Research is going strong at Agro-Culture Liquid Fertilizers. The year 2006 marked the 13th season of research at the North Central Research Station. There were several changes in the year, including the purchase of a new six-row planter for field plot use. Additionally, in response to requests for increased research efforts in horticultural crops, a new agronomist was added to the staff. He is Dr. Brian Levene who comes to Agro-Culture Liquid Fertilizers with a solid background in research and market support in fruit and vegetable crops.

This research report includes plot results from the North Central Research Station plus that of additional work outside of Michigan. Additionally, in a separate file you will find a compilation of research from past years sorted by crop. It is hoped that this report will be of use to you in learning more about the *High-Performance* crop nutrition from Agro-Culture Liquid Fertilizers.

Jerry L. Wilhm, Ph.D
Research Manager

Stephanie Zelinko
Research Agronomist

Brian Levene, Ph.D.
Research Specialist

Doug Summer
NCRS Supervisor

Phil Dush
NCRS Assistant

2006 Agro-Culture Liquid Fertilizers Research Report
Table of Contents

Other:

Specialty Crops:

Research. Who needs it? You do! We all do!

Agriculture is a whirlwind of change these days. New genetics, new crop protection technologies, new equipment, new tillage, new rotations, and so on. Is there room for new ideas in crop nutrition? Of course, but only if it is proven. And the way of proof is research followed by experience. Growers are too big and too busy to be primary researchers. So a company must shoulder the research responsibility itself. And no one has bigger shoulders than **Agro-Culture Liquid Fertilizers** and its central proving ground: the *North Central Research Station.*

The North *Central Research Station* was started in 1994 and has grown to 200 acres, and is the largest facility in the United States dedicated exclusively to the study of crop nutrition. With a full-time research staff of five, research is annually conducted on some ten field crops, more than a dozen different vegetable and horticultural crops as well as turf. This amounts to well over a thousand individual plots that are monitored and harvested for yield comparisons. Many variables such as tillage, application timing and placement, and quality effects are tested. This gives **Agro-Culture Liquid Fertilizers** the unique ability to answer questions from the field, test new products and ideas, and develop a solid database to back recommendations. In addition to its research function, the *North Central Research Station* is also used as a training facility for sales personnel and as a field day host for customers and growers from across the country, as well as internationally. So when **Agro-Culture Liquid Fertilizers** says, “Research proven”, we mean it!

Note: At the time of this writing, some of the outside research (university, contract research, etc) had not been received. With this CD format, this information will be inserted as it becomes available in subsequent report updates.

Rainfall:

The 2006 growing season turned out to be rather unusual with alternating wet and dry months. This made both spring planting and fall harvest a bit challenging. Overall, we had an extremely wet season with rainfall almost 10 inches over the normal for our area. Over 6 inches of rain in May delayed planting, likewise above normal rainfall in October postponed harvest for most of the state of Michigan. Below normal rainfall in June and August did cause some concern, however an extremely wet July and September came at an ideal time to produce good corn and soybean yields for the state of Michigan.

2006 Rainfall (inches) at the North Central Research Station
Gauge reading for the date indicated

April:	
7	0.95
12	0.26
13	0.01
14	0.05
23	0.01
24	0.20
25	0.07
(avg:3.1)	1.55

May:	
1	0.01
2	0.50
10	2.00
11	1.46
12	0.20
13	0.18
14	0.49
16	0.16
18	0.20
19	0.28
20	0.04
21	0.04
24	0.18
25	0.07
30	0.17
31	0.06
(avg:3.1)	6.04

June:	
3	0.08
4	0.01
7	0.61
18	0.46
21	0.88
28	0.57
29	0.01
(avg:3.7)	2.62

July:	
4	0.23
7	0.02
9	0.11
10	0.1
11	3.82
12	1.43
14	0.14
15	0.01
17	2.53
18	0.05
20	0.03
26	0.23
27	0.68
28	0.01
30	0.25
(avg:2.5)	9.64

August:	
2	0.02
3	0.78
4	0.01
10	0.01
19	0.1
23	0.01
24	0.19
25	0.02
28	0.08
29	0.05
30	0.01
(avg:3.7)	1.28

September:	
5	0.61
6	0.01
8	0.57
9	0.47
11	0.56
12	0.01
13	0.23
15	0.01
16	0.01
18	0.12
19	0.05
20	0.01
22	1.70
23	0.67
24	0.03
25	0.04
27	0.07
28	0.01
30	0.46
(avg:3.2)	5.64

October:	
1	0.01
2	0.35
3	0.09
4	0.52
10	0.02
11	0.50
12	0.08
13	0.07
16	0.04
17	0.76
18	0.03
19	0.10
21	0.20
22	0.63
27	0.06
28	0.17
(avg:2.3)	3.63

Total Rainfall
April - October
30.4" (normal: 21.6")

Total Rainfall
May-September
25.22" (normal: 16.2")

Irrigation:
The North Central Research Station is fortunate to have the capabilities to irrigate all plots. This summer, with the above normal rainfall, irrigation applications were less frequent than in years past. It is our goal to provide a minimum of 1 inch of water to all of our irrigated crops each week. If this does not come with natural rain occurrences, it is then applied by irrigation.

2006 Linear Irrigation
Inches of water applied by date

Farm 3

June:		July:	
14	1.0	7	1.0
23	1.0		1.0
	2.0		
		August:	
		14	1.0
			1.0

Season Total: 4.0 inches

Farm 5

June:		July:	
15	1.00	7	1.00
	1.00		1.00
		August:	
		11	1.00
		18	1.00
		26	1.00
			3.00

Season Total: 5.0 inches

2006 Other Irrigation
Inches of water applied by date

Trickle Tape

Farm 1 (06-106):	
8/15	1.0
	1.0 inches

Farm 2 (06-220):	
6/27	0.80
7/7	0.75
8/10	1.00
8/16	0.90
	2.65 inches

Trickle Tape

Farm 2: (06-221)	
6/16	0.75
6/27	0.75
8/16	0.90
	2.40 inches

Traveling Gun

Farm 2: (06-211)	
6/27	0.50
7/7	0.75
7/26	0.75
8/12	1.00
	3.00 inches

2006 Garden Irrigation
Inches of water applied by date

Trickle Tape

June:	
12	1.0
16	1.3
18	1.0
	3.3 inches
July:	
5	1.0
24	1.1
	2.1 inches

Trickle Tape

August:	
9	1.2
16	1.1
24	1.0
29	1.1
	4.4 inches

Season Total: 9.8 inches

Growing Degree Days:

North Central Research Station - 2006
Total Growing Degree Days By Month
(Base 50 degrees F - Limit 86 degrees F)

	2001	2002	2003	2004	2005	2006
May	358	218	209	299.7	220.9	316.1
June	533	582	450.4	463.5	664.8	515.3
July	646	755.8	639.5	588.4	681.4	716
August	650	616.8	628.1	492.5	649	610.4
September	340	459.3	356	454.9	474.3	292.5
Season Totals	***2527***	***2632***	***2283***	***2299***	***2690***	***2450***

Soil Test Values:

Soil Test Values by Experiment Number
North Central Research Station

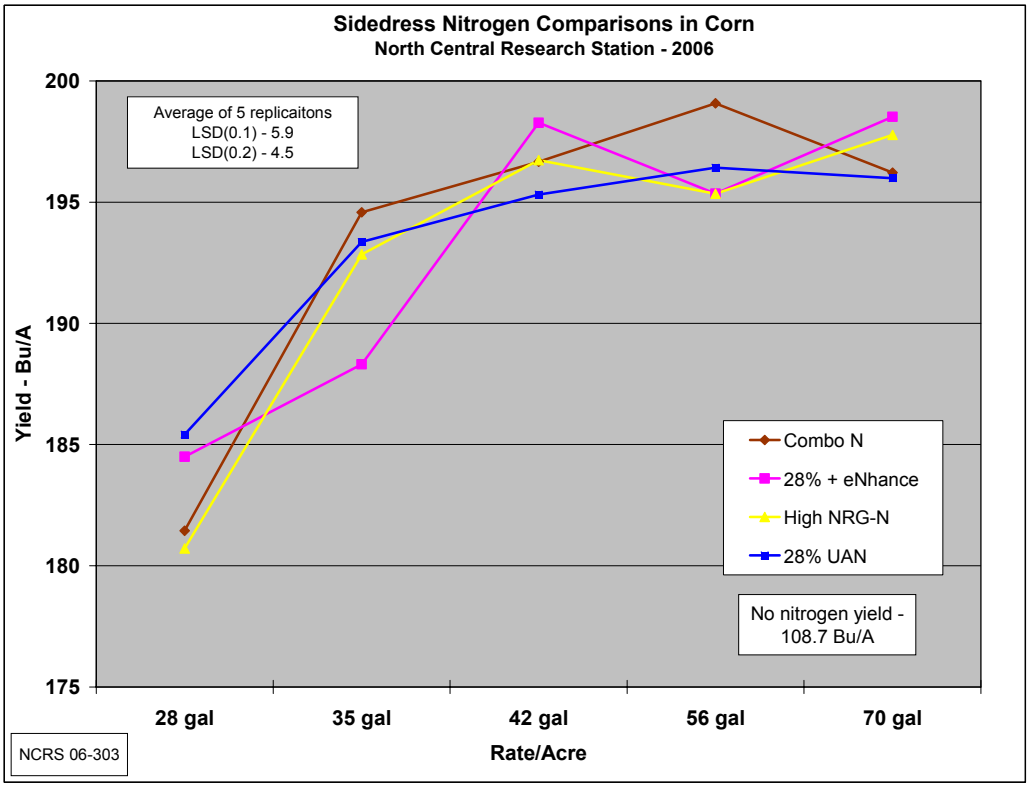
				ppm			% BASE SATURATION				ppm						Farm #
Exp. #	pH	%0M	CEC	P1	Bicarb	K	%K	%Mg	%Ca	%H	S	Zn	Mn	Fe	Cu	B	
06-106	5.9	2.2	7.2	60		127	4.5	19.3	59.2	16.6	10	1.2	8	57	0.8	0.4	1
06-201	7.3	1.8	6.3	61		87	3.5	16.9	79.0	0.0	12	1.9	52	32	0.5	0.5	2
06-202	7.3	1.8	6.3	61		87	3.5	16.9	79.0	0.0	12	1.9	52	32	0.5	0.5	2
06-203	7.3	1.8	6.3	61		87	3.5	16.9	79.0	0.0	12	1.9	52	32	0.5	0.5	2
06-204	7.3	1.8	6.3	61		87	3.5	16.9	79.0	0.0	12	1.9	52	32	0.5	0.5	2
06-205	7.3	1.8	6.3	61		87	3.5	16.9	79.0	0.0	12	1.9	52	32	0.5	0.5	2
06-206	7.3	1.8	6.3	61		87	3.5	16.9	79.0	0.0	12	1.9	52	32	0.5	0.5	2
06-207	7.3	1.8	6.3	61		87	3.5	16.9	79.0	0.0	12	1.9	52	32	0.5	0.5	2
06-208	7.3	1.8	6.3	61		87	3.5	16.9	79.0	0.0	12	1.9	52	32	0.5	0.5	2
06-209	7.3	1.8	6.3	61		87	3.5	16.9	79.0	0.0	12	1.9	52	32	0.5	0.5	2
06-210	7.3	1.8	6.3	61		87	3.5	16.9	79.0	0.0	12	1.9	52	32	0.5	0.5	2
06-211	7.2	2.2	7	66	25	137	5.0	17.0	77.5	0.0	10	0.8	10	25	0.6	0.5	2
06-221	7.2	2.2	6.6	34	16	92	3.6	16.2	79.9	0.0	7	0.8	7	48	0.4	0.4	2
06-302	7.3	2.2	6.6	38	17	71	2.8	17.3	7.9	0.0	9	1.6	9	94	0.5	0.6	3
06-303	7.5	2.6	7.1	36	12	80	2.9	15.8	80.4	0.0	9	0.9	5	16	0.4	0.5	3
06-503	6.9	3.0	10.8	24		40	0.9	25.2	72.7	0.0	12	1.0	2	32	0.7	0.6	5
06-505	7.2	2.1	8.2	53	26	100	3.1	20.5	75.6	0.0	9	1.1	12	54	0.7	0.5	5
06-506	7.0	2.4	8	61	18	120	3.8	18.8	76.0	0.0	12	1.2	10	35	0.4	0.5	5
06-507	7.1	3.1	11.4	31	13	54	1.2	21.3	76.8	0.0	7	1.4	5	78	1.1	0.7	5
06-508	7.3	2.3	11.4	33	17	95	2.1	26.9	70.4	0.0	7	1.2	10	44	1.0	0.6	5
06-510	7.6	2.6	7.9	47	28	120	3.9	27.2	67.4	0.0	8	1.3	10	22	1.0	0.7	5
06-513	7.5	2.3	9.2	35	18	88	2.5	30.9	65.1	0.0	10	1.3	12	20	0.7	0.8	5
06-514	6.5	3.2	12.2	35		50	1.1	24.4	67.1	7.0	10	1.1	3	32	0.8	0.6	5
06-516	6.9	2.7	13.0	30		101	2.0	21.5	75.6	0.0	10	1.7	10	64	1.1	0.7	5
06-556	7.9	2.3	15	18	15	100	1.7	23.8	73.8	0.0	11	1.6	8	27	1.3	0.6	5

Experiment: Sidedress Nitrogen Applications in Corn
Year (Experiment Number): 2006 (06-303)
Date of Planting/Harvest: 4-27-06 / 10-23-06
Hybrid: DeKalb 50-20 RR CB
Plot Size (replications): 15 ft x 210 ft / 130 ft (5 reps)

Soil Test Levels (ppm)
pH: 7.5 C.E.C.: 7.1
OM: 2.6% P1: 36 ppm
K: 80 ppm (2.9% BS)

Objective: Determine the optimal N source rate in corn following soybeans.

Nitrogen continues to be the most studied corn nutrient. With increased energy costs of late leading to increased cost of production of nitrogen fertilizers, careful rate management is necessary for best return on investment. The N sources tested were: High NRG-N, 28% UAN, 28% UAN + eNhance (eNhance added at a rate of 2 gallons per ton of 28%) and Combo N. Combo N is a blend of 50% High NRG-N and 50% 28% + eNhance. All materials were applied as a sidedress treatment at 28, 35, 42, 56 and 70 gallons per acre 46 days after planting to 12-inch corn in the V6-7 stage. Normally the corn would be sidedressed earlier, but it was slow to emerge after the cold and wet month of May. However, this was within the optimum timing window according to previous research of sidedress timing of corn following soybeans. Sidedress application placed the fertilizer midway between the rows through an application knife behind a flat coulter. All corn received the same planter fertilizer application of 4 gal/A Pro-Germinator + 6 gal/A Sure-K + 1 qt/A Micro 500 + 1 pt/A Boron. Yield data is presented in the following line graphs.



- Within each gallon per acre rate, there was no significant yield difference, except the application of 28% + eNhance at 35 gal/A. This is probably an anomaly since it was consistent with other treatments at the other rates.

- Generally, the optimum rate was 35 gal/A for all N products, as higher rates did not return significant yield increases. However, these yields are some 10% lower than in 2005 due to the cold May, which delayed emergence. Thus with lower yield potentials, the lower rates were effective.

Chlorophyll data. Relative chlorophyll content can be evaluated using a Minolta SPAD meter. Data was collected from replications one through three on July 31 when the corn was in the R1 stage of development. Measurements were taken midway between leaf base and leaf tip on the leaf just below the ear leaf. Twenty leaves were checked, ten from row 3, and ten from row 4, randomly selected within the length of the plot. Treatment averages were calculated. Additionally, the percent of maximum reading was calculated for the average readings. The highest average reading came from the 56 gal/A Combo nitrogen treatment (60.7). The following table lists the average SPAD reading, % of maximum calculation, and the corresponding average treatment yields.

Effect of nitrogen treatment on cholorophyll readings
North Central Research Station - 2006 (NCRS 06-303)

N source	gal/A	SPAD	% of max	Yield - Bu/A
High NRG-N	28	58.5	96.3	180.7
	35	58.9	97.0	192.8
	42	59.2	97.5	196.7
	56	59.0	97.2	195.3
	70	60.2	99.2	197.8
(source average):		*59.1*		*192.7*
28% UAN	28	57.9	95.4	185.4
	35	58.4	96.2	193.4
	42	60.3	99.3	195.3
	56	59.6	98.1	196.4
	70	60.5	99.6	196.0
(source average):		*59.3*		*193.3*
28% + eNhance	28	58.5	96.4	184.5
	35	58.9	97.1	188.3
	42	60.1	99.1	198.3
	56	60.4	99.5	195.4
	70	60.4	99.5	198.5
(source average):		*59.7*		*193.0*
Combo N	28	56.9	93.7	181.4
	35	58.3	96.1	194.6
	42	59.0	97.1	196.7
	56	60.7	100.0	199.1
	70	60.5	99.6	196.2
(source average):		*59.1*		*193.6*
No Nitrogen	--	35.8	59.0	108.7
	LSD(0.1)	2.0		5.9
	LSD(0.2)	1.5		4.5

- The lowest SPAD readings came from the lowest rate of application: 28 gal/A. Although the readings were still 93 to 96% of maximum compared to the no nitrogen treatment, which gave 59% of maximum.
- SPAD readings can be an indication of potential yield keeping in mind that the reading can be relatively high when reduced yield will occur. For example, 28 gal/A of 28% UAN produced an average SPAD reading 95.4% of maximum, but yield was significantly lower than the next higher rate of application (193.4 bu/A with 35 gal/A applied, which gave a SPAD reading of 96.2% of maximum).
- When averaged over SPAD reading for all rates of nitrogen applied within each source, the averages for the four sources tested were all close, as were the yields.
- More work will be done with different N sources, rates and SPAD meter readings in what would be a more "normal" (hopefully) year where yields were not reduced.

Conclusion: This year found 35 gal/A of nitrogen to be the optimal rate.

Experiment: *Nutri-Till*$_{TM}$ Fertilizer Applications for Corn
Year (Experiment Number): 2006 (06-503)
Date of Planting/Harvest: 4-27-06 / 10-25-06
Hybrid: Pioneer 36B03 RR RW
Plot Size: 6 rows x 90 ft (4 replications)

Soil Test Levels (ppm)
pH: 6.9 C.E.C.: 10.8
OM: 3.0% P1: 24 ppm
K: 40 ppm (0.9% BS)

Objective: Determine best placement and source of fertilizers for *Nutri-Till*$_{TM}$ strip tillage.
In recent years, *strip-till* or *zone-till* equipment has been developed to combine tillage strips in the seed zone with no-till between the rows for residue and moisture conservation. This has also presented an opportunity for nutrient application to reduce the need for extra application trips or application at planting or sidedress. The *Nutri-Till*$_{TM}$ applicator was custom-built by North Central Research Station supervisor Doug Summer. What makes *Nutri-Till*$_{TM}$ different is the ability for dual placement of liquid nutrition in the seed zone as well as below the seed. The deep shank is actually an anhydrous knife, which would place the liquid fertilizer approximately 6 inches below the surface. The seed zone placement is through a stream nozzle applied to the soil surface, and then covered by small hilling disks. Three coulters do the tillage and a rolling basket firms the tilled strip.

Nutri-Till$_{TM}$ implement in the raised position.

