Increasing Efficiency of Sub-Surface Drip UAN Application

NutriSphere-N showing promise in studies on the production of processing tomatoes.

Drs. Galen Mooso and Terry Tindall

The Fluid Journal • Official Journal of the Fluid Fertilizer Foundation • Fall 2013 • Vol. 21, No. 4, Issue # 82

▼ DOWNLOAD

Summary: *The results of this study on the effect of NutriSphere-N on UAN applications through a sub-surface drip irrigation system for process tomato production suggest that NutriSphere-N increases the efficiency of UAN applications over the grower standard practice and provides increased economic returns to growers. Upon reviewing this work, Chris Medeiros of Ingomar Packing Company said, "Based on the results of this study, I think that NutriSphere-N is an exciting new technology and should be further evaluated as a product to increase the efficiency of sub-surface drip UAN applications for the production of processing tomatoes."*

California tomato production and the economics generated are valued at over a billion dollars. Tomato production is generated on about 300,000 acres and makes up an important agronomic crop in the state. The vast majority of this acreage is for processing tomatoes as opposed to fresh market tomatoes. The greatest area of production is in the San Joaquin Valley. Within this geographic area there are no better examples anywhere of the competing demands for land, open space, environmental improvement, urban development, and water. This is a semi-desert area where water makes possible production practices for one of the most fertile productive areas in the world. With the limits on water and land many producers have moved toward drip irrigation, with the current estimation of about 65 percent under drip. This trend is expected to increase each year over the next few years.

As drip becomes more commonplace so does the opportunity for fluid fertilizers. Better understanding of the 4-R's in regards to timing, rates, and forms, and now placement of fluids through drip, are becoming paramount as a basis of developing best management practices associated with these types of tomato production systems.

Study initiated

Nitrogen (N) applications using sub-surface drip irrigation systems are a very efficient method of applying fertilizer with minimal losses due to the fact that plants are fed frequently throughout the growing season. A study was initiated by J. R. Simplot in the spring of 2012 to evaluate the effect of NutriSphere-N, a nitrogen management product marketed by Simplot.

There are increased concerns with nitrogen fertilizer applications in agricultural production systems. New legislation in California controlling N applications in crop production is being enacted, which may restrict future N applications.

Objective

The following report is an ongoing study that incorporates fluid fertilizer as urea ammonium nitrate (UAN) through a drip system in combination with a Nitrogen management polymer called NutriSphereN®, which is a patent by Specialty Fertilizer Products of Leawood, Kansas. The study was initiated to better understand the benefits of NutriSphere-N in subsurface drip applications in a commercial process tomato system.

Methodology

Initiation. Simplot Agronomic Service was contacted by Chris Medeiros of Ingomar Packing Company, Los Banos, California, regarding interest in NutriSphere-N for the purpose of improving the efficiency of N applications in subsurface drip irrigation systems for the production of processing tomatoes. Andy Gulley, Simplot Growers Solutions, Five Points, California, also consulted in this study.

Field. A tomato field near Firebaugh, California was selected for this study. The field was transplanted (H8504 variety) on May 14, 2012.

