

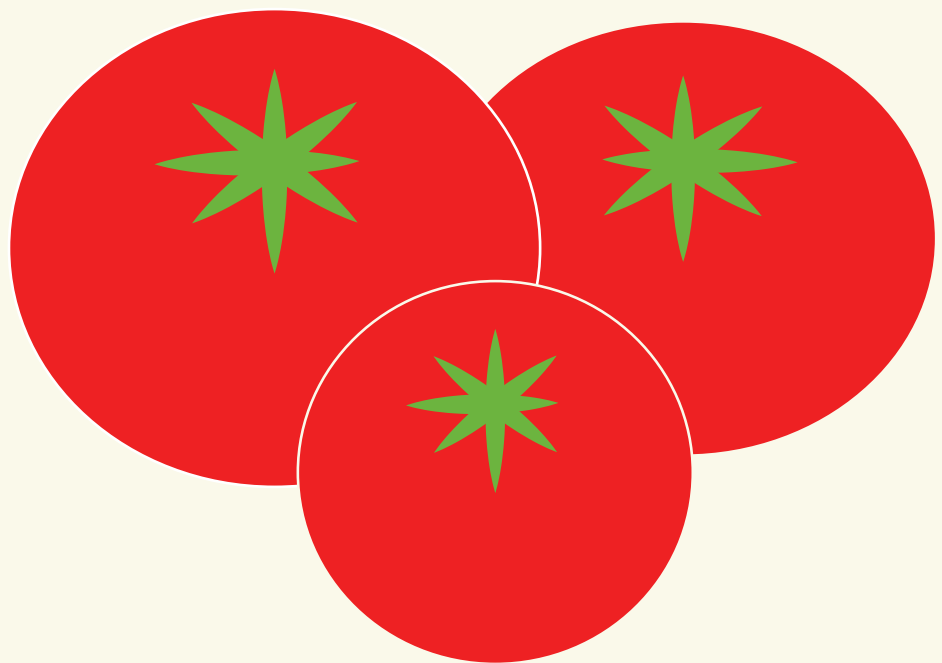
FUSN

Fused-Safe Nutrients™

Enhanced Efficiency Nutrient Management Studies in California on Peppers and Tomatoes Using FUSN™ and GAL-Xe® Controlled-Release Fertilizers

Terry A. Tindall, Ph.D., Director of Agronomy,
and Galen Mooso, Ph.D., Agronomy Manager

Oxnard, California, 2014




Simplot

Bringing Earth's Resources to Life

Continued interest exists to better understand fertilizer materials and any advances that can improve Nutrient-Use-Efficiency (NUE), balance production, improve economics, and address environmental considerations. This is especially true in some of the more sensitive regions of North America and nowhere is it more important than the vegetable producing areas along the west coast of California. Currently NUE associated with soluble fertilizer materials is about 50%. Many are saying within the California legislature that this level will no longer be sufficient and are now imposing laws and policy demanding that improvements be made with both the types of fertilizer applied as well as ensuring that the amount of nitrogen (N) being used on growing crops is the same as actually applied.

Certified Crop Advisors are now being asked to sign field reports ensuring that the newly implemented guidelines are being followed. Therefore, there is an increased awareness of challenges associated with improving NUE that includes not only timing and placement of nutrients, but also the fertilizer materials that are being used that include advanced formulations. With that in mind the J.R. Simplot Company is being proactive in the introduction of our F \bar{U} SN™ nitrogen fertilizer technology and improvements that this unique molecule may provide to vegetable production. We are also interested in their use and in determining agronomic understanding of our controlled release GAL-Xe® technology and how it compares to the grower standard practice of using urea in combination with liquid fertilizers.

Bell peppers

Field trials were established in the Oxnard area of California under the management of Dave Holden, who is a local, well-established, third-party independent researcher we have used in the past. All peppers and tomatoes were ordered from a greenhouse and transplanted as part of the grower standard practice. Nutrient treatments included the following:

- 1) Grower Standard Practice—180 lbs/ac N as urea applied pre-plant incorporated, 130 lbs/ac N applied 3 weeks post planting sidedress, 3-18-18 @ 5 gal/ac 5 weeks post-planting through the drip tape, 3-18-18 @ 5 gal/ac 7 weeks post-planting through the drip tape, UAN 32 @ 8 gal/ac 7 weeks post-planting through the drip tape, UAN 32 @ 8 gal/ac 9 weeks post-planting through the drip tape, KTS 0-0-25 @ 10 gal/ac 11 weeks post-planting through the drip tape, KTS @ 10 gal/ac 13 weeks after planting through the drip tape and KTS @ 10 gal/ac 15 weeks post-planting through the drip tape.
- 2) F \bar{U} SN (26-0-0) 180 lbs/ac N applied pre-plant incorporated, 180 lbs/ac N as F \bar{U} SN applied 3 weeks post-planting sidedress (with all remaining nutrients applied as treatment 1).
- 3) GAL-Xe (43-0-0) 125 lbs/ac N applied pre-plant incorporated, 0 N sidedressed (with all remaining nutrients applied as treatment 1).
- 4) GAL-Xe (43-0-0) 180 lbs/ac N applied pre-plant incorporated, 0 N sidedressed (with all remaining nutrients applied as treatment 1)
- 5) GAL-Xe (44-0-0) 125 lbs/ac N applied pre-plant incorporated, 0 N sidedressed (with all remaining nutrients applied as treatment 1)
- 6) GAL-Xe 44-0-0) 180 lbs/ac N applied pre-plant incorporated, 0 N sidedressed (with all remaining nutrients applied as treatment 1).

The FUSN technology is a new N fertilizer technology that is projected to come into the market on a commercial basis during 2015. It combines ammonium and nitrate with sulfate in a 2:1 double salt. The process creates a low-detonable fertilizer material that replaces ammonium nitrate. The manufacturing facility is located within the Simplot industrial complex in Lathrop, California. Agronomy responsibilities include field studies to help better understand the responses within various cropping systems in the Western U.S. Since California is a high-priority area, this project is moving forward for the third year (2015). This report is for the 2014 season.

GAL-Xe fertilizers are controlled release fertilizers that release N over a period of time strictly dependent on soil moisture. Release is controlled by thickness of the reactive products used to create a semi-permeable membrane. Therefore, moisture moves into the granule across the polymer boundary creating a urea solution. Because of the differences in osmotic gradient between the urea solution within the granule and the soil moisture, N solution moves across the membrane into the soil, allowing access to growing developing plants. Rates of N release across similar temperatures are then controlled by membrane thickness. Therefore, GAL-Xe 44-0-0 is thinner walled than GAL-Xe 43-0-0, allowing more N to move into the soil relative to the thicker coated GAL-Xe 43-0-0.

Harvest and yield

Each plot was harvested separately on September 8 with marketable and total yield determined. Using treatment one as a basis for comparison it quickly becomes apparent that improvements in bell pepper production can come about with the use of alternative fertilizer materials that have enhanced efficiency capabilities like Simplot's new FUSN as well as GAL-Xe controlled-release fertilizer. It is especially interesting to note the value of using GAL-Xe and its ability to improve marketable yield even with a small reduction in total amount of N being used. This becomes a glimpse of the remarkable technology to be introduced into the California vegetable market by the J.R. Simplot Company.

	Treatment	Marketable	Total Tonnage
1	GSP-Urea	25.0	29.3
2	GSP-FUSN (ASN)	27.5	35.5
3	Gal-Xe 43 Lower N	26.5	32.0
4	Gal-Xe 43	27.7	33.7
5	Gal-Xe 44 Lower N	28.6	32.3
6	Gal-Xe 44	31.3	35.5

Table 1. Total marketable and total tonnage of bell peppers being produced in California using FUSN and GAL-Xe fertilizer materials, 2014.

Economics

Improvements in yield and quality are certainly important factors, but it only tells a portion of the story. A central part of our story is the economic parameters being developed within this production area. Total economic yields are based on production of Jumbo, Ex-Large, Large, and Medium size peppers. Each category provides a unique value (data not provided by JRS marketing and business leaders at time of publication) with summaries created in providing dollar values for both marketable tonnage as well as total tonnage all based on yield and quality. There appears to be a nice shift based on previous years into larger peppers being produced for both the FUSN and GAL-Xe technologies when compared to the grower standard practice of using soluble urea. FUSN and GAL-Xe 44 provided the highest numeric yield that was also significantly higher than the GSP for both production and economic yield potential.