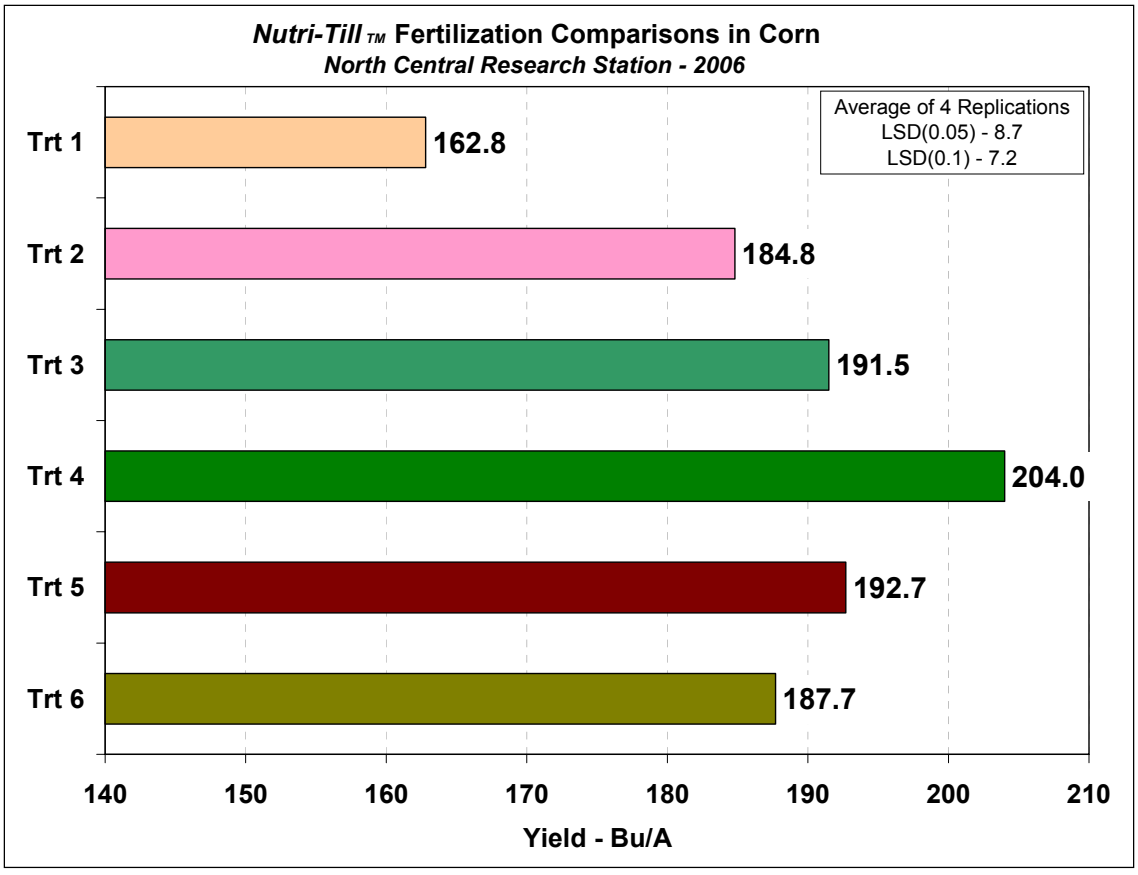
Fertilizer application and strip tillage on plots.

Planting over the Nutri-Till strips leaving wheat stubble residue between the rows.

The corn experiment was established on a Sebewa loam soil, which was in winter wheat in 2005. The *Nutri-Till*$_{TM}$ treatments were applied in the un-worked wheat stubble. The objective of the experiment was to compare fertilizer application either through the *Nutri-Till*$_{TM}$ implement, or through the planter on top of the unfertilized strips. Additionally, three different *Nutri-Till*$_{TM}$ applied nitrogen treatments were compared. There was also a conventional fertilizer treatment applied with *Nutri-Till*$_{TM}$.

The following table lists the treatments applied:

Nutri-Till applications in corn treatments:	
Trt 1:	(Nitrogen only) 41 gal/A High NRG-N with *Nutri-Till*
Trt 2:	Broadcast before *Nutri-Till*: 240 lb/A 0-0-60 with *Nutri-Till*: 68 gal/A 28% UAN Planter: 10 gal/A 10-34-0 + 2 qt/A 9% zinc*
Trt 3:	Planter: 4 gal/A *Pro-Germinator* + 11 gal/A *Sure-K* + 1 qt/A *Micro 500* + 1 pt/A *Boron** Sidedress: 41 gal/A *High NRG-N*
Nutri-Till seedzone: 4 gal/A *Pro-Germinator* + 11 gal/A *Sure-K* + 1 qt/A *Micro 500* + 1 pt/A *Boron** for Trts. 4, 5 and 6:	
Trt. 4:	*Nutri-Till* nitrogen: 41 gal/A High NRG-N
Trt. 5:	*Nutri-Till* nitrogen: 54 gal/A 28% UAN + *eNhance*
Trt. 6:	*Nutri-Till* nitrogen: 68 gal/A 28% UAN
* - Planter fertilizer placement was 1 inch to the side of the seed.	
Nutri-Till also ran in Trts. 2 and 3 as strip tillage only with no fertilizer applied.	



There was a significant yield increase with the addition of the Pro-Germinator, Sure-K, and micronutrients. The lower yield of Treatment 1 was likely due to the very low soil potassium level, which was addressed with the application of Sure-K.

- Application of all fertilizer with *Nutri-Till*$_{TM}$ resulted in a significantly higher corn yield (Trt 4 vs Trt 3). It is thought that having the nitrogen placed directly under the seed provides optimum access to the corn roots.
- Of the three nitrogen treatments, the High NRG-N resulted in the highest yield followed by 28% plus *eNhance* and 28% UAN. This yield difference was higher than expected and indicates the benefit of controlled release of properly placed nitrogen.

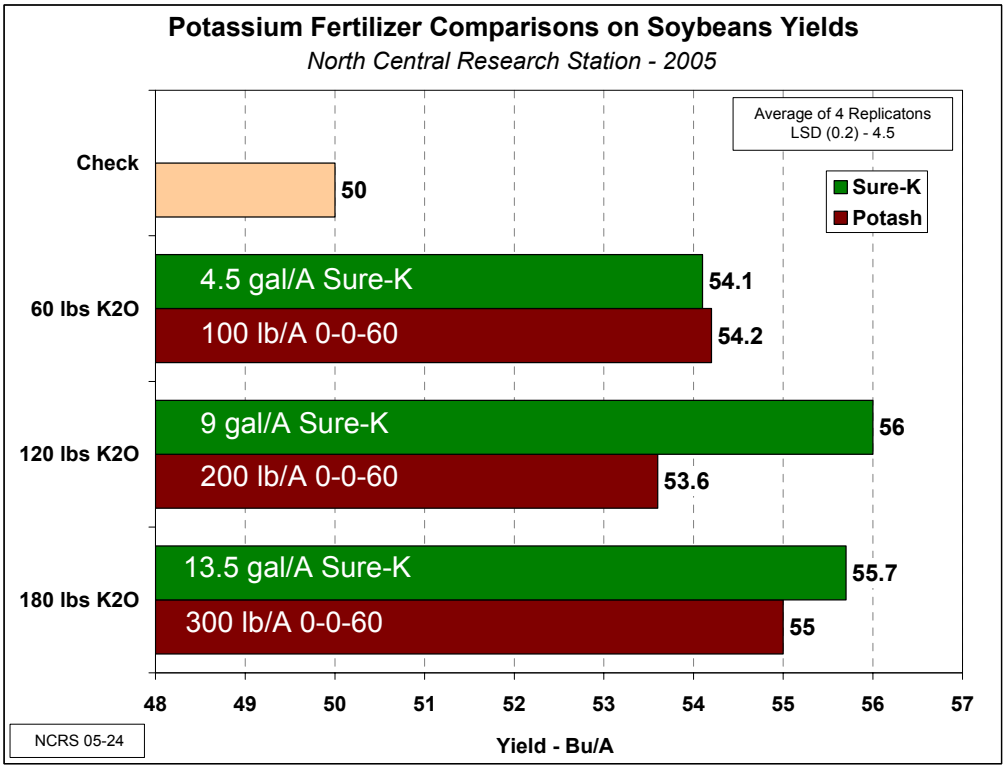
Conclusion: Application of all Liquid fertilizer with *Nutri-Till*$_{TM}$ before planting gave the best corn yield.

Experiment: Potassium Fertilizer Carryover from Soybeans to Corn
Year (Experiment Number): 2006 (06-505)
Date of Planting/Harvest: 4-28-06 / 10-25-06
Hybrid: NK 45A6
Plot Size (replications): 6 rows x 130 ft (4)

Soil Test Levels (ppm)
pH: 7.0 C.E.C.: 8.0
OM: 1.9% P1: 57 ppm
K: 75 ppm (2.5% BS)

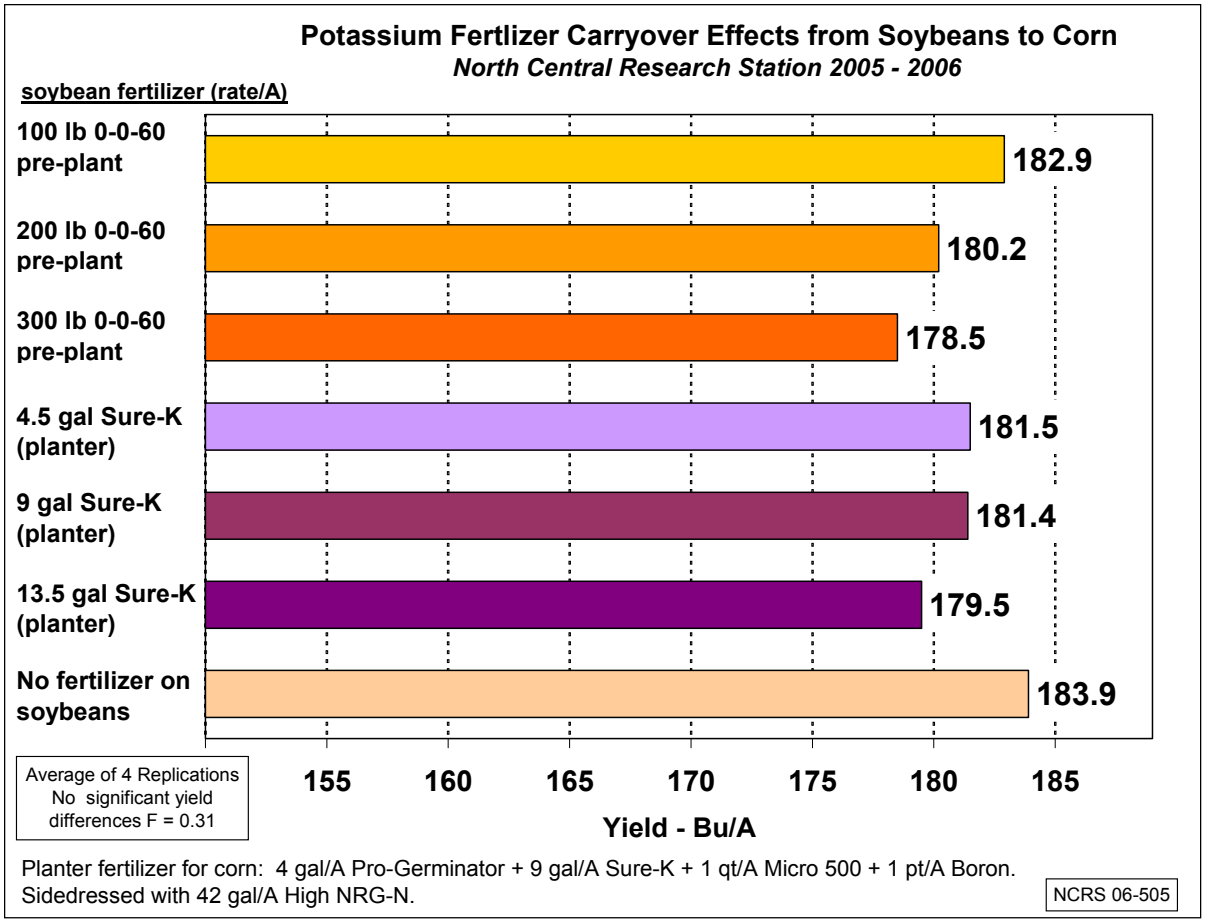
Objective: Determine if muriate of potash application is necessary.

Dry fertilizer is often spread with the intention of providing nutrition for a crop in the year of application (if applied in the spring) as well as carryover nutrition for a crop the following year. Agro-Culture Liquid Fertilizers on the other hand, are primarily applied for feeding a crop in the year of application. In 2005, a soybean experiment was conducted to evaluate effect of three different pre-plant incorporated rates of 0-0-60 and three different planter-applied rates of Sure-K. The soil in this experiment tested low in potassium (75 ppm), with a base saturation of 2.5%. We would consider this to be a moderate base saturations level for potassium. That is low enough to expect a yield response to applied potassium, but not so low where excessive soil adjustment is warranted. The results of potassium fertilizer applications to soybeans from 2005 appear in the following chart.



It was found that high rates of applied potassium fertilizer did not result in corresponding high yields. But what about the effects of fertilizer applied in soybeans on the following corn crop? To answer this, the entire plot area was planted to corn in 2006. The entire experiment received the same rate of applied fertilizer: 4 gal/A Pro-Germinator + 9 gal/A Sure-K + 1 qt/A Micro 500

+ 1 pt/A Boron at planting and 42 gal/A High NRG-N at sidedress. Plots were harvested for evaluation of potassium carryover effects on corn. Corn yields from these carryover plots appear in the following chart.



- There was no effect from the soybean potassium treatments on corn yield the following year, even at high rates as 300 lb/A 0-0-60.
- Evidently the soil K and in-season corn fertilizer application of Sure-K was sufficient at the current K levels.

Corn leaf samples were collected prior to tasseling to determine previous-season potassium applications effects on tissue K levels. Results appear in the following table.

Corn leaf tissue potassium levels	
Soybean fertilizer	leaf tissue % K
100 lb/A 0-0-60	1.81
200 lb/A 0-0-60	1.85
300 lb/A 0-0-60	2.12
4.5 gal/A Sure-K	1.72
9 gal/A Sure-K	1.40
13 gal/A Sure-K	1.36
no fertilizer	1.62
LSD(0.05):	0.27
LSD(0.10):	0.22

Corn leaf tissue K was higher following application of potash to soybeans in the previous year. But as seen in the previous chart, higher tissue K did not result in corn yield increases.

Conclusion: At moderate (2.5% or higher) levels of potassium expressed as % Base Saturation, application of muriate of potash is not necessary. Sure-K in either soybeans or corn is sufficient for optimum yield.

Experiment: Effect of Dairy Manure Applications on Fertilizer Rates for Corn
Year (Experiment Number): 2006 (06-506)
Date of Planting/Harvest: 4-28-06 / 10-24-06
Hybrid: DeKalb 5141 RR
Plot Size (replications): 15 ft x 140 ft (2 reps)

Soil Test Levels (ppm)
See below

Objective: Show how manure application changes fertility responses in corn.

A plot area was established in 1997 with three different dairy manure application rates to determine long-term effects on soil and subsequent changes in fertilizer requirements. Fresh dairy manure was applied in three different programs: No Manure, 20 Ton/A Manure in the fall , and 40 Ton/A Manure (20 ton/A in the spring and 20 Ton/A in the fall). Manure is worked into the ground after application.

In the fall of 2004 soil sample were taken to evaluate manure application effects on soil nutrient levels after eight years of manure applications. Soil test results are shown in Table 1.

Table 1. Soil Analysis After 8 Years of Dairy Manure Applications

North Central Research Station - 2005

Manure Per Year	P1 *ppm*	K *ppm*	%K *% base. sat*	Zinc *ppm*	Org. Matter *%*	CEC *meq/100g*
No Manure	56	90	3.3	1.2	2.1	7
20 Ton/A Manure	60	166	5.5	1.3	2.1	7.8
40 Ton/A Manure	68	250	8	1.4	2.3	8

Surprisingly, there was very little change in the soil phosphorus levels and organic matter where manure had been applied for the past 8 years. There was however, a significant change in the potassium levels where manure was applied. A planter fertilizer program of Pro-Germinator, Sure-K, Micro 500, and Boron was developed for each manure rate according to soil test (see Table 2).

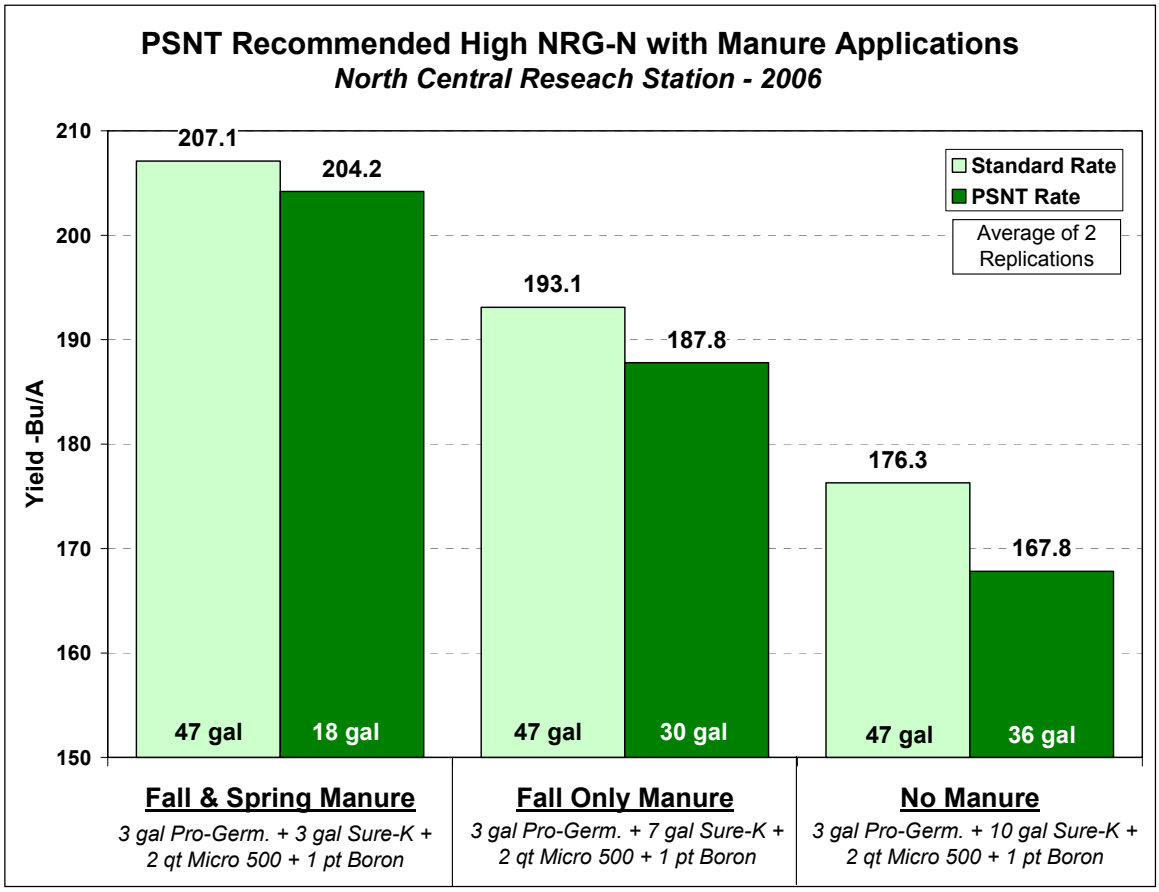
Table 2. Agro-Culture Liquid Fertilizer Recommendations Based on Soil Test

North Central Research Station - 2006

Manure per year	Pro-Germ. *gal/A*	Sure-K *gal/A*	Micro 500 *qt/A*	Boron *pt/A*
No Manure	3	10	2	1
20 Ton/A Manure	3	7	2	1
40 Ton/A Manure	3	3	2	1

In the 2006 experiment, the Pre-Sidedress Nitrate Test (PSNT) was used to determine the correct nitrogen rate to apply for each manure rate (after 9 years of manure applications). Multiple 12-inch core samples were taken throughout each manure rate and sent to

Michigan State University for analysis and recommendations. The recommended rates of nitrogen were applied as High NRG-N using the equivalence factor of 5 pounds of nitrogen per gallon. These rates were then compared to our standard High NRG-N recommendation of 47 gal/A, Which is based on a yield goal of 200 bu/A corn in a continuous corn rotation. Yields appear on the chart below.



Summary:

- Due to excessive cold and rainfall in May following planting, overall yields were some 10% lower in 2005 compared to previous years.
- Highest corn yield was achieved with the fall and spring manure applications with the standard 47 gal/A of High NRG-N. However, there was only a 3 bu/A yield advantage when compared to the PSNT recommendation of 18 gal/A. Simple economics shows the advantage of using the PSNT.
- Looking at all manure rates, the standard High NRG-N rate of 47 gal/A out yielded the PSNT rate. However, in most price situations the economic return was better using the PSNT rate in each manure rate.
- Yield gaps between the standard and PSNT nitrogen rates became greater with less manure being applied. This could be because of the additional organic nitrogen in the soil that became usable later into the season that was not available at the time of the PSNT.
- Comparing the yields from each of the manure rates with the standard High NRG-N application, there was a significant yield increase with the more manure applied, even though the planter fertilizer program was adjusted for each manure rate.

Again this could be a nitrogen rate response in relationship to the amount of manure being applied. Although when compared to the PSNT, economically there was no advantage to increasing the nitrogen rate.

Note on economics: To calculate the economic advantage of the standard rate compared to the PSNT rate (or any reduced rate) see below:

x = cost/gal of High NRG-N *divided by* the price/bu of corn
example: *x = $2.10 per gal / $3.50 per bu corn x = 0.6*
Therefore, for each additional gallon of nitrogen you apply you must gain 0.6 bu/A in yield.

