *E. coli*. The initial trials involved five replicates, each with pans placed at 2-, 4-, 8-, 16- and 32-inch heights. Overhead sprinkler irrigation systems provided the splash. The trials were conducted in broccoli in December and January, mustard greens in March and April, and cantaloupe in May and June.

The researchers noted splash-up in all pans, and very low *Salmonella* and *E. coli* concentrations were found in several pans. Vellidis said he'd like to pursue future research to examine measures farmers could implement, such as cover crops or residue management, that could potentially reduce splash.

Key Industry Take-Aways

- If using pond water to irrigate, collect water samples downstream of the pump intake, not the edge of a pond
- *Salmonella* concentrations do not correlate to generic *E. coli* levels
- *Salmonella* remains viable as it moves from a pond through irrigation systems
- Splash from overhead sprinklers and rain could be potential sources of *Salmonella* contamination

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