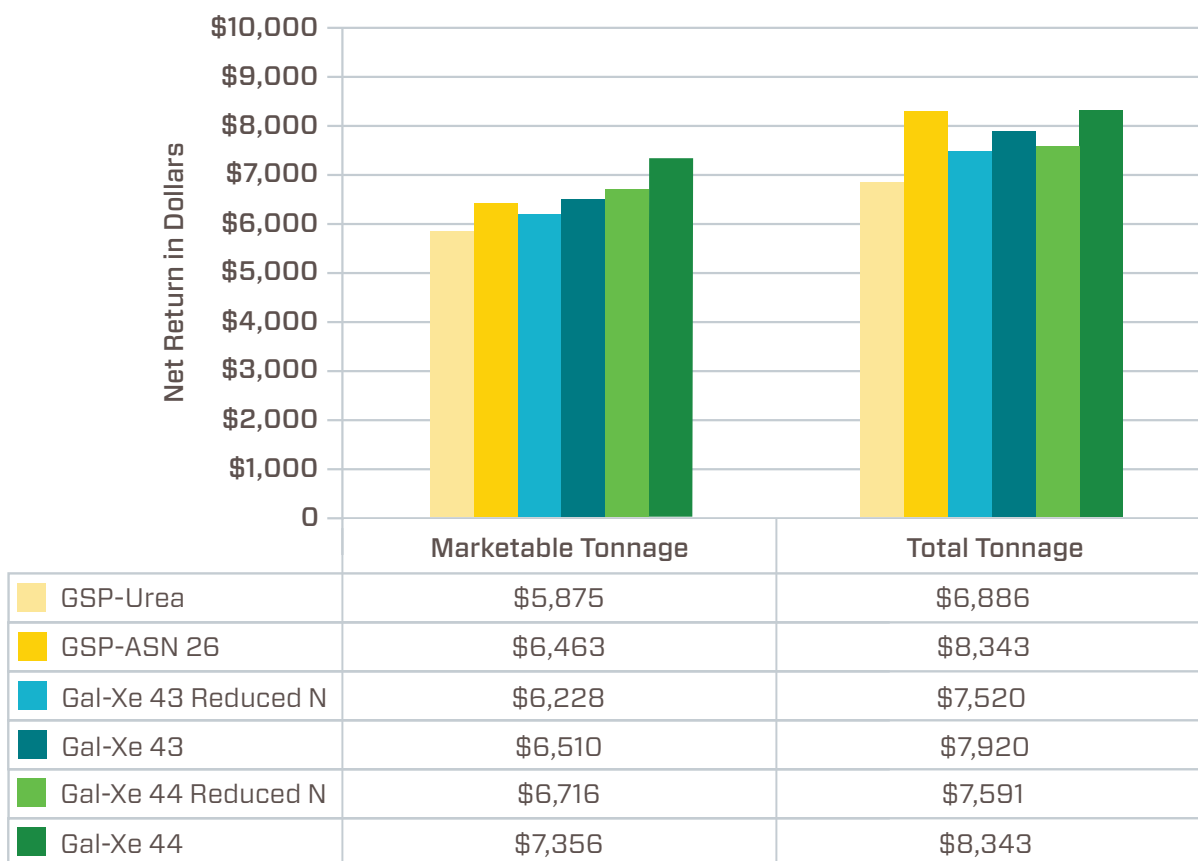


Figure 1. Economic parameters (prior to material costs being removed) for J.R. Simplot bell pepper field trials from Ventura, California—2014 growing season.

Fresh tomatoes

Tomatoes for the fresh market were planted at a similar time frame and location as the bell peppers. Fertilizer treatments used for the 2014 growing season were also identical to the peppers and can be referenced at the top of this report. Nutrients were compared to soluble urea that was split-applied between preplant applications, sidedress applications, and in-season UAN applied during the season and all through the drip lines (see peppers from complete treatment protocols).

Yields for the fresh tomatoes were relatively flat compared to the GSP with the only level of significant change being the reduction in overall yield associated with GSP, which was reduced by almost 18 tons for marketable yield for the GAL-Xe 44 at a lower N rate. It is interesting to note that GAL-Xe 44 at a similar rate as GSP produced the highest overall yield. It might be surmised that a short season crop like fresh tomatoes need a combination of soluble N as well as CRF to meet crop N demands.

Treatment	Marketable	Total
1 GSP-Urea	60.3	77.0
2 GSP-FUSN	63.0	78.8
3 Gal-Xe 43 Lower N	65.3	79.5
4 Gal-Xe 43	58.0	73.2
5 Gal-Xe 44 Lower N	42.8	55.0
6 Gal-Xe 44	77.5	83.2
\$/Ton	\$83	\$83

Table 2. Marketable and total tonnage of fresh market tomatoes associate with FUSN and GAL-Xe enhanced efficiency fertilizers being produced in the California markets—2014

Economics

Economic parameters were a direct reflection of harvestable marketable and total tonnage and based on the given dollar value of \$83.00/ton. Predicted dollar returns to the grower (gross dollar amounts without the associated input costs of materials) provide positive numbers for most of the treatments and especially for the GAL-Xe 44 at similar N rates as GSP (Fig. 2).