Economic advantage in the 2006 manure study

Table 3 shows the increased nitrogen rate (standard rate minus PSNT rate) in gallons per acre along the left hand side of the table. Nine x values make up the different columns along the top of the table. This value is calculated (as show in the example above) by dividing the price per gallon of High NRG-N by the price per bushel of corn. The number of increased gallons is then multiplied by the x value. The body of the table shows the number of bushels of corn needed to cover the increased cost of additional gallons of High NRG-N. Going back to our example above where x = 0.6, in the no manure application treatment an 6.6 bu/A yield increase would be needed to cover the cost of additional fertilizer (standard minus PSNT rate) used in the 2006 study.

Continuing onto Table 4, the yield increase seen with increasing the fertilizer rate is along the left hand side of the table. The same nine x values are listed along the top. The body of the table shows the economic advantage to increasing the fertilizer rate; this is found by subtracting the number of bu/A needed to cover nitrogen costs in the body of Table 3 from the increased yield seen in the 2006 study. A negative number shows a negative or no economic advantage to increasing the rate of High NRG-N. Looking at our example, x = 0.6, the only manure treatment that shows and economic advantage to increasing the High NRG-N rate is where no manure has been applied. Although both manure treated plots showed a yield increase, this increase did not cover the extra nitrogen costs.

Table 3.

Manure Rate	Increased N rate	x = $ per gal / $ per bu 0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1
		bu/A needed to cover nitrogen costs										
40 Ton/A	**29**	14.5	15.95	17.4	18.85	20.3	21.75	23.2	24.65	26.1	27.55	29
20 Ton/A	**17**	8.5	9.35	10.2	11.05	11.9	12.75	13.6	14.45	15.3	16.15	17
No Manure	**11**	5.5	6.05	6.6	7.15	7.7	8.25	8.8	9.35	9.9	10.45	11

Table 4.

Manure Rate	Yield Increase	x = $ per gal / $ per bu 0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1
		advantage to increased nitrogen rate										
40 Ton/A	**2.9**	-11.6	-13.05	-14.5	-15.95	-17.4	-18.85	-20.3	-21.75	-23.2	-24.65	-26.1
20 Ton/A	**5.3**	-3.2	-4.05	-4.9	-5.75	-6.6	-7.45	-8.3	-9.15	-10	-10.85	-11.7
No Manure	**8.5**	3	2.45	1.9	1.35	0.8	0.25	-0.3	-0.85	-1.4	-1.95	-2.5

* negative numbers means no advantage to increasing nitrogen rate.

Please NOTE: This is only an example, price per gallon of High NRG-N and bushel of corn need to be accurate in order to make a true comparison. Growers can calculate the x value using local prices and use the additional columns on the charts to better estimate economic return. However, as seen above the only combinations that showed an advantage to increasing the High NRG-N rate was in the no manure rate using an x value of 0.75 or less (which can be achieved with either high corn prices or low nitrogen price). Also note, the larger the number in the body of Table 4, the greater the advantage of increasing the nitrogen rate. Therefore, it is concluded that in this experiment the PSNT recommended rate is the most economical for most nitrogen and corn price situations.

Experiment: Potash Application Effects in Soil with Very Low Potassium Levels
Year (Experiment Number): 2006 (06-507)
Date of Planting/Harvest: April 28 / 10-24-06
Hybrid: NK45A6
Plot Size: 100 ft x 500 ft

Soil Test Levels (ppm)
pH: 7.4 C.E.C.: 11.1
OM: 2.8% P1: 42 ppm
K: 55 ppm (1.3% BS)

Objective: Determine corn yield effects of potash application in very low potassium soil.
A previously reported experiment showed that addition of 0-0-60 muriate of potash to soils with a moderate %K base saturation of 2.5% did not result in higher soybean or corn yields. What about soils with very low soil K levels and low %K base saturations? One field at the North Central Research Station has such a soil where the soil K level was 55 ppm and 1.3% base saturation in a sample collected in the summer of 2005. At that time, soybeans were exhibiting potassium deficiency symptoms of leaf chlorosis along the leaf margins, in spite of application of Sure-K at planting. Following soybean harvest, 300 lb/A of 0-0-60 muriate of potash was applied to a 1 acre section of the field. The entire field was ripped following this application, and worked with a field cultivator the next spring .
The next spring the entire field received a planter application of 4 gal/A of Pro-Germinator + 9 gal/A Sure-K + 1 qt/A Micro 500 + 1 pt/A Boron. A sidedress application of 42 gal/A of High NRG-N was also applied to the entire field. There was no observable potassium deficiency seen on the corn leaves during the season. No corn leaf samples were collected, although that would have been a good thing to do. At harvest, two strips from each portion of the field were harvested for yield comparison between the potash and no-potash treatments. Following harvest, soil samples were collected to evaluate potash application effects on soil K level. Results appear in the adjacent table.

Soybean leaves showing potassium deficiency.

*Carryover effects of muriate of potash application in low K soil**

	Yield Bu/A	Soil K ppm	Base saturation %K
300 lb/A 0-0-60	174.2	77	1.8
No potash	163.9	54	1.2

* - Muriate of potash 0-0-60 applied after 2005 soybean harvest

- Application of potash under these very low soil K levels did result in increased corn yield.
- Soil K levels did increase with application of muriate of potash. The portion of the field not receiving muriate of potash showed a soil K level nearly identical to that collected the previous summer. So the application of Sure-K did maintain the K level. But when the level is this low at the start, application of a K may prove beneficial to corn.

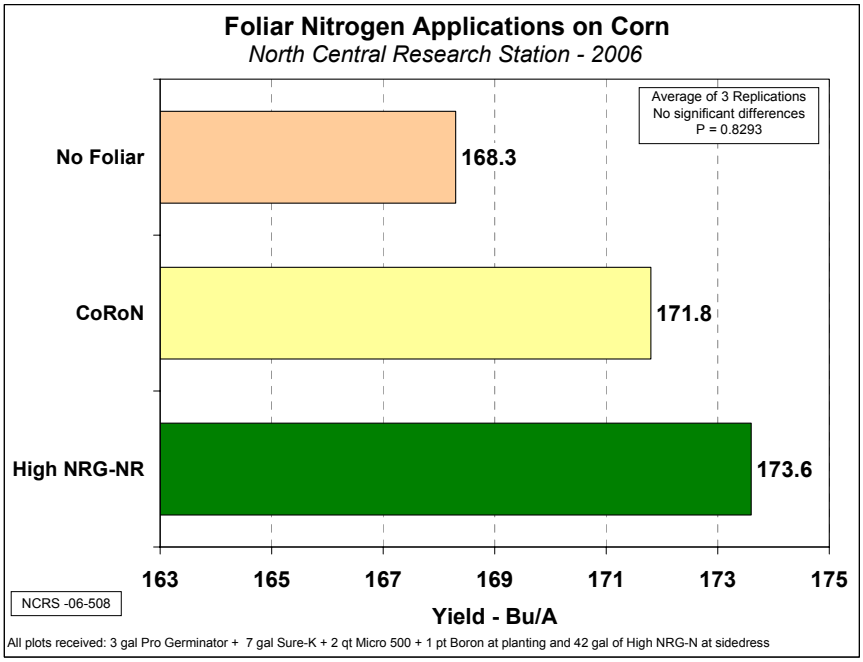
Conclusion: Under very low soil potassium conditions where soybeans show deficiency, an application of muriate of potash is recommended to raise soil K to manageable levels.

Experiment: Foliar Fertilization of Corn
Year (Experiment Number): 2006 (06-508)
Date of Planting/Harvest: 5-4-06 / 10-26-06
Hybrid: Pioneer 36B03
Plot Size (replications): 15 ft x 130 ft (3 reps)

Soil Test Levels (ppm)
pH: 7.3 C.E.C.: 11.4
OM: 2.3% P1: 33 ppm
K: 95 ppm (2.1% BS)

Objective: Determine effects of foliar-applied N sources on corn yield.

Foliar fertilization of corn has not been proven to show a positive response in many years of testing at the North Central Research Station. There has been a quite a variety of applications over the years, and modest yield increases have been obtained, but the cost of the treatment often exceeds the value of the return in increased bushels. Thus the conclusion most times has been that the best way to feed corn is to do it through the roots. But being a research facility, we keep trying. In 2006, the foliar treatments centered around nitrogen fertility. One product tested was CoRon, which has an analysis of 25-0-0-0.5 boron. The Agro-Culture Liquid Fertilizers comparison was with High NRG-NR, which is a 24-0-0-1 Sulfur. High NRG-NR is a urea-based N source, with 20% urea, 2% ammoniacal and 2% nitrate nitrogen. It has a low-salt index and is suited for foliar applications. In this experiment, applications were applied at the V6 growth stage when the corn was 15 inches tall. The application rate of both fertilizers was 3 gallons per acre in a total carrier volume of 10 gallons per acre with water applied through 11002 turbojet nozzles at 30 psi. Yield results are in the following chart.



- Although there was an increase in yield with both treatments, differences were not statistically significant.
- Additional fertilizers tested in the experiment such as Sure-K, Protriastim and Micronutrients also did not produce yield increases leaving us with the same conclusion that the best was to feed a corn plant is through the roots with a fertilizer program based on soil testing.

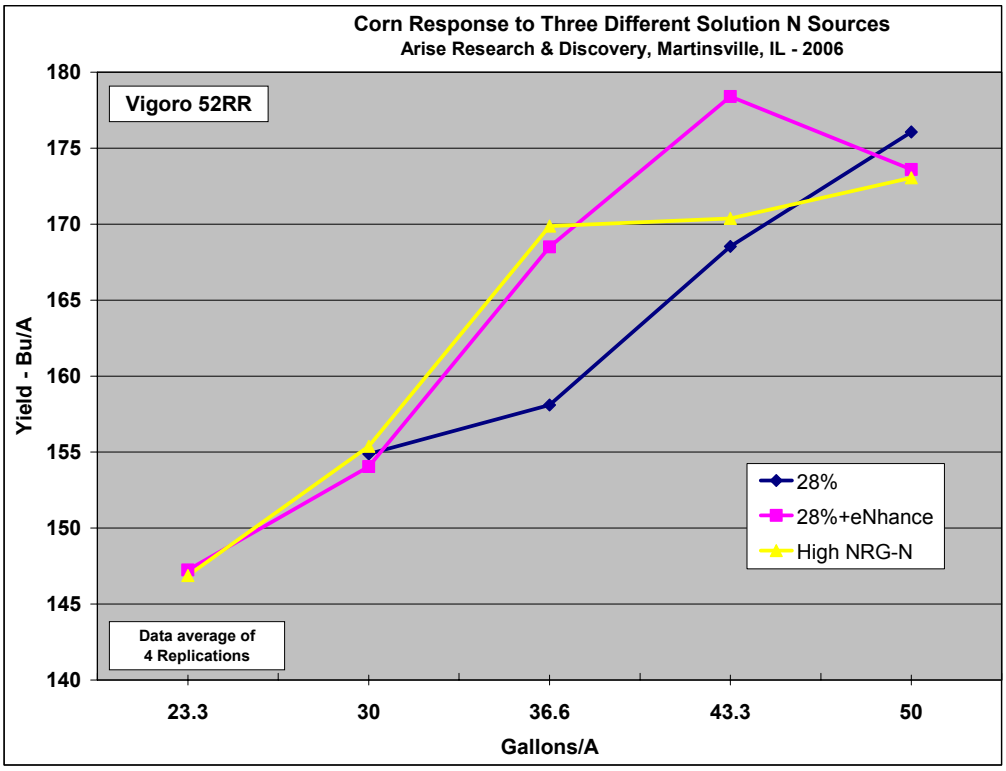
Conclusion: Foliar nitrogen had minimal influence and is probably not worth applying.

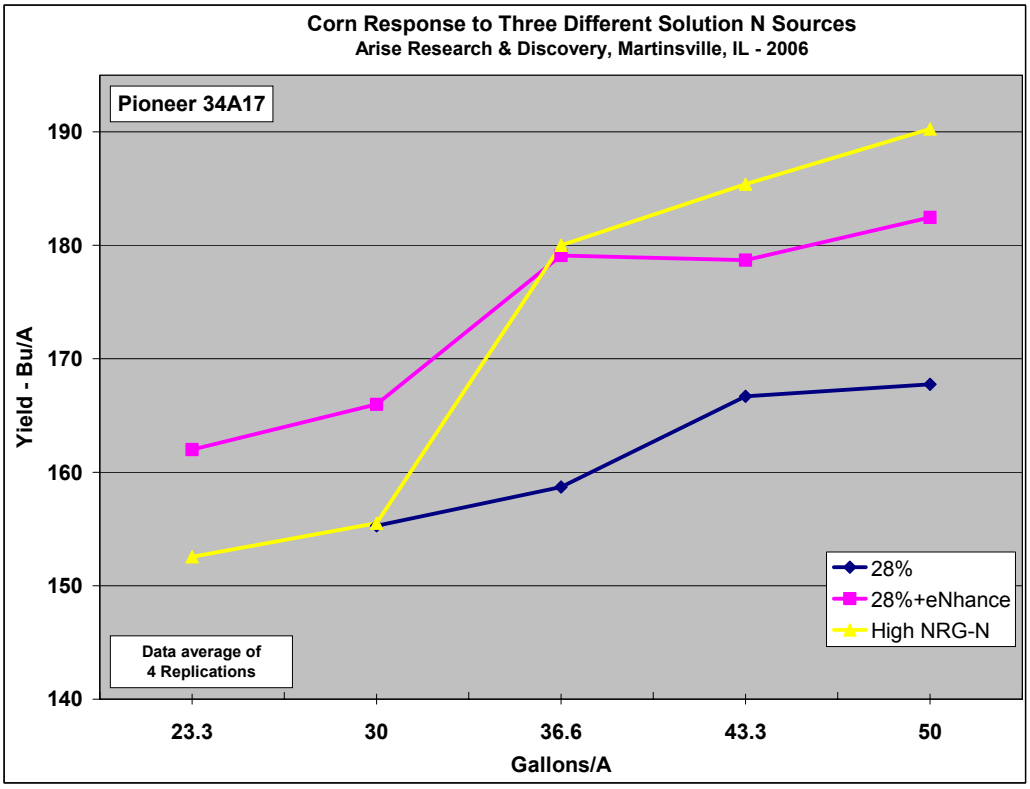
Experiment: Nitrogen Source Comparison in Corn (Illinois)
Year: 2006
Location: Arise Research & Discovery, Martinsville, IL
Date of Planting/Harvest: May 30 / October 10
Hybrid: Vigoro 52RR and Pioneer 34A17
Plot Size (replications): 4 row x 50 ft (4 reps)

Objective: Determine if three different N sources cause similar yield responses in corn.

With increased nitrogen cost in recent years, there has been renewed interest in investigations of application rate responses for corn yield. Another area of question is whether or not different corn hybrids exhibit similar responses to different nitrogen application rates. An experiment was conducted at Arise Research and Discovery in Martinsville, IL to test three different nitrogen sources at different application rates for yield response in two different corn hybrids.

Nitrogen sources tested were High NRG-N, 28% UAN and 28% UAN with eNhance. The eNhance is an additive for UAN solutions to provide increased nitrogen efficiency and stabilization. It is added at a rate of 2 gallons per ton of 28% UAN. Rate applied were 23.3, 30, 36.6, 43.3 and 50 gal/A for High NRG-N and 28% + eNhance. Rates were the same for the 28% UAN, except for the 23.3 gal/A rate. All treatments were applied as sidedress applications thirty days after planting with a coulter injection applicator. It should be noted that the late planting date was due to 9.3 inches of rain which fell during the six weeks prior to planting. An application of 200 lb/A of 0-0-60 was applied preplant broadcast and incorporated to the entire experimental area. Yield results appear in the following two line graphs.





- There was a differential response to the three N sources between the hybrids.
- In both hybrids, at the middle rate of application (36.6 gal/A), both High NRG-N and 28% + eNhance had higher yield than did 28% UAN.
- With the Pioneer 32A14, all rates of High NRG-N and 28% + eNhance at 36.6 gal/A and higher yielded significantly higher than 28% UAN.
- With the Vigoro 52RR, there was a linear correspondence between yield and application rate as yield increased with increased rate of application. Yield with High NRG-N peaked with 36.6 gal/A. Yield with 28% + eNhance peaked at 43.3 gal/A.
- The greater yields obtained at lower rates with High NRG-N and 28% + eNhance compared to 28% UAN indicate higher nitrogen efficiency.

Experiment: Corn Yield Response to Source and Rate of Fluid Nitrogen
Cooperators: Dr. Gyles Randall and Jeff Vetch, University of Minnesota, Southern Research and Outreach Center, Waseca, MN
Year: 2006
Plot Size (replications): 4 row x 50 ft. (4 replications)

Note: the final written report had not been received at the time of this writing, so it will be inserted in a future revised edition. Data presented are from the preliminary yield report, but did not include dates and other details.

Introduction (as written by the cooperators in project proposal)
Nitrogen (N) is an essential plant nutrient that is generally the most limiting nutrient for corn production. It is also applied for the 50+ million acres of corn in the Corn Belt in greater quantities than any other nutrient. With increasing emphasis on spring split application and decreasing usage of anhydrous ammonia, fluid fertilizer N (28% UAN) is gaining a larger share of the N market. This is particularly true for split and sidedress application strategies.

A range of application rates of the three nitrogen sources was planned. The sources were: 28% UAN, 28% + eNhance and High NRG-N. As both High NRG-N and 28% + eNhance are promoted as providing enhanced nitrogen, the rates applied were based on increased nitrogen equivalence. For example, High NRG-N is promoted as being as effective at a 60% rate of application compared to a full rate of 28% UAN. The addition of eNhance to 28% UAN at a rate of 2 gallons per ton is promoted as making this combination product as effective at an 80% rate of application compared to a full rate of 28% UAN. Actual rates of application (in gallons per acre), pounds of actual N applied and "equivalent" pounds of N applied for High NRG-N and 28% + eNhance appear in the following table.

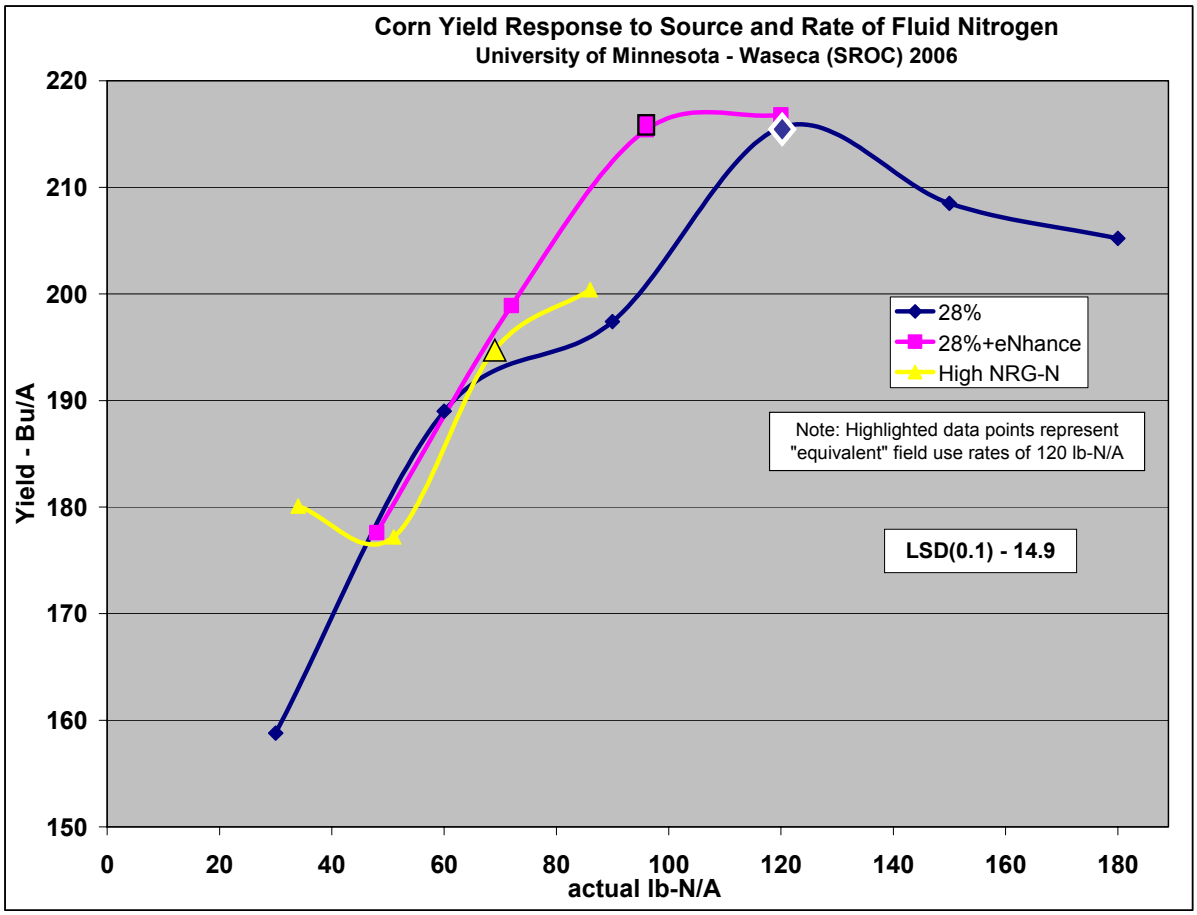
Nitrogen source application rates for corn
Univ. of Minnesota Southern Research & Outreach Center

28% UAN:	**10**	**20**	**30**	***40***	**50**	**60**	**gal/A**
	30	**60**	**90**	***120***	**150**	**180**	**lb-N/A**
28%+eNhance		**16**	**24**	***32***	**40**		**gal/A**
		48	**72**	***96***	**120**		**lb-N/A**
(3.75 lb equiv. N/gal)		**60**	**90**	***120***	**150**		**lb-equiv.N/A**
High NRG-N		**12**	**18**	***24***	**30**		**gal/A**
		34	**51**	***69***	**86**		**lb-N/A**
(5 lb equiv. N/gal)		**60**	**90**	***120***	**150**		**lb-equiv.N/A**

The "normal" rate of application in this area of Southern Minnesota is 120 lb/A of nitrogen per acre, or 40 gal/A of 28% UAN. Equivalent rates of the test nitrogen sources is 24 gal/A of High NRG-N and 32 gal/A of 28% + eNhance.

