Use of Reclaimed Water as an Alternative Water Source for Irrigation of Tomato in Southwest Florida

By: Crystal Snodgrass, Extension Agent I, Manatee County-South Central, Monica Ozores-Hampton, Post Doctoral Associate, Southwest Florida Research and Education Center, Eric Simonne, Associate Professor, Horticultural Sciences Department, Steven Sargent, Professor, Horticultural Sciences Department, Daniel C. McClure, and Tom Wilkes

The use of reclaimed water in vegetable irrigation has become a hot topic as of late. Several factors contribute to the increasing popularity of this idea. With greater restrictions on food safety and water conservation and quality, vegetable growers are doing everything in their power to deliver the best product in the safest manner possible. These restrictions not only come from government agencies but are being adopted by many buyers. Buyers are tightening restrictions on all aspects within the industry including more stringent food safety audits. Some even require tomatoes to be grown under certain conditions such as the use of only potable water sources. The use of reclaimed water has the potential to reuse millions of gallons of wastewater. This wastewater must undergo chemical treatments and pass certain requirements before it can be reused. However, some argue that the use of reclaimed water raises the potential for contamination and even increase the incidence of plant pathogens. Further research is needed in this area as we enter this new age of food safety and resource conservation. The decision to use reclaimed water raises several questions such as: How will my yield be affected? Will my fertilizer rates be affected? Can I cut costs without reducing fruit quality and yield? Just to name a few.

An award winning paper, written by Dr. Monica Ozores Hampton et al. 2007 (Proc. Fla. State Hort. Soc. 120:184-188), begins to answer many of these questions. In a 2006 study in southwest Florida, it was shown that the use of reclaimed water adds to the total N supplied to the crop and should be counted when calculating total N rates in seepage irrigated tomato. The study considered several aspects including the effect of the added N from reclaimed water to a wide range of nitrogen rates, levels of N and K found in petiole samples throughout the season, effect on yield and fruit quality, and finally considers economic benefit.
The fertilizer trial was conducted in the spring of 2006 in a commercial tomato field near Palmetto, FL. A preplant or bottom mix fertilizer was applied via broadcast method to supply 20, 79, and 33 lb acre\(^{-1}\) of N, P, K respectively. A randomized complete block design was used with four replications. N rates were applied as ammonium nitrate placed by hand in two grooves formed on the top of the bed (hot bands) using pre-calibrated cups at rates of 0, 40, 100, 22, 280, 340, and 400 lb acre\(^{-1}\). Approximately 6 weeks after treatment tomato transplants were planted.

Contribution of N from reclaimed water was calculated by multiplying N concentration by volume of irrigation water applied. Farm water meters were used to determine irrigation volume. Nitrate-nitrogen and NH\(_3\) daily concentration were accessed by the Central Laboratory/Industrial Compliance of Manatee County using various methods. Results showed that assuming a 50% N uptake efficiency by the tomato plants and a 2% organic matter mineralization rate, that the N rate available to the tomato plant from sources other than soluble fertilizer was 56 lb acre\(^{-1}\). This amount is approximately 28% of the UF/IFAS recommended rate of 200 lb\(^{-1}\) of N. In 2006 at a cost of $0.40/lb of N, the equivalent value is $22/acre.

Plant nutritional status was also tested by measuring NO\(_3\)-N and K petiole concentrations every 2 weeks throughout the season. The results showed that fertilizer rates above 176 lbs/A of N did not improve plant nutritional status and did not prevent the drop in NO\(_3\)-N concentration at the end of the season.

Fruit yield was accessed with 2 spring harvests. Ninety percent of all yields were contributed by the first harvest, while only 10% was contributed by the second harvest. In the first harvest 70% of fruit were extra large. Extra large fruit showed a negative response to N rates and yield of extra large fruit was decreased by 5-25 lb boxes for each added 100 lbs of N. There was no significant difference between treatments in medium and large fruit. During the second harvest, extra-large yield response was not significant, while large fruit yield increased by 1.2 25 lb box/acre with each added 100lbs of N. Although this increase was positive, it did not offset the decrease in extra-large yield from the first harvest. These results indicate that tomato did not respond to N rates greater than the UF/IFAS recommended rate when the spring crop was harvested twice.

Post harvest evaluations were conducted at both harvests using ten tomatoes at breaker/turning stage samples from each plot. Tomatoes were stored until they reached table ripe stage. Soluble solids concentration (SSC), total titratable acidity (TTA) and pH were measured. The results from these tests showed that the effect of N rate on tomato pulp pH, TTA, and SCC was not significant from both harvests. All measurements were within the typical range for Florida 47 tomatoes. Therefore, N rates between 76 lbs acre\(^{-1}\) and 476 lb acre\(^{-1}\) had no affect on fruit quality.

Results from this study indicate that the contribution of N from reclaimed water should be accessed when calculating total N applied. It may be possible for growers to decrease N rates without sacrificing yield and fruit quality. Although further research in the area of reclaimed water use in vegetables is needed, irrigation with reclaimed water may be a promising alternative and may prove to save water and money on fertilizer costs.
2006 multiple N trial, Palmetto, Florida (Photo: Monica Ozores-Hampton)