Fertigation. The first fertigation application of the Urea Ammonium

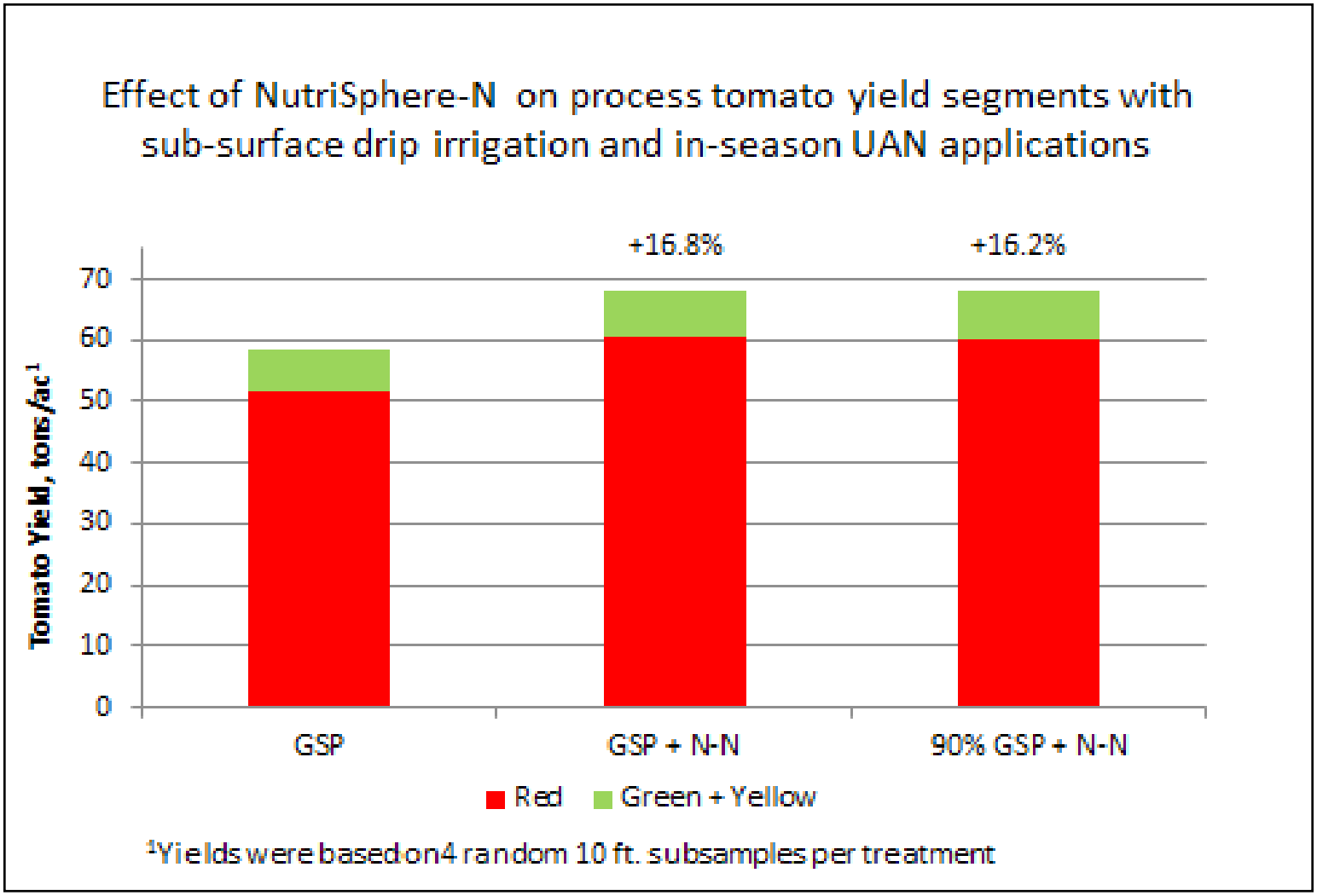

Figure 1. Effect of NutriSphere-N on random hand harvest process tomato yields with sub-surface drip and in-season UAN applications.

Nitrate (UAN) 32% N was made on May 23, 2012. It was anticipated that there would be 10 applications of UAN-32 during the growing season at approximately weekly intervals. The NutriSphere-N (L) was injected at a rate of 8 oz in two gallons of water per 2-acre plot on the 1st, 3rd, 5th, 7th, and 9th, with UAN applications starting 30 minutes prior to UAN fertigation applications (for a total of 20 oz/A of NutriSphere-N/acre/season).

Equipment. NutriSphere-N was injected into each 2-acre plot at the modified riser using a 2.5 gal EZ-Flow fertilizer tank (tanks were set on the fastest application setting). Four 2.5 gallon EZ flow tanks and induction couplings were provided by Simplot for use during this study.

N rate. A total of 200 lbs/A was applied in 10 fertigation applications during the growing season.

Treatments. Three treatments were evaluated for this study:

- Grower Standard Practice (G) = no additional treatment
- NutriSphere-N application prior to the 1st, 3rd, 5th, 7th, and 9th UAN fertigation applications
- 90 percent GSP + NutriSphere-N application prior to the 1st, 3rd, 5th, 7th, and 9th UAN fertigation applications. UAN applications were not to be made to these plots during the 4th fertigation cycles.

Plots were 24 rows by the length of the field (725 feet or approximately 2 acres per plot).