Nitrogen sources were applied approximately 30 days after planting with a coulter injection rig. A line graph of corn yields appear in the following graph. (Yields of the normal and equivalent rates are highlighted.)

- Yield of the normal rate of 120 lb-N/A of 28% UAN was 215.6 Bu/A. The 80% equivalent rate of 28% + eNhance yielded 215.4 Bu/A. This equivalent rate of 28% + eNhance (96 lb-N/A) yielded significantly higher than the similar rate of



28% UAN (90 lb/A) which yielded 197.4 Bu/A. This strongly shows the performance advantage of the added eNhance. Yields peaked with these 2 rates.

- The equivalent normal rate of High NRG-N yielded 194.5 Bu/A which was significantly lower than the yields of the full rate of 28% UAN or the 80% rate of 28% + eNhance. The reason for this yield reduction is not clear. However, the yields produced with these relatively low rates of applied nitrogen are quite high. It is remarkable that 120 lb-N/A can produce 215 Bu/A. The reduced equivalent rate of 72 lb of actual N per acre with 24 gal/A of High NRG-N may have put High NRG-N at its limit under these conditions.

Experiment: Seed Treated Soybeans
Year (Experiment Number): 2006 (06-106)
Date of Planting/Harvest: 6-2-06 / 10-10-06
Hybrid: Stine 1916
Plot Size (replications): 5 ft x 250 ft (3 reps)

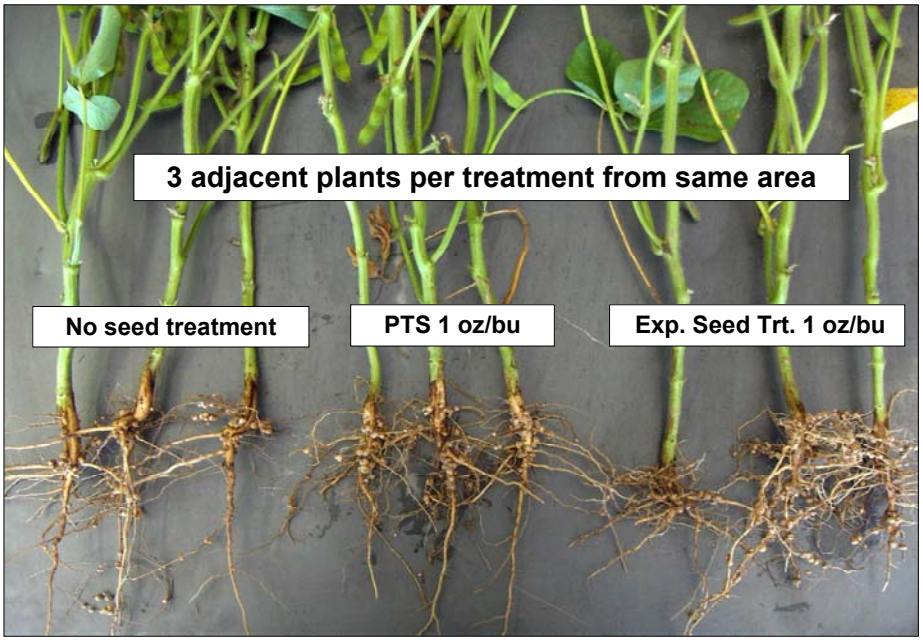
Soil Test Levels (ppm)	
pH: 5.9	C.E.C.: 7.2
OM: 2.2%	P1:60 ppm
K: 127 ppm	(4.5% BS)

Objective: Determine if a nutritional seed treatment can influence soybean yield.

Seed treatments are commonly used to combat things as disease and insect pests. But can a seed treatment enhance the nutritional status of a crop? The volume of a seed treatment on a per acre basis is very small, in the ounces per acre range. Thus the direct application of any nutrient would be very small and likely not effective. But what if the seed treatment could enhance soil microbes as the *Rhizobia* bacteria that form soybeans nodules? Two experiments were conducted to evaluate soybean seed treatments: one at the North Central Research Station and one in South Central Kansas.

At the North Central Research Station as experiment was established to evaluate two different seed treatments: Protriastim (PTS) and an Experimental Seed Treatment (EST). Protriastim is a fermentation product consisting of a protein source and a tri-alcohol with the purpose of increasing plant metabolism. It is not generally viewed as a microbe stimulant. These materials were mixed with soybean seed at a rate of 1 fluid ounce per bushel of seed. This was done the day before planting. All soybean seed was inoculated before planting. At planting with a six row planter, 2 boxes were filled with untreated seed, 2 boxes with PTS treated seed and 2 boxes with EST. Then three passes were made with the planter for the three replications of 2 rows with each treatment, including the check. A planter fertilizer application of 7 gal/A Sure-K + 1 qt/A Micro 500 was placed an inch to the side of each seed row.

In early September, adjacent soybeans from each treatment were pulled for nodule evaluation, as shown in the following picture.



- The soybeans with the Experimental Seed Treatment had the most and largest nodules, followed by the PTS.

At maturity, the two soybean rows per treatment were harvested for yield determination.

Effect of Soybean Seed Treatment on Soybean Yield *North Central Research Station - 2006*			
Seed trt.	Yield Bu/A	% moisture	Test wt. lb/Bu
none	48.3	12.7	48.3
PTS 1 oz/Bu	49.8	12.8	49.8
EST 1 oz/Bu	51.0	12.9	51.0
LSD(0.2)	*2*	*nsd*	*nsd*

- Although small, there was a significant yield increase with the Experimental Seed Treatment over the no seed treatment.

In Kansas, a field was planted to soybeans on June 13 following winter wheat harvest. There were three strips of soybeans planted with Experimental Seed Treatment at a rate of 2 fluid ounces per acre, and three strips with no seed treatment. The seed was inoculated with Cell Tech. Soybeans were harvested on October 4.

Effect of Soybean Seed Treatment on Soybean Yield *South Central Kansas - 2006*			
Seed trt.	Yield Bu/A	% moisture	Test wt. lb/Bu
none	58.6	10	56.0
EST 2 oz/Bu	64.2	9.3	56.7

- The Experimental Seed Treatment had a more dramatic effect on soybeans in Kansas than at the NCRS with a much higher yield, drier harvest moisture and higher average test weight. Field tests will be expanded in 2007 for further evaluations for future market introduction.
- Thanks to Area Manager Jerry Cordell and Sales Account Manager Brian Waugh for their work in the establishment and follow through of this test in Kansas.

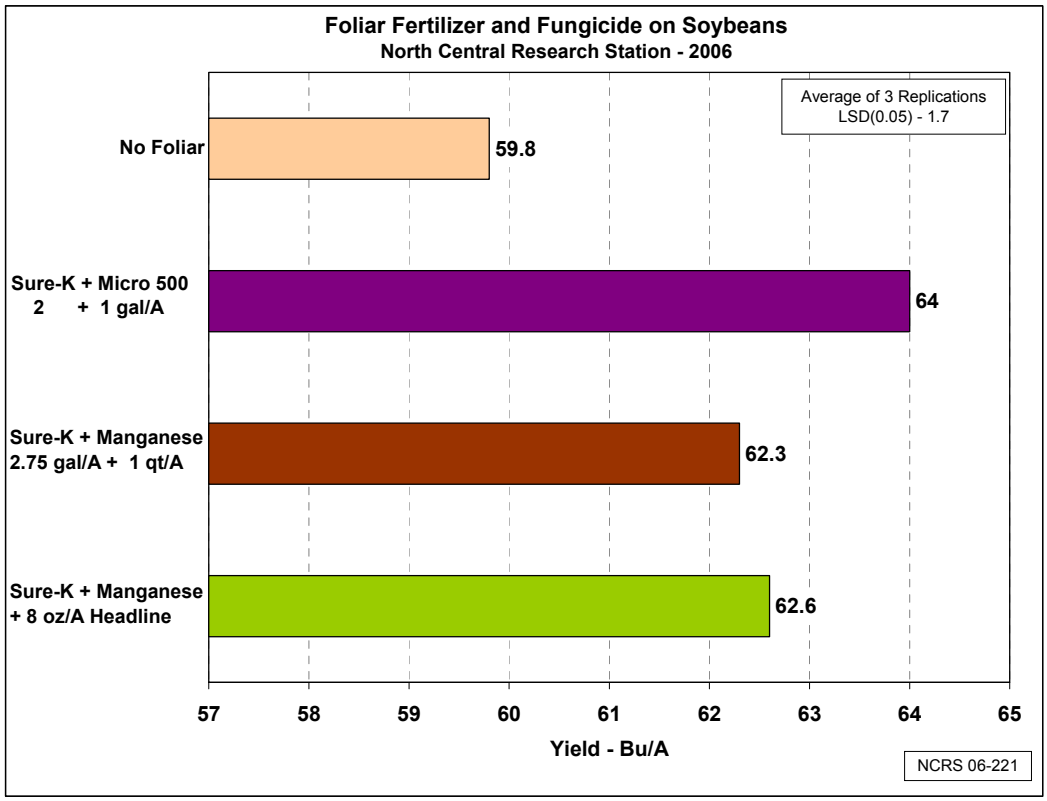
Conclusion: Seed treatments can influence soybeans by their effect on microbes like *Rhizobia.*

Experiment: Foliar Fertilizer Plus Fungicide on Soybeans
Year (Experiment Number): 2006 (06-221)
Date of Planting/Harvest: 6-12-06 / 10-16-06
Hybrid: Pioneer 92B38
Plot Size (replications): 15 ft x 345 ft (3 reps)

Soil Test Levels (ppm)
pH: 7.2 C.E.C.: 6.6
OM: 2.2 % P1:34 ppm
K: 92 ppm (3.6% BS)

With the threat of soybean rust, there is increased awareness of foliar fungicide application in areas prone to attack. Fortunately, the affected areas have been confined to the Southern States, even though late season infestation has occurred as far North as Indiana in 2006. But this late –season infection did not affect yield. None the less, there is interest in foliar fungicides anyway as perhaps a way to increase overall plant health. An experiment was conducted to evaluate several foliar applications including the fungicide Headline.

All soybeans received a planter-time application of 1 gal/A Pro-Germinator + 7 gal/A of Sure-K and 1 qt/A of Micro 500. Soybeans were planted in 15 inch rows. Foliar application was on July 7 when the soybeans were in the R1 stage, and 12 inches tall. Total spray volume was 15 gal/A with flat fan nozzles (Turbojet 11002) at 45 psi. Treatments included the standard 3 gal/A of Sure-K, 2.75 gal/A Sure-K + 1 qt/A Manganese, and 2 gal/A Sure-K + 1 gal/A Micro 500, all of which maintained the fertilizer volume at 3 gal/A. Headline fungicide was added at a rate of 8 oz/A to the Sure-K plus Manganese rate for an additional treatment. Yield results appear in the following chart.



- Yields were very consistent across replications as indicated by the low LSD value.
- All foliar treatments resulted in a statistically significant yield increase, with the highest yield from the application of the Sure-K + Micro 500, although the cost of the Micro 500 is a consideration.
- The application of the Headline did not increase yield over application without it. It was observed that the Headline-treated soybeans remained green longer at senescence than the soybeans in the other treatments which turned yellow sooner. However, this did not affect moisture as all treatments averaged 13.4% moisture at harvest.
- Future testing should evaluate foliar only applications, with no fertilizer applied at planting.

Conclusion: Application of Headline fungicide with foliar fertilizers did not increase of decrease soybean yield in the absence of disease.

Experiment: Fertilizer Applications in Nutri-Till™ and No-Till Soybeans
Year (Experiment Number): 2006 (06-510)
Date of Planting/Harvest: 6-2-06 / 10-26-06
Hybrid: Stine 1918
Plot Size (replications): 15 ft (6-30 in rows) x 300 ft (2 reps)

Soil Test Levels (ppm)
pH: 7.6 C.E.C.: 7.9
OM: 2.6 % P1: 47 ppm
K: 120 ppm (3.9% BS)

Objective: Determine best fertilizer applications for two reduced tillage options.

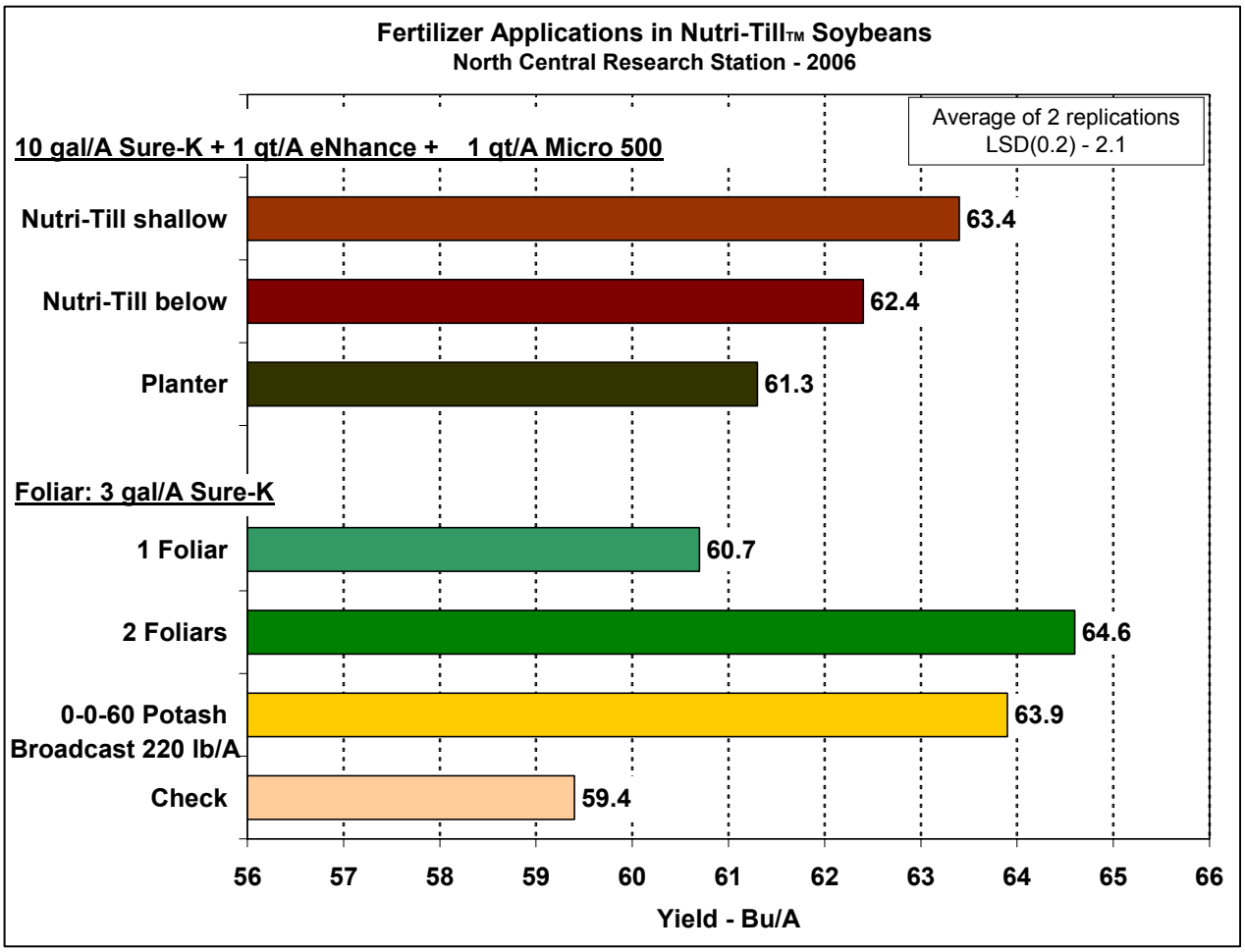
In recent years, *strip-till* or *zone-till* equipment has been developed to combine tillage strips in the seed zone with no-till between the rows for residue and moisture conservation. This has also presented an opportunity for nutrient application to reduce the need for extra application trips or application at planting. The *Nutri-Till™* applicator was custom-built by North Central Research Station supervisor Doug Summer. What makes *Nutri-Till™* different is the ability for dual placement of liquid nutrition in the seed zone or below the seed. The deep shank is actually an anhydrous knife which would place the liquid fertilizer approximately 8 inches below the surface. The seed zone placement is through a stream nozzle applied to the soil surface, and then covered by small hilling disks. Three coulters do the tillage and a rolling basket firms the tilled strip.

An experiment was conducted to evaluate fertilizer applications in both *Nutri-Till™* and no-till soybeans. The experimental area was in high-yielding corn in 2005 and there was heavy residue. Half of each replication was conducted in *Nutri-Till™* and half in no-till. Both were planted in 30 inch rows. The *Nutri-Till™* treatments were applied on May 10. Persistent rainfall the rest of May delayed planting until June 2. There were three methods of application: 1) shallow fertilizer placement in the seed zone, 2) below the seed placement and 3) no fertilizer placement in the strips. The fertilizer rate used was 10 gal/A Sure-K + 1 qt/A eNhance + 1 qt/A Micro 500. (The eNhance was used in response to the low soil test for sulfur.) When this fertilizer rate was applied through the planter, it was placed one inch to the side of the seed.

