

## 2017 Nitrogen Fertilizer Technology Studies on Lettuce

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**Methods:** This trial was conducted at the USDA Spence Research Station. The soil at the site was Chualar sandy loam: pH 7.22; OM (LOI) 1.45%; Sand, Silt Clay 67, 18, 15%, respectively. The variety ‘Sun Valley’ was seeded on June 15 and the first germination water was applied with sprinklers on June 16. No nitrogen (N) was applied at or prior to planting. The crop was sprinkler irrigated until the plants were thinned (10 inch spacing) on July 6. On July 7 drip tape was installed (one medium flow tape applied to the middle of the bed). All fertilizer was applied through the drip system in two applications on July 11 and July 28 (see Table 1 for rates and types of materials tested). The standard fertilizer used was urea ammonium nitrate (UAN 32) except for treatments that provided all of their own N. A drip application system that had 12 separate manifolds was used to apply the each treatment (one treatment per manifold see photo 1). Battery powered pumps were used to inject fertilizer and fertilizer additive mixtures into each manifold. All injections were made during the middle third of irrigation events. Each plot was two 40-inch beds wide by 100 feet long; all treatments were arranged in a randomized complete block design with four replications. All experimental fertilizer treatments were applied at a moderate fertilizer rate (80 lbs N/A) in order to detect any increase in yield from the treatments over the unamended moderate N treatment. All amended treatments were compared with an unamended treatment (80 lbs N/A), a standard treatment (150 lbs N/A) and the untreated control (0 lbs N/A). The field was irrigated with 130% ET which supplied excess irrigation water to test which materials to provide an improvement in yield under an excessive irrigation regime. Soil samples were collected six times during the crop cycle. Lettuce was harvested on August 17 by cutting fifty four untrimmed heads from the two inside seedlines of each plot and weighing them to provide a measure of total crop biomass. Six heads from each plot were subsampled, dried and analyzed for total N content to provide a measure of N uptake (biomass N).

### Results:

There was a strong response to applied N in this trial. The untreated control had lower yield and N uptake than all other treatments (Table 1). The standard treatment had higher yield and higher N uptake than all other treatments. The unamended moderate N treatment yield was intermediate to the untreated control and standard treatments; this provided a good opportunity to be able to determine if the experimental treatments, also applied at the moderate N level, gave any yield improvement. None of the experimental treatments increased the fresh or dry biomass yield over the unamended moderate N treatment (Table 1). 7-0-1-7-7 had greater N uptake and higher percent N in the tissue than the unamended moderate treatment. There were no significant differences in soil mineral N levels until after the second fertigation on August 1 (Table 2); on this date, soil ammonium levels were higher in the 7-0-1-7-7 treatments than in the unamended moderate N treatment. Following that date, none of the treatments had higher levels of mineral nitrogen than the unamended moderate N treatment.



Photo 1. Injection manifold

Table 1. Application protocol of fertilizer treatments and yield components of lettuce on August 23

Material	Additive Rate	Total Fertilizer N/A	Fresh Biomass tons/A	Mean head lbs	% solids	Dry Biomass lbs/A	N uptake lbs/A	Tissue %N
Untreated	---	0	19.65 a	1.3	6.9	2,680.1	47.4 a	1.8
Standard (UN32)	---	150	37.92 c	2.4	5.9	4,507.0	127.4 e	2.8
Moderate (UN32)	---	80	33.17 b	2.1	6.0	3,961.2	93.8 bc	2.4
AR-034	2 gallons/ 100 lbs N fert	80	32.20 b	2.1	5.8	3,714.6	95.6 bcd	2.6
Nutrasphere	9.0 fl oz/A	116	34.30 b	2.2	5.6	3,851.0	106.2 cd	2.8
Nutrasphere	9.0 fl oz/A	80	32.14 b	2.0	5.5	3,526.8	91.3 b	2.6
7-0-1-7-7	---	80	33.06 b	2.1	5.6	3,717.8	107.0 d	2.9
7-0-1-7-8	---	80	32.19 b	2.1	5.9	3,777.4	95.6 bcd	2.5
BioWish Crop Liquid	0.4% wt/wt fert	80	32.74 b	2.1	6.0	3,908.4	99.1 bcd	2.5
BioWish Crop 16-40-0	1.0 lb/A	80	32.27 b	2.1	6.0	3,844.6	101.4 bcd	2.6
Pr>F treat			0.0001	0.0001	0.0047	0.0001	0.0001	0.0001
LSD <sub>0.05</sub>			3.14	0.2	0.6	369.1	12.8	0.2

Table 2. Mineral nitrogen levels in the top foot of soil on six evaluation dates during the crop cycle

Material	Additive Rate	Fertilizer total N/A	June 20		July 11		July 25		Aug 1		Aug 7		Aug 18	
			NH <sub>4</sub> -N	NO <sub>3</sub> -N										
Untreated	---	0	1.0	12.1	0.6	10.0	0.5	1.9	0.5	4.3	0.4	5.7	0.5	9.0
Standard	---	150	1.0	12.1	0.5	10.6	1.0	4.9	1.7	19.2	1.1	13.8	1.4	21.5
Moderate	---	80	1.0	12.1	0.5	14.6	0.7	3.8	0.9	9.6	1.3	14.2	0.8	10.7
AR-034	2 gallons/ 100 lbs N fert	80	1.0	12.1	0.4	14.0	1.1	6.8	0.9	13.4	0.5	6.7	0.6	7.0
Nutrasphere	9.0 fl oz/A	116	1.0	12.1	0.6	13.4	0.8	3.1	1.2	13.2	0.8	12.1	0.9	14.2
Nutrasphere	9.0 fl oz/A	80	1.0	12.1	0.6	13.1	0.6	2.8	1.2	14.1	1.1	15.2	0.7	10.0
7-0-1-7-7	---	80	1.0	12.1	0.4	13.3	0.6	3.3	1.7	15.5	1.0	11.0	1.0	14.5
7-0-1-7-8	---	80	1.0	12.1	0.5	10.7	0.7	3.6	1.1	7.7	0.5	8.1	0.7	11.5
BioWish Crop Liquid	0.4% wt/ wt fert	80	1.0	12.1	0.6	11.4	0.8	4.7	1.4	12.3	0.9	15.2	0.8	8.1
BioWish Crop 16-40-0	1.0 lb/A	80	1.0	12.1	0.5	9.9	0.9	4.3	0.8	9.1	0.7	10.5	0.6	7.9
Pr>F treat			---	---	0.9181	0.5177	0.2454	0.2986	0.0024	0.005	0.0136	0.315	0.067	0.0049
LSD <sub>0.05</sub>			---	---	NS	NS	NS	NS	0.6	6.6	0.5	NS	0.5	6.7