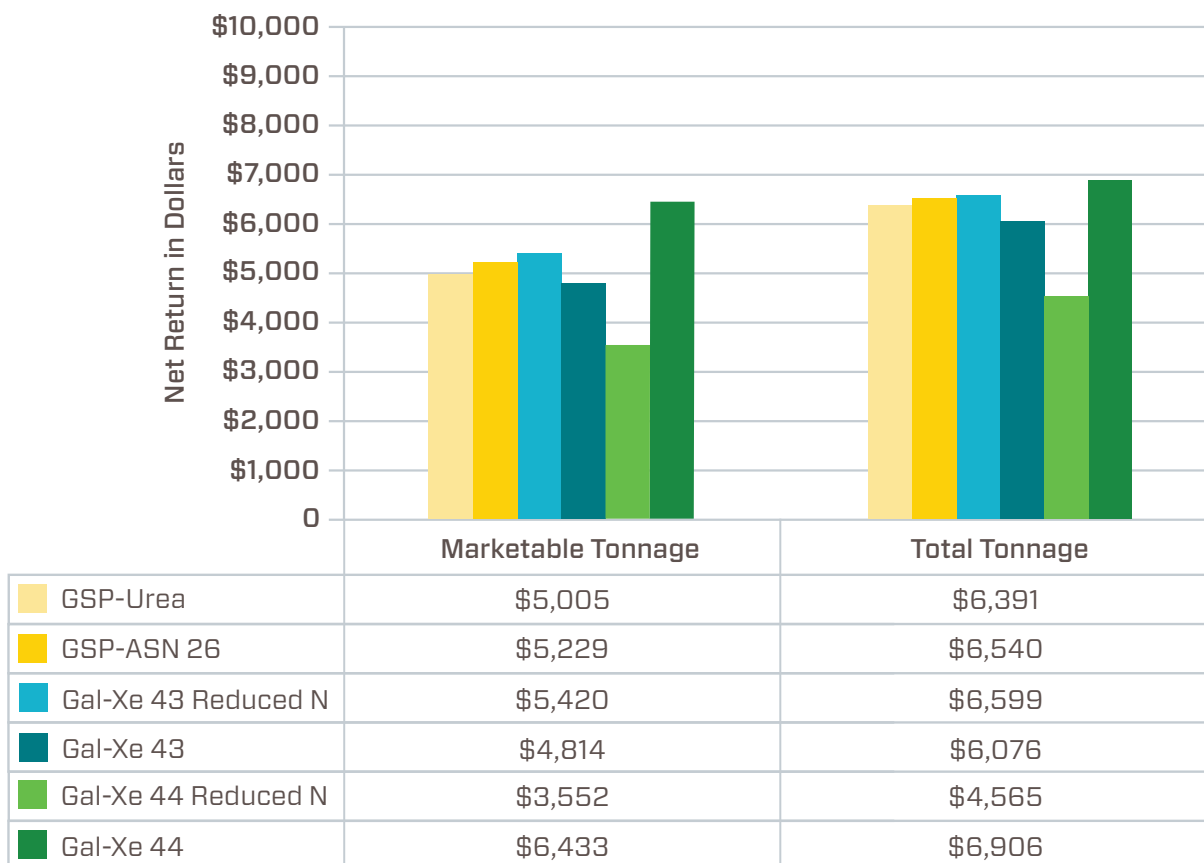


Figure 2. Predicted economic parameters for fresh market tomatoes being produced with J.R. Simplot advanced fertilizer technologies in Ventura County, California, during the 2014 growing season and being produced on drip irrigation.

Opportunities do exist to promote the use of both FUSN and Simplot's GAL-Xe fertilizer materials into fresh tomato production areas of southern California. This appears to be especially true for GAL-Xe 44, which provided a potential grower return (gross \$) of over \$1,400.00 more per acre for marketable yields as well as over \$515.00 dollars if total tonnage is expressed. These dry fertilizers are not be utilized as the total amount of N within the system, but a combination of dry and in-season applications of UAN and low salt 3-18-18. Additional efforts need to be done to further explore the possible wide-spread adoption of these technologies into the larger vegetable-producing area of California and Arizona.



Simplot® and GAL-Xe® are registered trademarks of J.R. Simplot Company. FUSN™ is a trademark of J.R. Simplot Company.