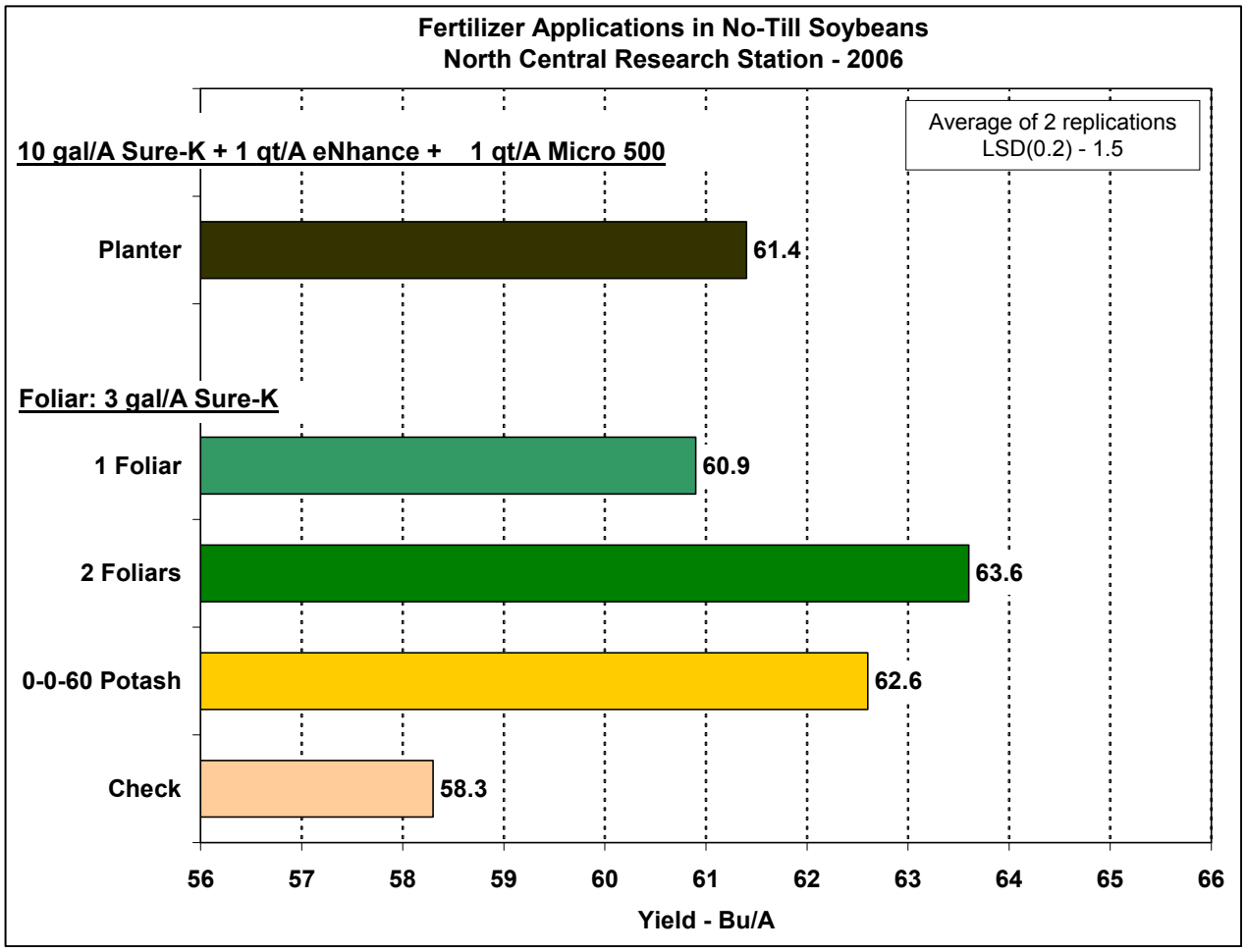
Nutri-Till™ implement in the raised position.

No-Till plot after planting in heavy residue.

In addition to the fertilizer placement comparisons, foliar fertilizer treatments were also applied. One or two foliar applications of 3 gal/A of Sure-K were applied. Foliar applications were applied on July 5 when soybeans were in the V3 (3 trifoliate) stage and on July 17 when he soybeans were in the R1 stage (first flower). No other fertilizer was applied to the plots receiving foliar treatments. Additionally, broadcast applications of muriate of potash (0-0-60) were applied to both systems. Application was prior to *Nutri-Till*$_{TM}$ and planting. Treatment yields appear in the following charts.



- Yield response to fertilizer was lower than expected likely due to late planting.
- Shallow placement of fertilizer with *Nutri-Till*$_{TM}$ was slightly better than deeper placement below the seed zone. But *Nutri-Till*$_{TM}$ was better in yield than planter applications.
- Two foliar applications resulted in the highest overall yield. This continues to show the efficiency of foliar applications of Sure-K on soybeans.
- The action of the *Nutri-Till*$_{TM}$ and the planter evidently provided some incorporation of the potash. However, this same plot also received 200 lb/a of 0-0-60 in *Nutri-Till*$_{TM}$ corn in 2005.



- As it was with the *Nutri-Till*$_{TM}$ **,** the two foliar applications of 3 gal/A of Sure-K provided the highest yield.
- *Nutri-Till*$_{TM}$ yields were slightly higher than the no-till yields.

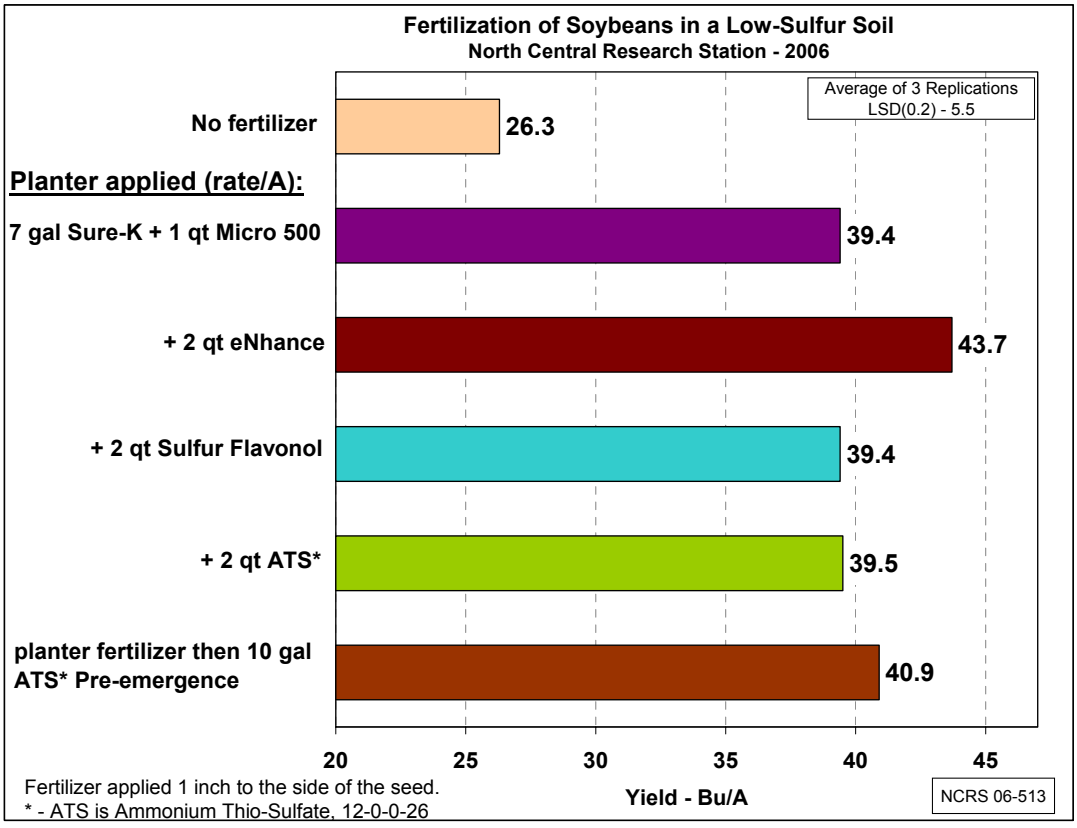
Conclusion: *Nutri-Till*$_{TM}$ fertilizer application before planting was better than planter application of fertilizer. But in both systems, the foliar application of Sure-K resulted in the best yield.

Experiment: Sulfur Fertilization in Soybeans
Year (Experiment Number): 2006 (06-513)
Date of Planting/Harvest: 6-6-06 / 10-10-06
Hybrid: Pioneer 92B38
Plot Size (replications): 15 ft (6-30 in rows) x 130 ft (3 reps)

Soil Test Levels (ppm)
pH: 7.5 C.E.C.: 9.2
OM: 2.3% P1:35 ppm
K: 88 ppm (2.5% BS)
Sulfur: 10 ppm (Low)

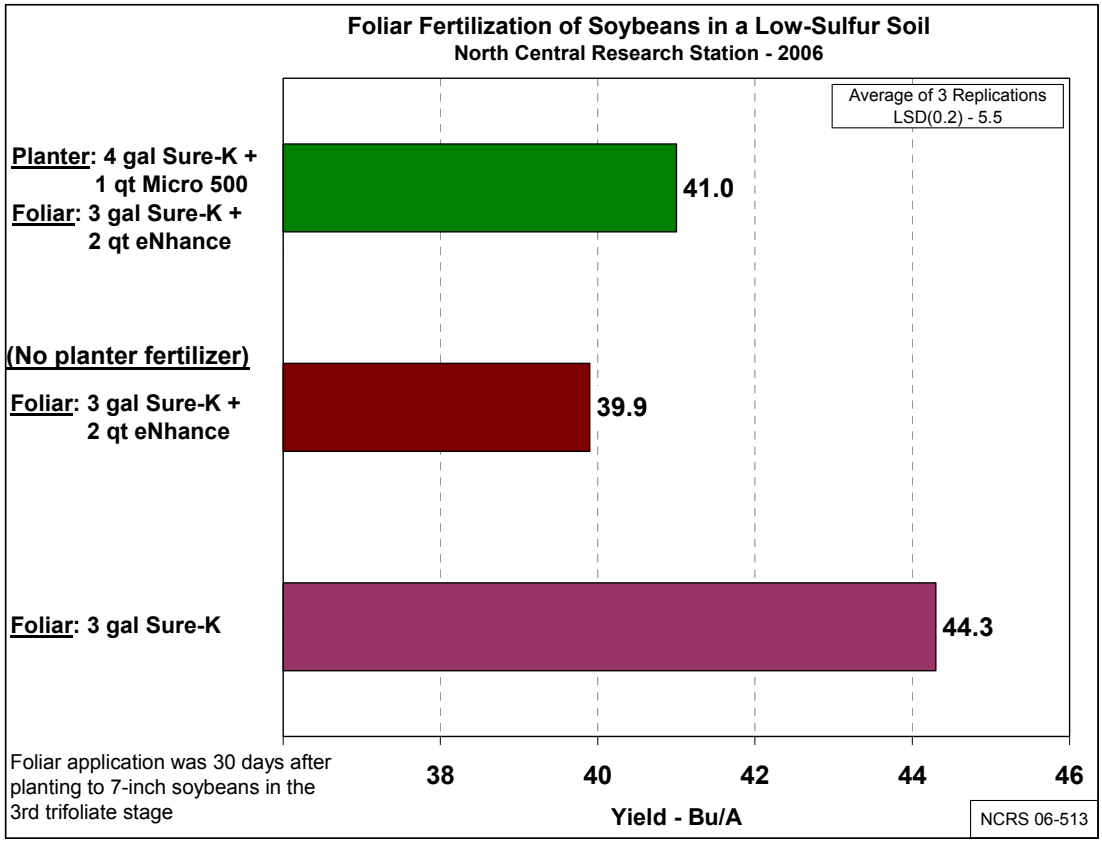
Objective: Determine which of several sulfur fertilizer additives has the greatest influence on corn yield.

If a soil test indicates low sulfur, should sulfur fertilizer be applied for soybeans? An experiment was conducted to find out. With a soil test sulfur level of 10 ppm (rated Low), several different sulfur applications were applied in conjunction with a standard planter applied treatment of 7 gal/A Sure-K + 1 qt/A Micro 500, placed 1 inch to the side of the seed. These included 2 qt/A each of 6% Sulfur Flavonol, eNhance (8.7% sulfur) and ammonium thio-sulfate (ATS, 12-0-0-26S). Additionally, a surface broadcast application of ATS was applied after immediately after planting at a rate of 10 gal/A. (Due to excessive rainfall in May, planting was delayed until June 6 which is some three weeks later than normal. Delayed planting may have affected final yield.) Treatment yields from planter treatments appear in the following chart.



- Although there was a strong response to addition of planter fertilizer, the application of sulfur did not result in a significant yield response.
- Highest numerical yield was with the addition of eNhance to the planter fertilizer. The eNhance also contains manganese and zinc which may have an effect, although the planter fertilizer did include Micro 500.
- The addition of 28.7 lb of sulfur/A with the broadcast application of ATS also did not affect yield. This would indicate that 10 ppm of soil sulfur is not limiting soybean yield.

Foliar applications. Three foliar treatments were included in this experiment. Foliar applications were made 30 days after planting to soybeans in the V3 stage and 7 inches tall. Applications were made at a total spray volume of 10 gal/A with water. One of the treatments had 4 gal/A of Sure-K + 1 qt/A Micro 500 at planting, and then a foliar application of 3 gal/A Sure-K + 2 qt/A eNhance, to keep the total volume of Sure-K at 7 gal/A as in the planter treatments. The next foliar treatment had the same foliar volume, but with no planter treatment. The third foliar treatment was simply the standard foliar application of 3 gal/A Sure-K. Foliar yields appear in the following chart.



- Results are confusing in that the foliar applications of only 3 gal/A of Sure-K, with or without eNhance, were as high as the full 7 gal/A rate of Sure-K with the planter.
- The application of Sure-K alone was the highest numerical yield in the experiment which confirms the effectiveness of this foliar application. The inclusion of eNhance

to Sure-K resulted in a lower yield, although not statistically so. However, it suggests some potential for antagonism which should be investigated. But again, the soil sulfur level must not have been a limiting factor to warrant inclusion of sulfur fertilizer.

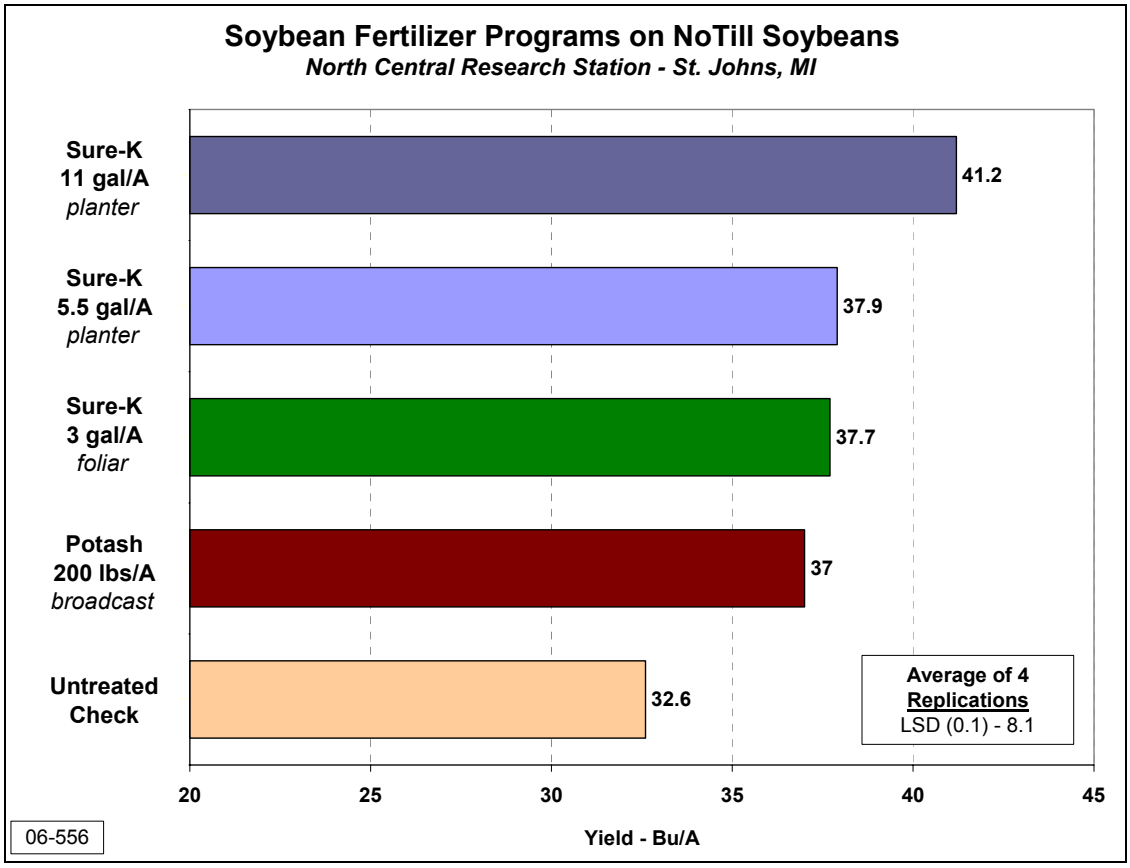
Conclusion: Despite the low soil sulfur according to the soil test, application of supplemental sulfur did not increase soybean yield. Under these conditions, emphasis should be placed on potassium fertilization only.

Experiment: Soybean Fertilizer Programs
Year (Experiment Number): 2006 (06-556)
Date of Planting/Harvest: 6-2-06 / 10-16-06
Hybrid: Pioneer 92B38
Plot Size (replications): 15 ft x 100 ft (4 reps)

Soil Test Levels (ppm)
pH: 7.9 C.E.C.: 15
OM: 2.3% P1: 18 ppm
K: 100 ppm (1.7% BS)

Objective: Determine if high rates of Sure-K are needed in a low potassium soil.

A soybean experiment was established to evaluate several different soybean fertility programs. Soybeans were planted in 30" rows with a no-till planter on June 2. Sure-K was applied in a band one inch to the side of the seed or foliar applied in mid-July when the soybeans were in the R1 stage. Potash was broadcasted prior to planting. In this study we compared a standard rate of planter-applied Sure-K (5.5 gal/A) to a standard foliar application of 3 gal/A. Previous studies have shown that a foliar application works as well as a band application even though less material is being applied. Also compared was a high rate of Sure-K, 11 gal/A, to evaluate the effect of a higher rate in this low potassium soil. An application of 200 lbs of 0-0-60 muriate of potash was included as a conventional fertilizer comparison. Yield results are shown in the chart below.



Results:

- All fertilizer increased soybean yield over the untreated check.
- As seen in past research, similar yield response was seen with the standard 5.5 gal/A band application of Sure-K (37.8 bu) to the 3 gal/A foliar application of Sure-K (37.7 bu). At this low soil K level, two foliar applications should have been tested.
- Comparable results were seen with the standard Sure-K application (37.8 bu) compared to the conventional potash application (37 bu), even though more actual potassium was applied with the potash. (Sure-K provides 71.5 equivalent pounds of K_20 where potash provided 120 lbs of K_20.)
- With the low soil potassium level and, correspondingly, low percent base saturation, highest overall yield was achieved with the increased rate of Sure-K (11 gal/A).

Conclusion: Higher planter-applied rates as 11 gal/A of Sure-K significantly increased soybean yield when soil K level is low with only 1.7% base saturation.

Experiment: Nitrogen Applications on Winter Wheat
Year (Experiment Number): 2006 (06-302)
Date of Planting/Harvest: 9-8-05 / 7-19-06
Hybrid: Pioneer 25R47
Plot Size (replications): 1 acre plots

Soil Test Levels (ppm)
pH: 7.3 C.E.C.: 6.6
OM: 2.2% Bicarb P: 17 ppm
K: 71ppm (2.8% BS)

Objective: Determine if the controlled-release N fertilizer High NRG-N is as effective as other liquid N sources when applied under cold conditions to winter wheat.

A two-year experiment was established to evaluate 3 different nitrogen programs on winter wheat. In both years, the wheat was planted after soybean harvest. The experiments were adjacent to each other on Farm 3 of the North Central Research Station. A fertilizer application of 3 gal/A Pro-Germinator + 7 gal/A Sure-K + 1 qt/A Micro 500 was applied at planting. Topdress applications were applied at Feekes stage 3. Coincidently, that application was on April 6 in both years. The target application was for 120 lb/A of applied nitrogen. This was achieved with 40 gal/A of 28% UAN as the standard conventional treatment. Application of eNhance with 28% is promoted as being equivalent to a full application of 28%, but with 80% of the applied volume, or in this case: 32 gal/A. High NRG-N is promoted to provide equivalent performance at an applied rate of 60% of 28% UAN, or in this case: 25 gal/A. All applications were made with straight product and no dilution. At harvest, two-15 foot header swaths were taken from each wheat block for yield determination. The two swaths were weighed separately for average yield determination. The yields appear in the following table.

Topdress comparison in winter wheat
North Central Research Station

		Bu/A		
Nitrogen	gal/A	2005	2006	Avg.
28% UAN	40	71.5	78.3	**74.9**
28% + *eNhance*	32	70.3	78.2	**74.3**
High NRG-N	24	59.2	67.9	**63.6**
No N	0	39.7	45.3	**42.5**

Treatment yields were consistent in both years of the experiment. While yields for the straight 28% and the 28% + eNhance were similar, the yield with High NRG-N was lower by about the same percentage each year. It is felt that this is due to the earliness of the application while the weather is still cold causes restriction in the release of nitrogen for early-season growth. The fact that this occurred similarly for two years indicates that performance of High NRG-N for topdressing wheat in the cool Northern U.S. may not be the best recommendation. However, the consistent performance of the eNhance at a reduced rate of application is a good alternative.

Conclusion: When applied as a single application under cold conditions, High NRG-N may not be able to supply sufficient nitrogen for early growth of winter wheat coming out of dormancy.