Injection. NutriSphere-N was injected into the 2-acre plot area using an EZ Flow mainline dispersing tank connected to the induction coupling. Risers were modified with the installation of an injection coupling, which was attached to the mainline dispersing tank with a hose. The injection coupling creates a suction that then empties the tank while the tank is turned on. The tanks were turned on during the first 30-minute pre-fertigation cycle when only water was running through the system.

"Results suggest NutriSphere-N increases sub-surface drip UAN efficiency."

Replication. Each N-N treatment was replicated two times for a total of four plots. The balance of the field received no additional treatment (grower standard practice).

Plant tissue analyses were collected twice during the growing season and analyzed for nutrient status. Tomato leaf analyses as sampled on July 5th are presented in Table 1. NutriSphere-N did not have any effect on tomato leaf nutrient analysis; all values were in the sufficiency range.

Hand harvest. Plots were sub-sampled on September 25, 2012. Four random 10 linear feet of row plots were hand harvested and separated into red, yellow,

green, and cull segments and weighed to determine yield.

Summing up

Yield. Based on the random hand samples taken on September 25, 2012, N-N and the 90 percent GSP+N-N treatments increased yield over the grower standard practice by 16 percent. The random hand samples very closely predicted the commercial harvest yield for the N-N treated plots at 68 tons/A of yield. The random hand samples harvested were sorted into red, yellow, green, and culls. Looking at the segmented yields, the N-N treatments increased the yields of red tomatoes by 8 tons/A. The green + yellow yield was similar for all treatments at approximately 8 tons/A. These results show that the N-N treatments increased the amount of red tomatoes over the grower standard practice.

Commercial harvest. Tomatoes were harvested on October 6, 2012 by a contract harvest crew. NutriSphere-N treated plots were harvested separately and tracked through processing to determine the effect of NutriSphere-N compared to the Grower Standard Practice and a 10 percent reduction of N with NutriSphere-N compared to the Grower Standard Practice. The N-N plots were harvested separately from the rest of the field by commercial harvest equipment on October 6. The commercial harvest economic information is presented in Table 2. Nutrisphere-N increased total yield by 6.5 percent over GSP while reducing the total amount of N by 10 percent with NutrisSphere-N increasing yields by 6.2% compared to GSP.

Return. Both NutriSphere-N treatments provided an improved economic return to the grower without sacrificing any tomato color score or solids. Based on a contracted return of $69.40/ton, both NutriSphere-N treatments yielded a 29:1 benefit to cost ratio; this meant that for every $1 invested in the NutriSphere-N the grower received a $29 increase in revenue (Table 3).

Dr. Mooso is the Agronomy Manager for the J.R. Simplot Company and is a member of the Fluid Fertilizer Foundation (FFF) R and E Committee. Dr. Tindall is Senior Agronomist for the J.R. Simplot Company in Boise, Idaho and is also a member of the FFF Board of Directors and its Fluid Journal Editorial Committee.

Table 1. Mean tomato leaf sample analysis on samples collected on July 5, 2012*

	N	P	K
GSP	5.02	0.52	3.30
GSP + N-N	4.97	0.49	2.95
90% GSP + N-N	4.68	0.49	3.40

**Tomato leaf sufficiency range for N=3.5-4.5, P=0.25-0.41, K=2.0-3.0*

Table 2. Mean tomato leaf analysis on samples collected on August 13, 2012*

	N	P	K
GSP	5.59	0.46	2.59
GSP + N-N	5.52	0.44	2.40
90% GSP +N-N	5.77	0.46	2.41

**Tomato leaf sufficiency range for N=3.5-4.5, P=0.25-0.41, K=1.6-3.1*

Table 3. Effect of NutriSphere-N on economics of subsurface drip tomato production.

	Total N Applied Lb N/A	Total yield Tons/A	Color Score	% Solids	Total return @$69.40/ ton	Nutri-Sphere-N Benefit
GSP	200	64.2	23	4.9	$4,455.50	
GSP + N-N	200	68.4[1]	22.4	4.9	$4,747.00	$281.50
(+$10/A)						(29:1)
90% GSP + N-N	180	68.2[1]	22.9	5.0	$4,733.00	$280.50[2]
(+$10/A)						(29:1)

[1]Harvest yields represents 2 x 2.0 acre plots

[2]Includes a N cost savings of $12.50 per acre based on UAN-32 = $400/ton.