(*From the Post Harvest 2006 issue of LIQUID Does It Better)*

Top dressing winter wheat: Agro-Culture Liquid Fertilizers lead the way

By Dr. Jerry L. Wilhm, Research Manager

It is time for topdress applications for winter wheat in the Central Plains, and Agro-Culture Liquid Fertilizers has several options to get the most from your crop. As is often the case, there is more to consider than just price and product. To get ahead, consider what can happen after application and the resulting *net* return.

Weather at topdress time in the Central Plains can be windy and dry, and loss of nitrogen through volatilization is a prescription for yield loss. With flavonol polymer chelation technology, *High NRG-N* is formulated to keep more of the nitrogen where it is applied until rainfall can carry it into the root zone. Also, application cost can be a negative when tallied against yield return. Due to volumes and timings, conventional nitrogen solutions are usually split-applied, which increases application costs. But the *High-Performance* of *High NRG-N* enables comparable performance at 40% lower application volume.

The emergence of *eNhance* as an additive to conventional nitrogen solutions has provided performance and yield returns to many growers when economic and product-on-hand issues are presented. The *eNhance* can "enhance" UAN performance through stabilization and nutrient balance when thoroughly mixed with 28% UAN at 2 gallons per ton, or 32% UAN at 2.25 gallons per ton. When applied, the "enhanced" nitrogen can provide comparable performance at 20% lower application volume.

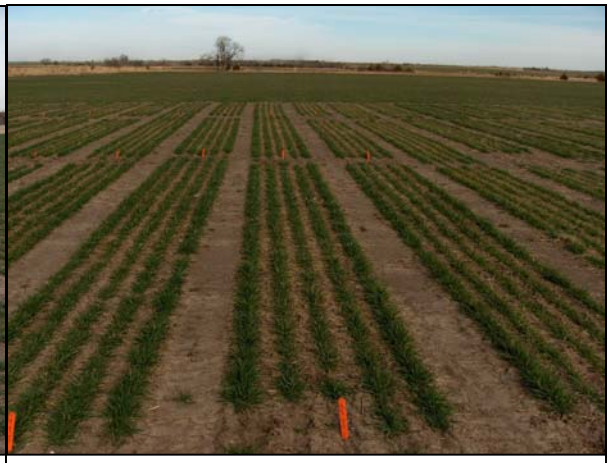
But prove it! For the last two years, replicated winter wheat plots were established near Billings in North Central Oklahoma in the middle of the prime wheat growing part of the state. Working with Area Manager Johnston Grain Company agronomists Jason Wiley and Mike Meeker, a small-plot drill and combine, topdress applications of several different nitrogen sources were compared. Treatments consisted of single and split applications of High NRG-N, 28% UAN plus eNhance, and straight 28% UAN. Topdress applications were applied with a small-plot sprayer with a ground-driven diaphragm pump. It was custom built by Agro-Culture Liquid Fertilizers Sales Account Manager Jacob Nowakowski. This accurately applied the nitrogen solutions through stream-bar nozzles to the plots. Typically 110 lb/A of nitrogen is applied for a yield goal in the 80 bu/A range. Applied treatments were based on this rate.

Topdress nitrogen treatments for winter wheat. Billings, OK 2006.

	N source	gal/A	timing*
1.	28% UAN	36.6	single application
2.	28% UAN	25; 11.6	split application
3.	High NRG-N	22	single application
4.	High NRG-N	15; 7	split application
5.	28% with eNhance	29.3	single application
6.	28% with eNhance	20; 9.3	split application

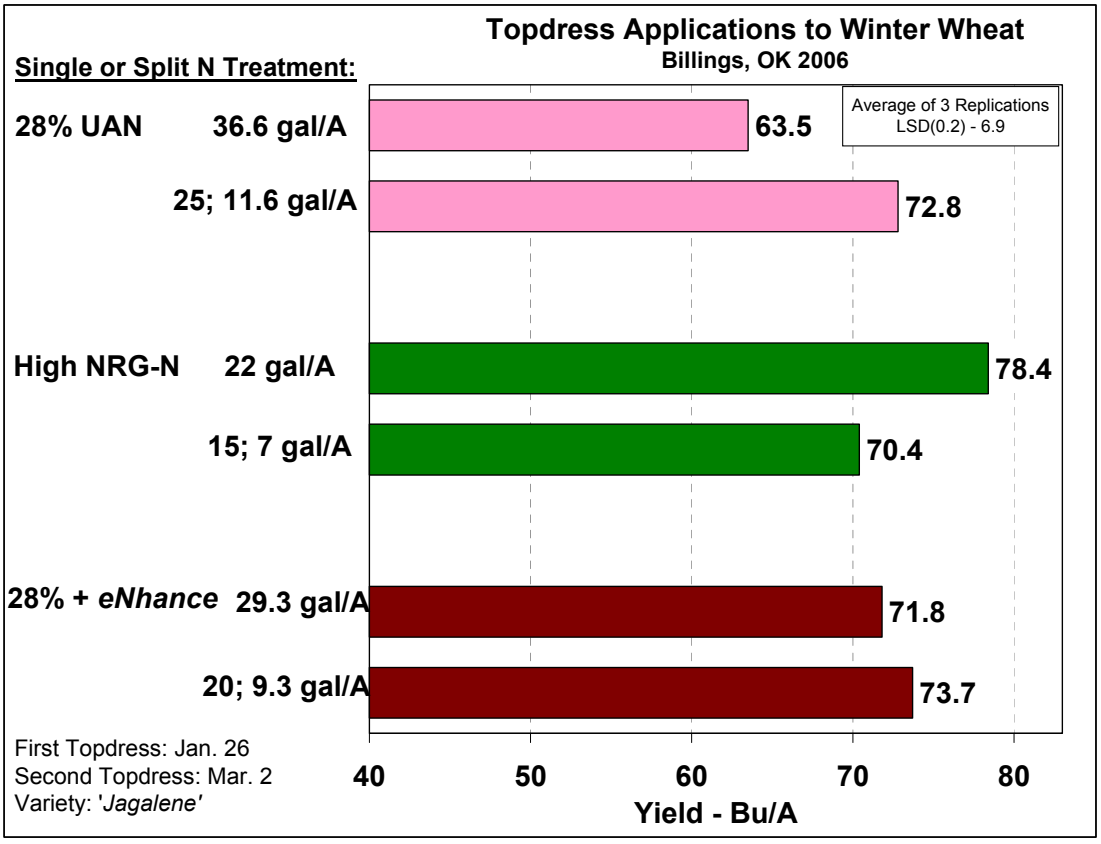
* - single application applied on Jan. 26;
split application applied on Jan. 26 and March 2

Jacob Nowakowski applies a topdress nitrogen treatment on winter wheat plots.



Winter wheat plot layout for topdress nitrogen evaluations.

Conditions were very dry following the first application on January 26. Official weather data collected about 15 miles from the test site recorded only 0.01 inches of rainfall between the first and second application on March 2. However, following the second application nearly 2 inches of rain was recorded within 3 weeks, keeping in mind this was several miles away from the test site. But it does indicate stress conditions early after first application. This apparently influenced treatment performance and subsequent yield data shown in the following chart.



Wheat yields were quite good considering the early dry conditions. Yield data show that a single application of High NRG-N is sufficient for maximum yield, even a rate 40% lower than that of straight 28% UAN. It is apparent that there was nitrogen loss from the 28% UAN single application as yield was significantly reduced. This is probably a reason that split application of UAN solutions is the common practice. However, the addition of *eNhance* to the same 28% UAN solution did offer protection from nitrogen loss. Wheat yield with the single application of 28% UAN with *eNhance* was significantly higher than the single application without it, even at a higher rate (36.6 gal/A vs. 29.3 gal/A).

This is the second year of this trial. In 2005, these same treatments were applied in a nearby location. The following table lists the two-year treatment averages.

Topdress nitrogen treatments for winter wheat. Noble County, OK
Two year treatment averages, 2005 - 06.

	N source	gal/A	timing*	Bu/A
1.	28% UAN	36.6	single application	56.3
2.	28% UAN	25; 11.6	split application	61.4
3.	High NRG-N	22	single application	66.7
4.	High NRG-N	15; 7	split application	65.2
5.	28% with eNhance	29.3	single application	63.4
6.	28% with eNhance	20; 9.3	split application	61.9

Two years of research concludes: *Topdress applications of High NRG-N or the addition of eNhance enable top production of winter wheat while enabling savings on application costs and more acres covered per tank compared to conventional nitrogen solutions.*

(Note: These results from Oklahoma are quite different from what the previous report found in topdress applications in Michigan. Where cold weather does not restrict nitrogen release, High NRG-N is the best application due to *High-Performance* at a reduced application volume.)

Experiment: *Nutri-Till*TM Sugarbeets
Year (Experiment Number): 2006 (06-514)
Date of Planting/Harvest: 5/5/06
Variety: Beta 5451
Plot Size (replications): 15 ft x 135 ft (2 reps)

Soil Test Levels (ppm)
pH: 6.5 C.E.C.: 12.2
OM: 3% P1: 35 ppm
K: 50 ppm (1.1% BS)

Objective: Determine if *Nutri-Till*TM is an effective means of seedbed preparation for a sensitive crop like sugarbeets.

Sugarbeets require a well-prepared seed bed for best stand and growth. Most heavy tillage is done in the previous fall, with only light finishing tillage in the spring primarily to smooth the ground. Thus, reduced tillage for sugarbeets has not been viewed as an option. However, strip tillage, or more specifically, *Nutri-Till*TM does offer an opportunity for soil conservation practices for sugarbeets. What makes *Nutri-Till*TM different is the ability for dual placement of liquid nutrition in the seed zone as well as below the seed. The deep shank is actually an anhydrous knife, which would place the liquid fertilizer approximately 6 inches below the surface. The seed zone placement is through a stream nozzle applied to the soil surface, and then covered by small hilling disks. Three 18 inch 13-wave coulters do the tillage and a rolling basket firms the tilled strip.

Nutri-Till TM implement in the raised position.

Nutri-Till TM soil preparation and fertilizer application on sugarbeet plots.

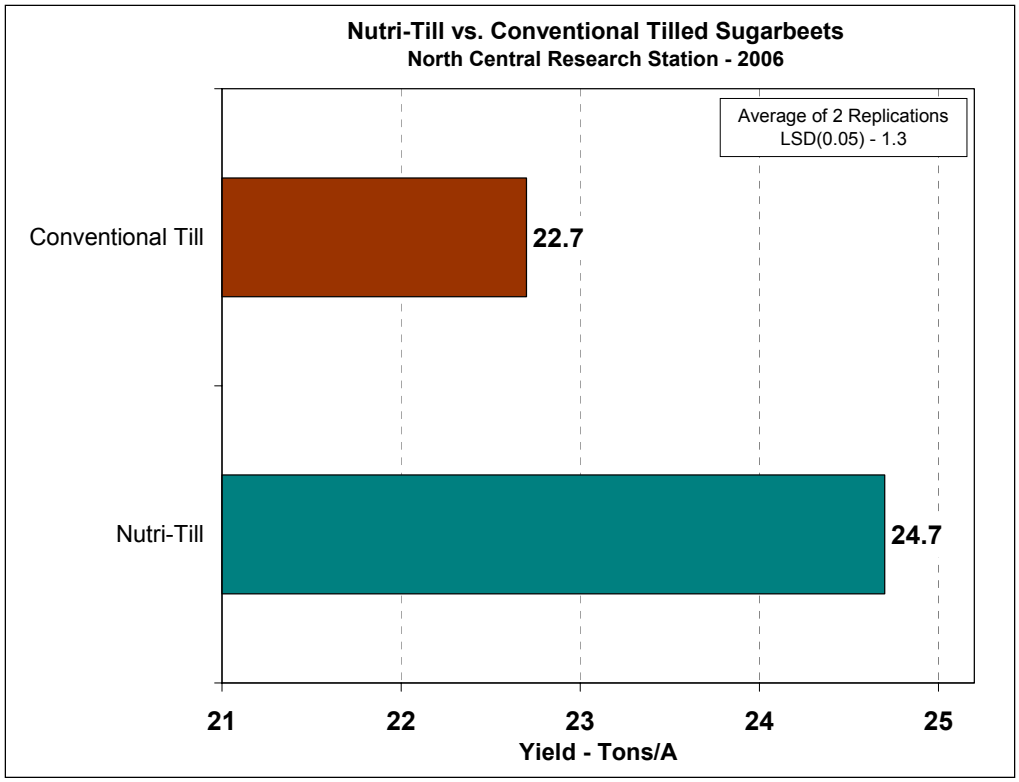
Planting over the *Nutri-Till*TM strips leaving wheat stubble residue between the rows.

The sugarbeet experiment was established on a Sebewa loam soil, which was in winter wheat in 2005. The *Nutri-Till*TM treatment was applied in the un-worked wheat stubble. Part of the test area was worked with a field cultivator in the fall and spring.

The objective of the experiment was to compare fertilizer application either through the *Nutri-Till*$_{TM}$ implement or through broadcast and planter in the worked ground. The same amounts of fertilizer were used on both tillage systems. The *Nutri-Till*$_{TM}$ application was two weeks prior to planting. Treatments are explained in the following chart.

Fertilizer	Tillage	Fertilizer Placement
32 gal/A 28% with eNhance	Conventional	surface broadcast after planting
	Nutri-Till	5 inches below seed placement
3.25 gal/A Pro-Germinator + 15 gal/A Sure-K + 1 qt/A Micro 500 + 1 qt/A Manganese	Conventional	with planter 2x2 placement
	Nutri-Till	in seed zone

Treatment yields appear in the following chart.



The *Nutri-Till*TM application of treatments resulted in a significantly higher sugarbeet yield compared to the same application of nutrients with conventional tillage. This is especially useful in the anticipated saving of time from the multiple tillage passes usually performed in seedbed preparation in sugarbeets.

Conclusion: *Nutri-Till*$_{TM}$ is an excellent tool for growing sugarbeets.

Fehringer
Agricultural
Consulting

7033 Highway 312 • Billings, Montana 59105-5027 • (406) 373-5985 • Fax: 373-4435

2006 Agro-Culture Liquid Fertilizers Sugarbeet Trials

at
Billings, Montana

Conducted by:

Neal E. Fehringer, Certified Professional Agronomist, C.C.A.
Fehringer Agricultural Consulting, Inc.

The following is a summary of the fertilizer application rates and dates, petiole collection dates, harvest methods and dates. Comments are located thereafter.

1) Preplant fertilizer was all broadcast applied fall 2005. Liquid was applied via a sprayer on an ATV. Three locations were established. Each location was 30 feet wide by the length of the field. Preplant dry was applied via air spreader truck with 60 foot booms. Topdress nitrogen was broadcast applied late June 2006 to the dry treatments why the farmer was doing the rest of the field.
2) Fields were tilled 3-4 inches deep after fertilizer application. In early 2006, fields were ridged on 24 inch row spacing for beets.
3) Fertilizer application rates are as follows for the 4 different treatments:
   a) Dry 1X: 165-35-0-0-0 actual units were applied preplant with 100-0-0 actual N topdress applied (265-35-0-0-0 actual units total per acre). Products applied were 343 pounds per acre of urea + 67 pounds per acre of MAP (11-52-0) preplant. In June, 217 pounds per acre of urea were topdress applied.
   b) Liquid 1X: 165-35-0-0-0 actual units were applied preplant (31.9 gpa of High NRG-N + 3.5 gpa of Pro-Germinator). No topdress nitrogen was applied on the King Avenue Liquid 1.5X: 248-52-0-0-0 actual units were applied preplant with no topdress N (248-52-0-0-0 total) (~48 gals/ac High-NRG-N & 5.2 gals/ac of Pro-Germinator).

c) Liquid 1.5X: 248-52-0-0-0 actual units were applied preplant with no topdress N (248-52-0-0-0 total) (~48 gals/ac High-NRG-N & 5.2 gals/ac of Pro-Germinator).location. On the two South Billings Blvd locations, 40 actual units (8 gpa of High NRG-N) was applied in late June 2006 as a sidedress via spoke wheel applicator.
d) Dry 2X: 330-70-0-0-0 actual units were applied preplant with 100-0-0 actual N topdress (430-70-0-0-0 actual units total per acre). Products applied were 686 pounds per acre of urea + 134 pounds per acre of MAP (11-52-0) preplant. In June, 217 pounds per acre of urea were topdress applied.

4) Costs per acre of the different fertilizer treatments with application are as follow:
   a) Dry 1X: $116.25.
   b) Liquid 1X: $98.15
   c) Liquid 1.5X: $127.38
   d) Dry 2X: $191.00
   e) Prices of dry products were: Urea @ $335 per ton & MAP @ $350 per ton.
   f) Prices of Agro-Culture Liquid Fertilizer Products: High NRG-N @ $2.16 per gallon & Pro-Germinator @ $3.53 per gallon.
   g) Application cost: $5 per acre per application.
5) Fields were planted about third week of April. Seeding rate was 240 seeds per 100 row-feet
6) Micro-rates were applied three times. All locations were sprayed with the same herbicide mixture on the same days. Weed control was compromised due to having to delay the second spraying because of cold night time temperatures (upper 20's & lower 30"s).
7) Petiole sampling occurred on July 7, August 4, and October 5 & 6 during harvest. Sixteen petioles of the next to last fully expanded leaf were collected for each treatment for every date.
8) Hand harvests were made October 5 and 6. Mike Kilzer and Mark Kuntz (my agronomic assistant) were present.
9) Harvests were taken from the same planter row at the upper, middle, and lower portion of the treatment area. Areas of low weed density or no weeds were harvested.
10) Five feet by two rows (10 row feet total) were topped with a gas powered weed trimmer. Beets were dug with a garden fork.
11) Total and harvestable beets per 100 row feet were taken. Harvestable beets are those that are 3 inches in diameter or greater. Less than three inches would most likely go through the grab rolls.
12) Harvested beets from each replication were placed in Western Sugar's tare bags and processed by the tare lab at the Billings Factory. Data returned by Western Sugar were gross weight, net weight, and per cent sugar.

2006 Beet Trials Comments

1) Total and harvestable beets, harvest weights, per cent sugar, total gross revenue, and gross revenue less fertilizer costs were compiled and graphed for Dry: 1x and Liquid: 1X (page 4 of 4 of Excel Yield sheet) because there were 9 total replications at this trial site. I also compiled data and graphed it for Dry: 1X, Liquid: 1X, and Liquid 1.5X (page 1 of 4 of Excel Yield sheet). However, this data will not be as statistically strong because there were only 3 replications to compare from the location near Burger King (King Ave site).
2) For the Dry v. Liquid at 1X rates, Liquid AgroCulture fertilized beets yield more, 37.73 tons per acre versus 33.99. Yield was greater for the liquid because of a higher harvestable per centage. The liquid program had 208 total beets with 178 beets harvestable per 100 row feet for an 87.96%. The dry program had 195 total beets with 151 harvestable for a 78.23%. Sugar per centage was the same for both types of fertilizers. Gross revenue and gross revenue less fertilizer were better for Liquid AgroCulture fertilized beets.
3) For King Avenue trials, Dry: 1X yielded 36.74 tons per, Liquid: 1X yielded 41.85 tons per acre, and Liquid: 1.5X yielded 40.62 tons per acre. Again, the yield difference was in the number of harvestable beets per 100 feet, 150 for Dry: 1X, 193 for Liquid: 1X, and 183 for Liquid: 1.5X. Both liquid programs had substantially higher harvestable beet numbers than for dry, 93.39 & 94.73 versus 80.37, respectively. No substantial difference was observed in sugar per centages. Gross revenue and gross revenue less fertilizer were best for Liquid: 1X for the King Avenue trials.
4) On page 2 of the Excel Yield sheet, lists the results of the north location of the South Billings Boulvedard (SSB-N). Treatments were Dry: 1X, Liquid: 1X, and Dry: 2X. The Dry: 2X yielded the best here. What is interesting is that doubling the urea fertilizer at preplant application did not result in lower harvestable beets. Because the total number of beets was lowest for Dry: 2X, the resulting harvestable beet per centage was higher than Dry: 1X. Doubling the urea reduced the initial beet stand but the extra fertilizer increased the size of the remaining beets.
5) As far as petiole tests, nitrogen content was highest in Dry: 2X. Nitrogen content declined throughout the season.
6) Phosphorus peaked with the 8/3/06 sampling. The Liquid 1.5X had the highest concentration on every sampling date. Doubling the dry P did not increase P content.
7) No potassium, calcium, magnesium, or micros were applied.
8) Sulphur was highest (or nearly so) for Dry: 2X. The only sulphur applied was that contained in the High-NRG-N.

Report written by Neal E. Fehringer, Certified Professional Agronomist, C.C.A. on 1/25/07.

2006 Agro-Culture Liquid Beet Trials
Crop Production Data - King Avenue

Field	Fertilizer	Rep	Net Wt (lbs.)	Yield T/Ac	% Sugar	# Sugar per acre	Beets/10 Row Ft Total	Beets/10 Row Ft Harvest	% Harvest	Beets/100 Row Ft Total	Beets/100 Row Ft Harvest	Value/T	Gross Rev/Ac	Fert Cost/Ac	**Gross Rev Less Fert**
King	Dry: 1X	1-1	34.4	37.46	16.10	12,063	18	15	83.33	180	150				
		1-2	31.2	33.98	16.50	11,212	18	14	77.78	180	140				
		1-2	35.6	38.77	15.94	12,359	20	16	80.00	200	160				
	AVERAGES			**36.74**	**16.17**	**11,878**	**18.7**	**15.0**	**80.37**	**187**	**150**	$41.025	**$1,507**	$116.25	**$1,391**
King	Liquid: 1X	2-1	37.9	41.27	16.88	13,934	19	17	89.47	190	170				
		2-2	38.0	41.38	16.70	13,822	20	19	95.00	200	190				
		2-3	39.4	42.91	15.44	13,250	23	22	95.65	230	220				
	AVERAGES			**41.85**	**16.33**	**13,668**	**20.7**	**19.3**	**93.38**	**207**	**193**	$41.589	**$1,741**	$84.25	**$1,656**
King	Liquid: 1.5X	3-1	39.8	43.34	16.52	14,320	16	15	93.75	160	150				
		3-2	39.1	42.58	15.55	13,242	20	19	95.00	200	190				
		3-3	33.0	35.94	16.38	11,773	22	21	95.45	220	210				
	AVERAGES			**40.62**	**16.14**	**13,112**	**19.3**	**18.3**	**94.73**	**193**	**183**	$40.920	**$1,662**	$127.38	**$1,535**

King Avenue Averages
(3 Replications of Each Treatment)

Fertilizer	Yield T/Ac	% Sugar	# Sugar per acre	Beets/10 Row Ft Total	Beets/10 Row Ft Harvest	% Harvest	Beets/100 Row Ft Total	Beets/100 Row Ft Harvest	Value/T	Gross/A	Fert Cost/Ac	**Gross Rev Less Fert**
Dry: 1X	36.74	16.17	11,878	18.7	15.0	80.37	187	150	$41.025	$1,507	$116.25	**$1,391**
Liquid: 1X	41.85	16.33	13,668	20.7	19.3	93.38	207	193	$41.589	$1,741	$84.25	**$1,656**
Liquid: 1.5X	40.62	16.14	13,112	19.3	18.3	94.73	193	183	$40.920	$1,662	$127.38	**$1,535**

2006 Agro-Culture Liquid Beet Trials
Crop Production Data - South Billings Blvd. - N

Field	Fertilizer	Rep	Net Wt (lbs.)	Yield T/Ac	% Sugar	# Sugar per acre	Beets/10 Row Ft Total	Beets/10 Row Ft Harvest	% Harvest	Beets/100 Row Ft Total	Beets/100 Row Ft Harvest	Value/T	Gross/A	Fert Cost/Ac	**Gross Rev Less Fert**
SBB-N	Dry: 1X	4-1	32.7	35.61	15.68	11,167	26	20	76.92	260	200				
		4-2	28.5	31.04	14.59	9,056	17	17	100.00	170	170				
		4-3	24.3	26.46	15.67	8,293	20	6	30.00	200	60				
	AVERAGES			**31.04**	**15.31**	**9,506**	**21.0**	**14.3**	**68.97**	**210**	**143**	$37.901	$1,176.31	$116.25	**$1,060.06**
SBB-N	Liquid: 1X	5-1	Gated pipe leaked all summer - did not use this data.												
		5-2	29.0	31.58	14.80	9,348	20	19	95.00	200	190				
		5-3	25.7	27.99	15.40	8,620	17	14	82.35	170	140				
	AVERAGES			**29.78**	**15.08**	**8,984**	**18.5**	**16.5**	**88.68**	**185**	**165**	$37.197	$1,107.88	$84.25	**$1,023.63**
SBB-N	Dry: 2X	6-1	28.6	31.15	14.64	9,119	10	10	100.00	100	100				
		6-2	35.3	38.44	15.06	11,579	26	17	65.38	260	170				
		6-3	35.0	38.12	16.02	12,212	17	17	100.00	170	170				
	AVERAGES			**35.90**	**15.28**	**10,970**	**17.7**	**14.7**	**88.46**	**177**	**147**	$37.809	$1,357.37	$191.00	**$1,166.37**

2006 Agro-Culture Liquid Beet Trials
Crop Production Data - South Billings Blvd. - S

Field	Fertilizer	Rep	Net Wt (lbs.)	Yield T/Ac	% Sugar	# Sugar per acre	Beets/10 Row Ft Total	Beets/10 Row Ft Harvest	% Harvest	Beets/100 Row Ft Total	Beets/100 Row Ft Harvest
SBB-S	Liquid: 1X	7-1	36.7	39.97	14.97	11,966	20	16	80.00	200	160
		7-2	30.2	32.89	15.14	9,958	21	19	90.48	210	190
		7-3	47.6	51.84	14.52	15,053	24	18	75.00	240	180
	AVERAGES			**41.56**	**14.83**	**12,326**	**21.7**	**17.7**	**81.83**	**217**	**177**
SBB-S	Dry: 1X	8-1	30.3	33.00	15.12	9,978	20	14	70.00	200	140
		8-2	Poor stand in replication - data not used.								
		8-3	31.2	33.98	15.08	10,247	19	18	94.74	190	180
	AVERAGES			**33.49**	**15.10**	**10,113**	**19.5**	**16.0**	**82.37**	**195**	**160**

2006 Agro-Culture Liquid Beet Trials

Crop Production Data: 1x treatment results by location

Field	Fertilizer		Yield T/Ac	% Sugar	# Sugar per acre	Beets/10 Row Ft Total	Beets/10 Row Ft Harvest	% Harvest	Beets/100 Row Ft Total	Beets/100 Row Ft Harvest	Value/T	Gross/A
King	**Dry: 1X**		37.46	16.10	12,063	18	15	83.33	180	150		
SBB-N	**Dry: 1X**		31.04	15.31	9,506	21	14	68.97	210	143		
SBB-S	**Dry: 1X**		33.49	15.10	10,113	20	16	82.37	195	160		
		AVERAGES	**33.99**	**15.53**	**10,560**	**19.5**	**15.1**	**78.23**	**195**	**151**	$38.788	**$1,319**
King	**Liquid: 1X**		41.85	16.33	13,668	21	19	93.38	207	193		
SBB-N	**Liquid: 1X**		29.78	15.08	8,984	19	17	88.68	185	165		
SBB-S	**Liquid: 1X**		41.56	14.83	12,326	22	18	81.83	217	177		
		AVERAGES	**37.73**	**15.45**	**11,659**	**20.3**	**17.8**	**87.96**	**203**	**178**	$38.483	**$1,452**

Dry v. Liquid Averages

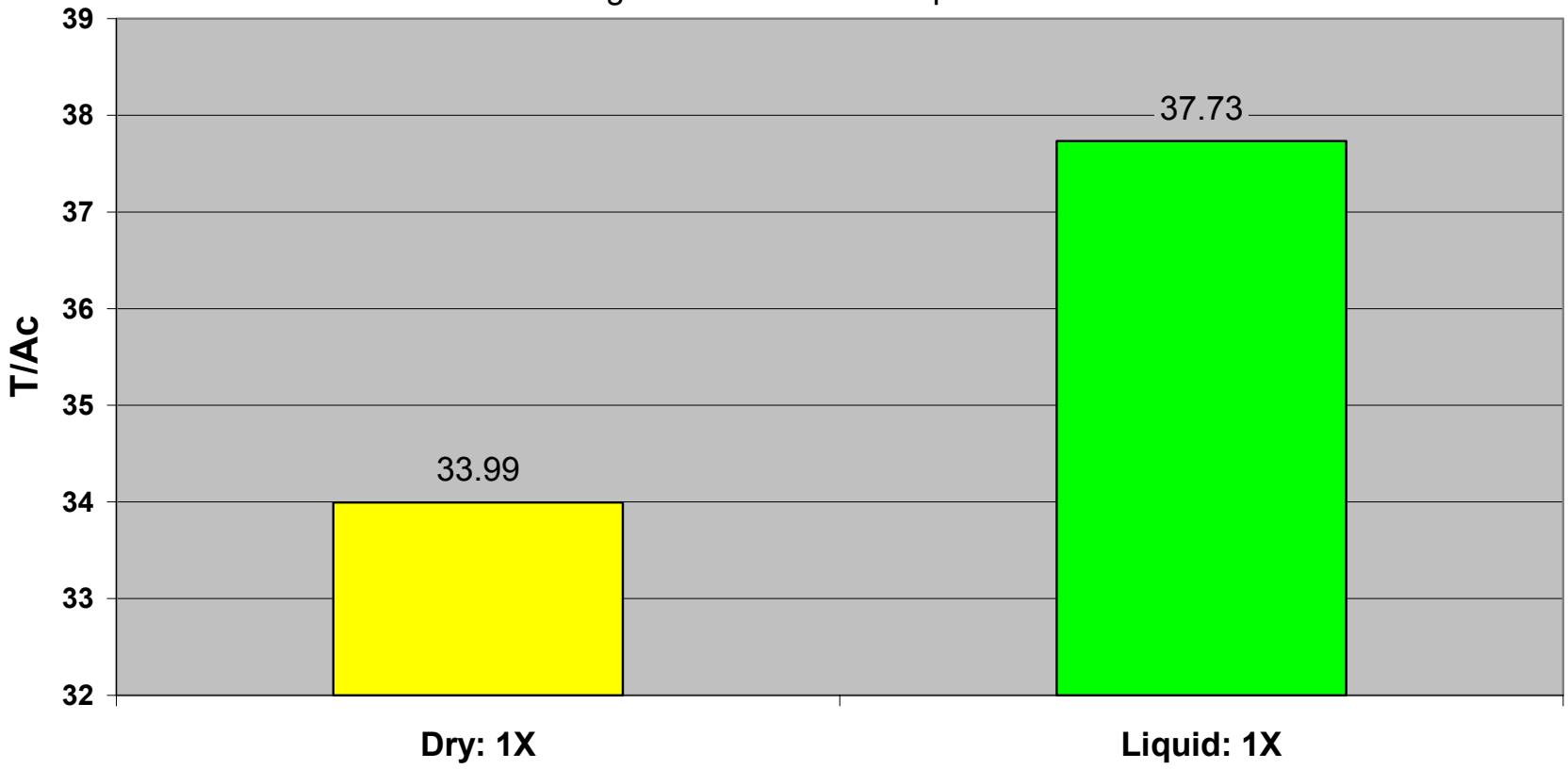
(9 Replications of Each Treatment)

Fertilizer	Yield T/Ac	% Sugar	# Sugar per acre	Beets/10 Row Ft Total	Beets/10 Row Ft Harvest	% Harvest	Beets/100 Row Ft Total	Beets/100 Row Ft Harvest	Value/T	Gross/Ac	Fert Cost/Ac	**Gross Rev Less Fert**
Dry: 1X	33.99	15.53	10,560	19.5	15.1	78.23	195	151	38.788	$1,319	$116.25	**$1,202**
Liquid: 1X	37.73	15.45	11,659	20.3	17.8	87.96	203	178	38.483	$1,452	$84.25	**$1,368**

2006 Agro-Culture Liquid Beet Trials

Beet Yield

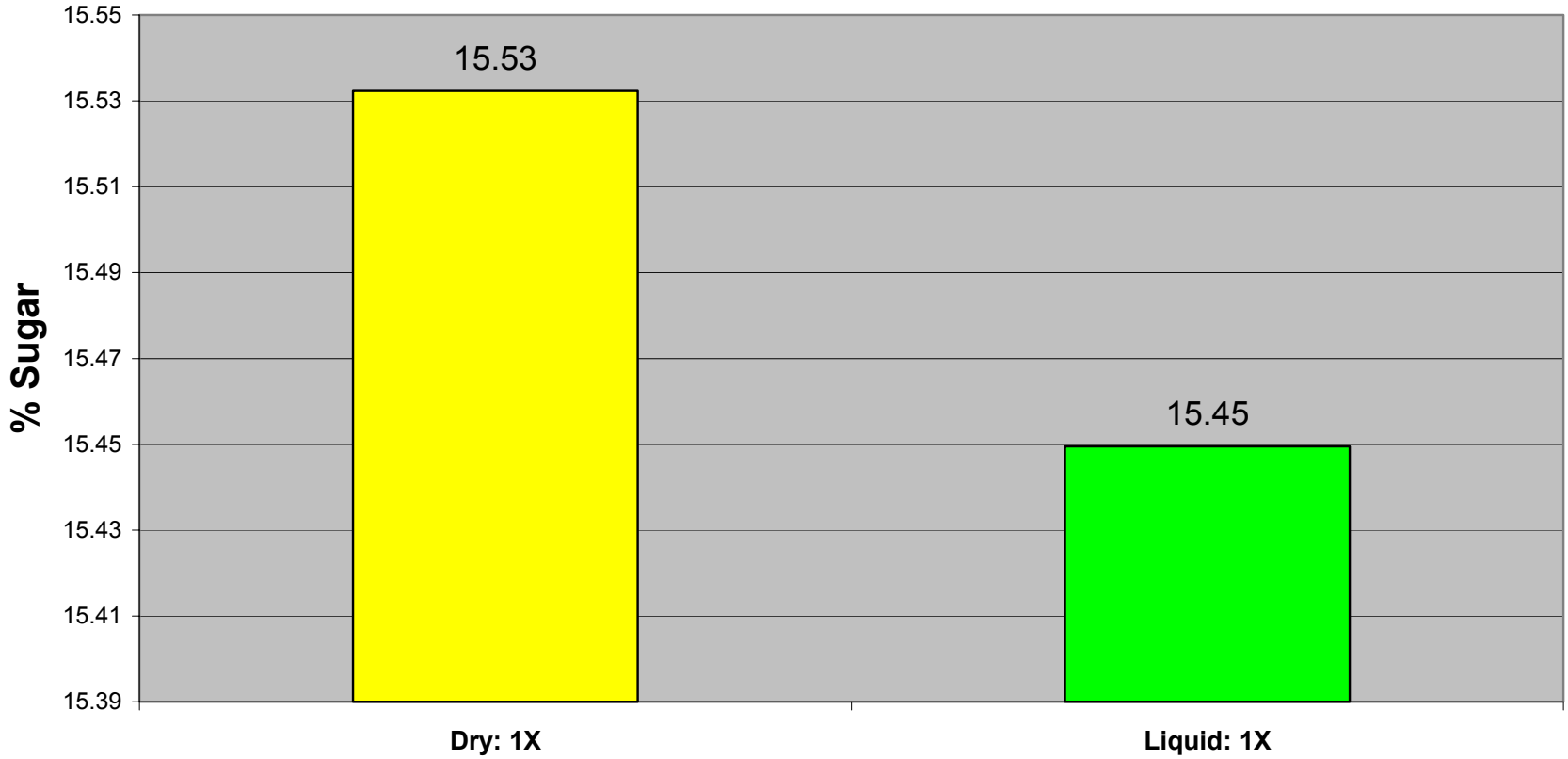
Overall averages: 3 locations x 3 replications each



2006 Agro-Culture Liquid Beet Trials

Sugar Content

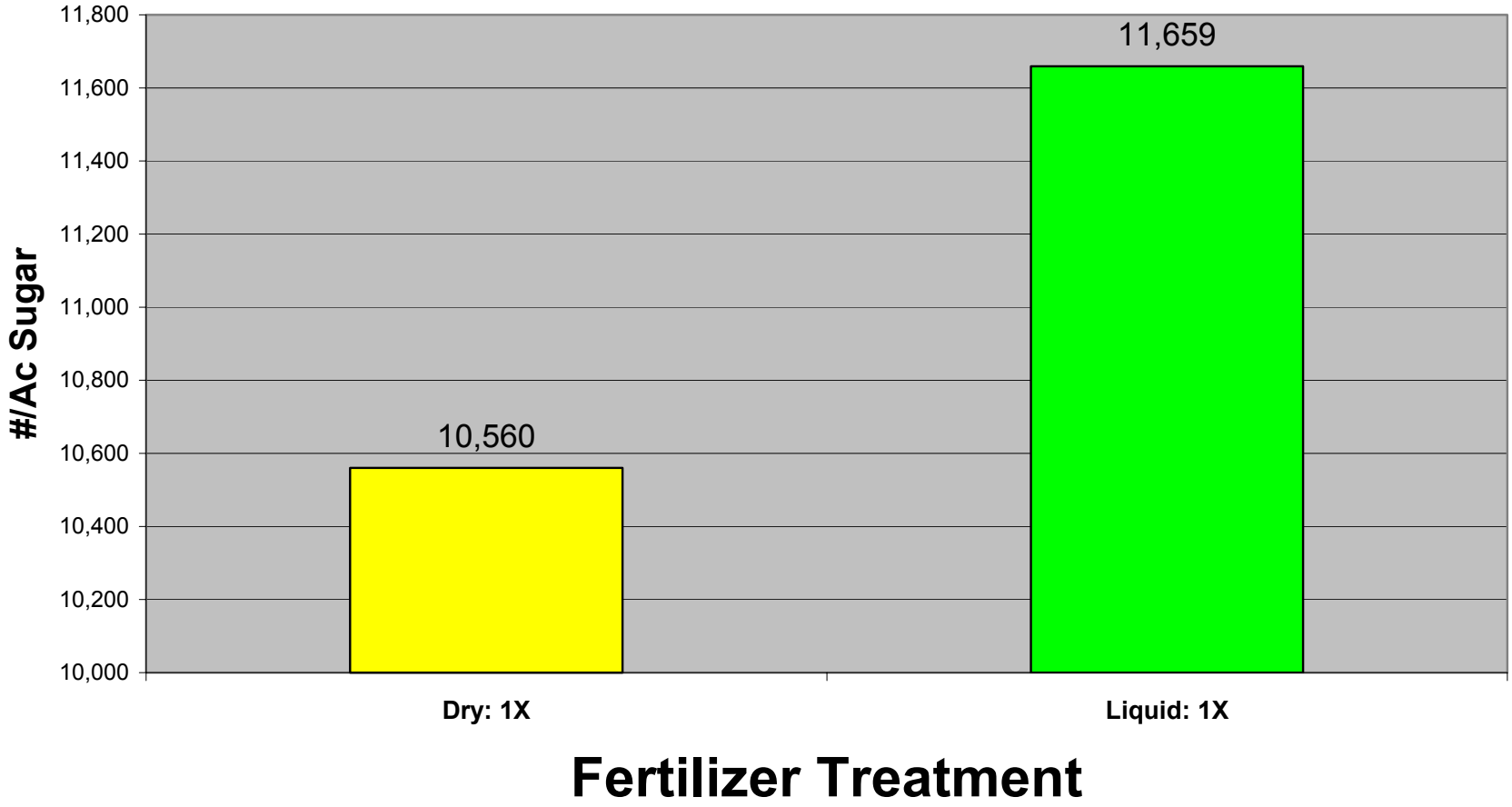
Overall averages: 3 locations x 3 replications each



2006 Agro-Culture Liquid Beet Trials

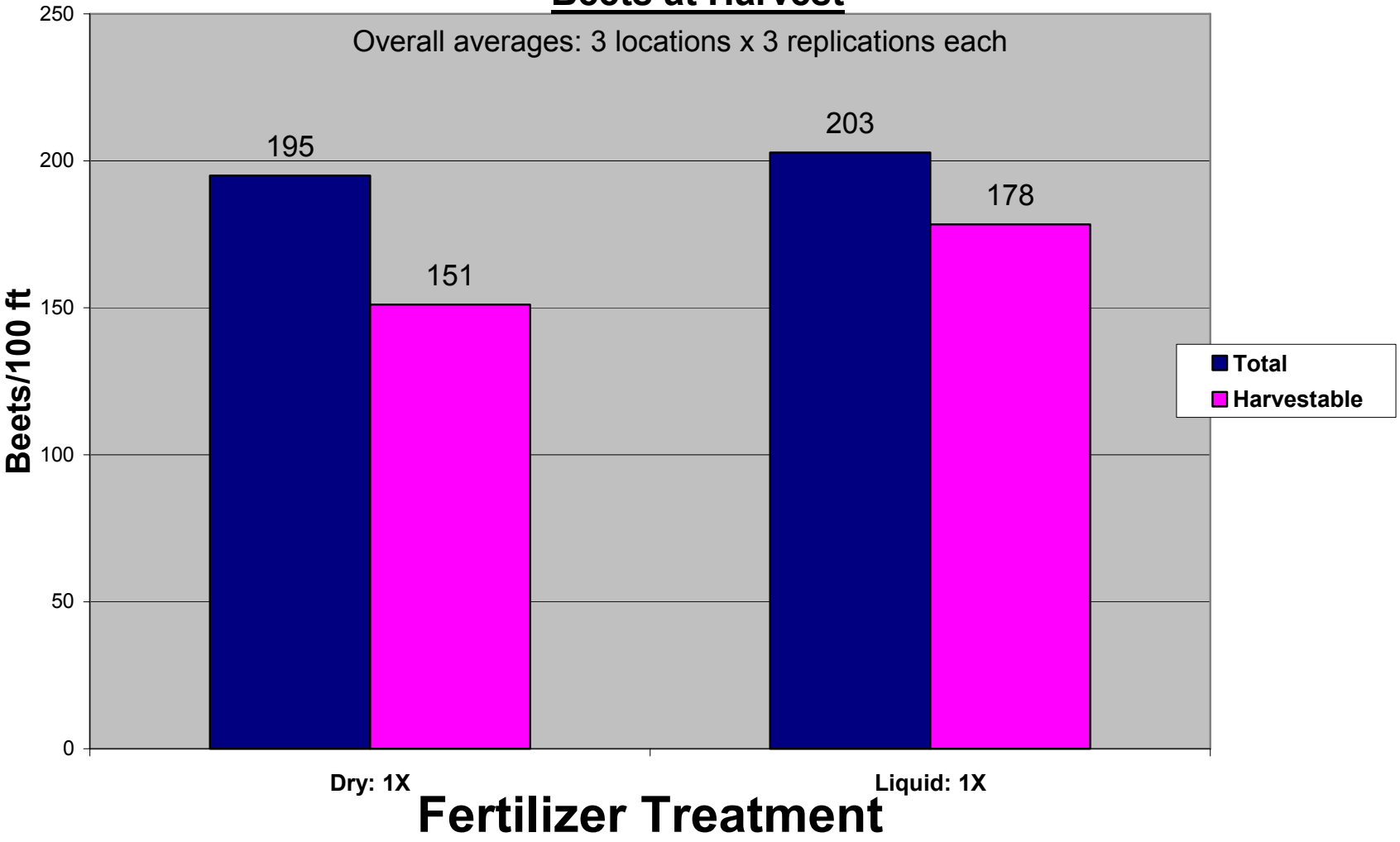
Sugar Produced per Acre

Overall averages: 3 locations x 3 replications each



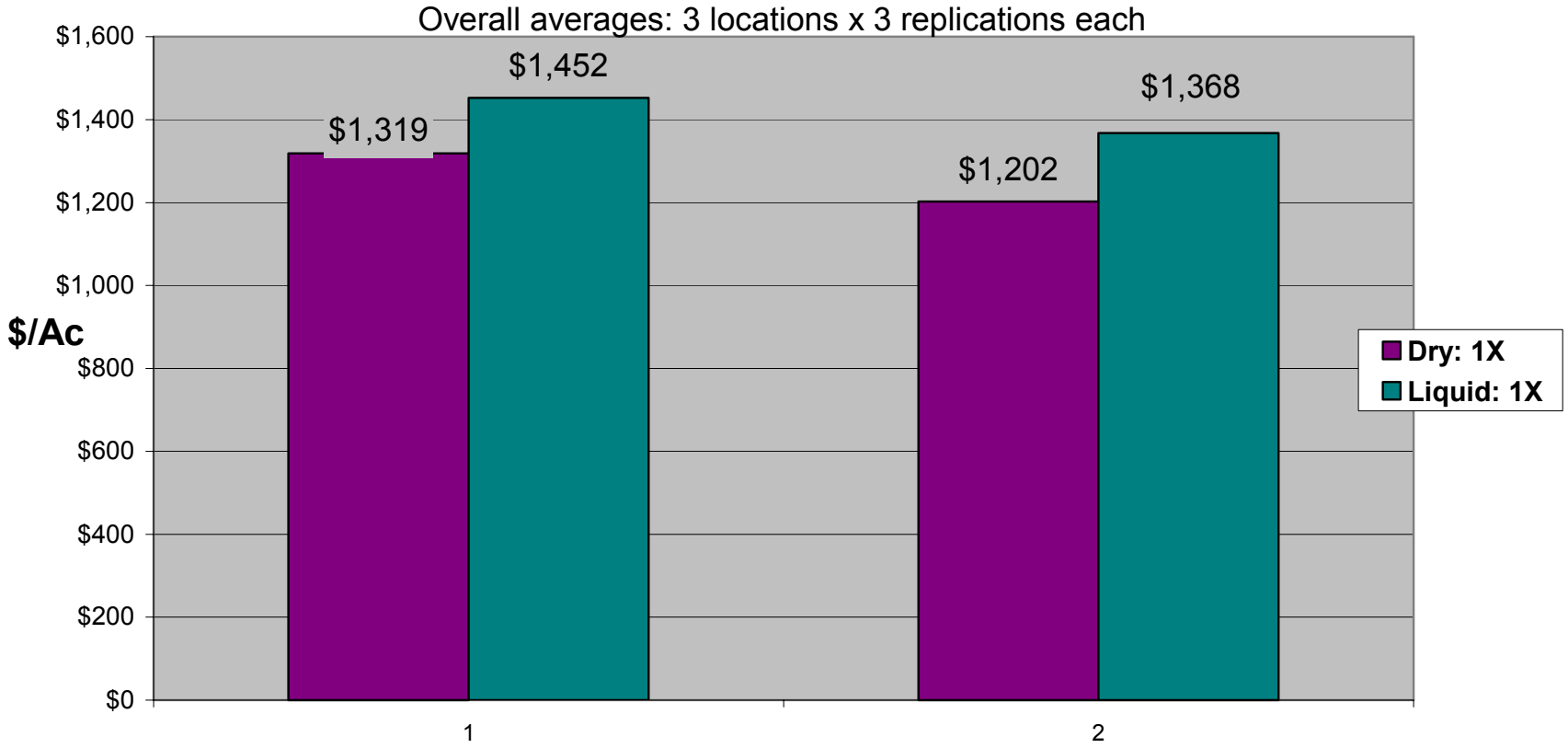
2006 Agro-Culture Liquid Beet Trials

Beets at Harvest



2006 Agro-Culture Liquid Beet Trials

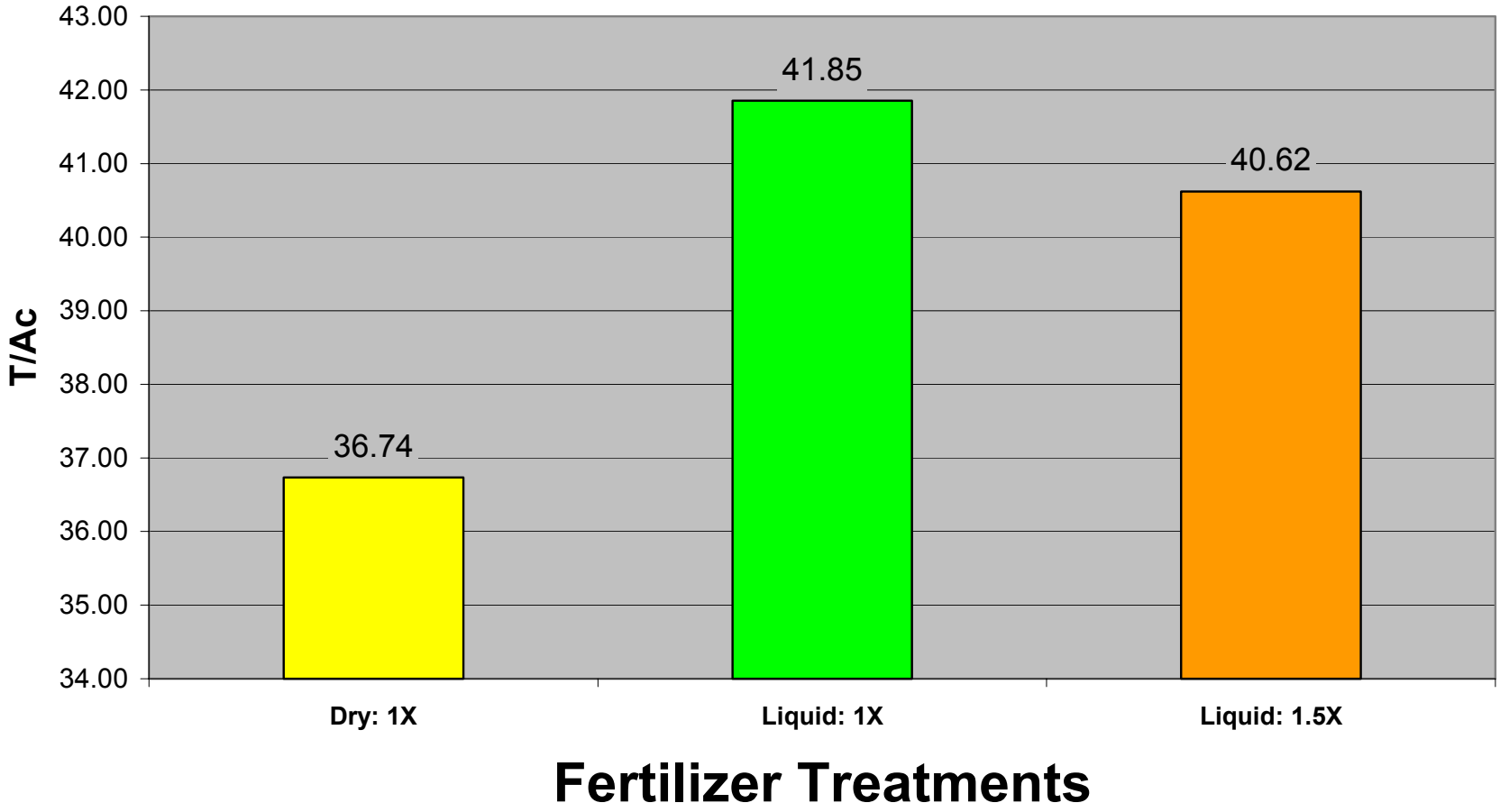
Dry v. Liquid AgroCulture Gross Revenues per Acre



2006 Agro-Culture Liquid Beet Trials

King Ave. Yields

(3 Reps of each)



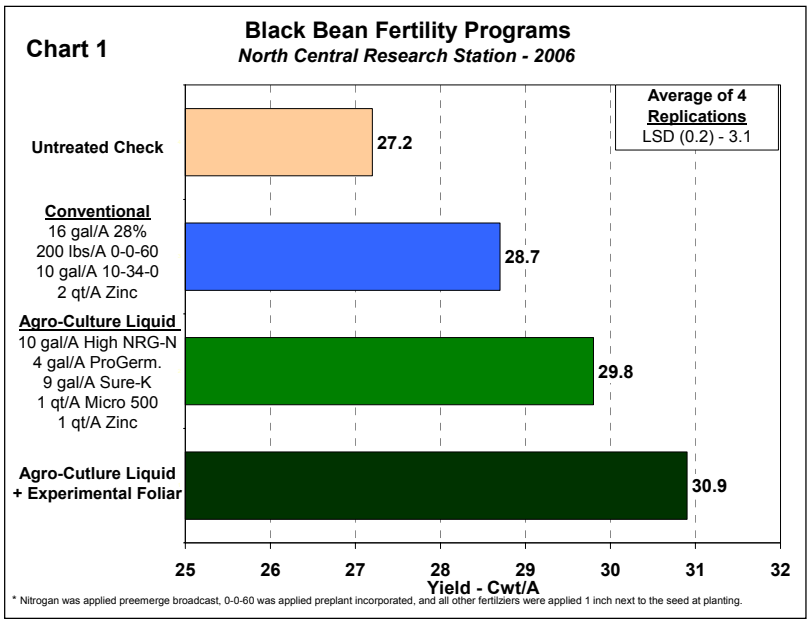
Experiment: Black Bean Fertility Programs
Year (Experiment Number): 2006 (06-516)
Date of Planting/Harvest: 6-6-06 / 9-21-06
Variety: Jaguar
Plot Size (replications): 15 ft x 50 ft (4 reps)

Soil Test Levels (ppm)
pH: 6.9 C.E.C.: 13
OM: 2.7% P1: 30 ppm
K: 101 ppm (2.0% BS)

Objective: Determine effects of reduced inputs from Agro-Culture Liquid Fertilizers on black bean yields compared to conventional fertilizer.

The 2006 black bean experiment evaluated complete fertilizer programs using 28% UAN, potash, and 10-34-0 as a conventional program and compared that to an equal Agro-Culture Liquid Fertilizers program. The Agro-Culture Liquid Fertilizers program consisted of High NRG-N, Pro-Germinator, Sure-K, Micro 500, and Zinc. Both programs were compared to a no fertilizer check treatment. The nitrogen application for both programs was applied broadcast after planting. Liquid fertilizers were applied in a band 1 inch to the side of the seed. Dry potash in the conventional program was broadcast and incorporated before planning.

An additional foliar treatment was also added to this experiment to see if there was any benefit to additional fertilizer later in the growing season. An experimental fertilizer source was applied in mid July when the beans were at the 3rd trifoliate stage. This application was made in addition to the Agro-Culture Liquid Fertilizers program listed above. Yield results for all treatments are shown on chart 1.



Conclusion:

- All fertilizer treatments increased black bean yields over the untreated check.
- The Agro-Culture Liquid Fertilizers program yielded 1.1 cwt per acre higher than the conventional program.
- The addition of the experimental foliar treatment increased dry bean yields 1.1 cwt per acre over the Agro-Culture Liquid Fertilizers program along and increased yields 3.7 cwt per acre over the untreated check.

Experiment: Fertilization of Irrigated Established Alfalfa
Location: Irrigation Research Foundation
Yuma, Colorado
Year: 2006
Plot Size: 20 x 400 feet per plot with 1 replication

Soil Test Levels (ppm)
pH: 7.4 C.E.C.: 6.2
OM: 0.6% Bicarb P: 13 ppm
S: 4 ppm K:131 ppm (5% BS)

Objective: Determine effects of fertilizer application timing and content on alfalfa yield and quality.

The Irrigation Research Foundation is a private, non-profit, independent research and demonstration farm. The main purpose of the IRF is to promote proper water usage and to provide a location for testing important issues that affect the region's agricultural producers (from the IRF website). An experiment was conducted to evaluate several different Liquid fertilizer treatments for effect on alfalfa yield and quality. Comparisons were made against a dry fertilizer program. The dry program applied in early February was actually for corn as this stand was originally going to be tilled up and planted to corn. But in order to accommodate this experiment, the alfalfa was kept even though a portion of the field had already had the dry fertilizer applied. Liquid treatments were applied in strips to a portion of the field which had not received dry fertilizer. As seen from the picture, this seven year old stand was still in good production.

Alfalfa fertilizer test plots at the Irrigation Research Foundation in 2006

One of the objectives tested was fertilizer management in high pH and low soil-sulfur conditions that exist at the IRF. One practice currently in use in certain areas is the combination of ammonium thiosulfate (ATS, 12-0-0-26) with the Liquid fertilizer application. Due to the potential for foliage burn, this should be applied early in the season before substantial foliage development. This can also be applied through stream bar nozzles to keep the fertilizer in concentrated bands. (Nozzles with 20 inch spacing apply fertilizer in 4 evenly spaced bands.) Another objective is to compare Liquid fertilizer application timing. Some producers want to apply all of the fertilizer early in the season in one application, while it is usually recommended to split apply after each cutting to allow for even feeding through the season. Treatments applied are in the following table. Treatments were not able to be replicated, but were instead applied in large strip plots. At harvest, four sub-samples were taken along the plot length for yield calculation and for forage analysis conducted by Olsen's Agricultural Laboratory, Inc of McCook, NE. This method correlated well with whole plot weight measurements.

Base Liquid fertilizer program:	
7 gal/A	Pro-Germinator
6 gal/A	Sure-K
2 qt/A	Micro 500
1 qt/A	Boron
13.75 gal/A	

Treatment list for Alfalfa Fertilization Test at the Irrigation Research Foundation

1. Dry fertilizer already applied: 452 lb/A 31-2-18 (140-9-81)

2.

Timing:	one application in spring prior to foliage emergence	
Method of application:		Stream bar nozzles. (Run close to ground to maintain stream spacing.)
Rates:	10 gal/A	Ammonium Thio-Sulfate +
	13.75 gal/A	Base Liquid fertilizer
	23.75 gal/A	

3.

Timing:	One application in spring just after greenup to 4 inch growth	
Method of application:		Broadcast spray straight fertilizer (no dilution with water)
Rate:	14.25 gal/A	Base Liquid fertilizer + 2 qt/A Sulfur

4.

Timing:	4 applications: 1) Just after greenup to 4 inch growth and 2,3,4) 7 days after first 3cuttings*	
Method of application:		Broadcast spray: can dilute with water to spray 10 gal/A
Rate:	3.5 gal/A	Base Liquid fertilizer + 2 qt/A Sulfur applied in 4 applications

5.

Timing:	3 applications: 7 days after each of the first 3 cuttings	
Method of application:		Broadcast spray: can dilute with water to spray 10 gal/A
Rate:	4.75 gal/A	Base Liquid fertilizer + 2 qt/A Sulfur applied in 3 applications

6.

Timing:	3 applications: 7 days after each of the first 3 cuttings	
Method of application:		Broadcast spray: can dilute with water to spray 10 gal/A
Rate:	4.5 gal/A	Base Liquid fertilizer applied in 3 applications +
	2 gal/A	High NRG-N wit each application
	6.5 gal/A	per application

Yield and Forage Quality data are in the following tables.

Alfalfa Fertilizer Treatment Yields (Tons/A)
Irrigation Research Foundation, Yuma, CO - 2006

trt	1st	2nd	3rd	4th	total 1-4	total 2-4
1	2	1.4	1.2	1.6	**6.2**	**4.2**
2	2.2	1.4	1.2	1.7	**6.5**	**4.3**
3	2.4	1.4	1.2	1.6	**6.6**	**4.2**
4	2.4	1.5	1.2	1.7	**6.8**	**4.4**
5	*	1.5	1.2	1.7		**4.4**
6	*	1.4	1.2	1.7		**4.3**

* - Unfortunately it was not specified to take yield checks of first cuttings of Treatments 5 and 6 since first fertilizer applications were not applied until *after* the first cutting. Thus, total production could not be determined.

- All Liquid treatments did out-yield the dry treatment. For the treatments where all four cuttings were weighed, the multiple applications (Trt. 4) yielded higher than the single early applications (Trt. 2 and 3).

Fertilizer Effects on Alfalfa Relative Feed Value (RFV) Irrigation Research Foundation, Yuma, CO - 2006						
trt	RFV1	RFV2	RFV3	RFV4	avg 1-4	avg 2-4
1	179.8	157.3	179.4	166.0	**172.2**	**168.4**
2	165.8	191.1	209.2	171.4	**184.4**	**190.6**
3	164.5	156.6	166.3	164.3	**162.9**	**162.4**
4	174.3	166.3	209.2	149.3	**174.8**	**174.9**
5	*	142.3	194.6	176.6		**171.2**
6	*	187.4	187.7	180.5		**185.2**

- The dry treatment (Trt. 1) had a higher RFV at the first cutting likely due to the fact the application had been made nearly four months prior to cutting allowing time for nutrient effect. But in the following cuttings the effect was less pronounced compared to the Liquid treatments
- The single early application of ATS in combination with the Liquid treatment (Trt. 2) maintained effect on RFV throughout the season giving the highest overall average. However, addition of High NRG-N (Trt. 6), which contains sulfur, was close behind for forage quality.

Conclusion: It is more effective to split Liquid fertilizer applications through the season rather than to make a single early application. Addition of ammonium thiosulfate and High NRG-N increase hay quality as determined by relative feed value.

Experiment: Nitrogen Source Comparison on Turfgrass
Year (Experiment Number): 2006 (06-211)
Plot Size (replications): 14 ft x 100 ft (3 reps)

Soil Test Levels (ppm)
pH: 7.2 C.E.C.: 7.0
OM: 2.2% P1: 66 ppm
K: 137 ppm (5.0% BS)

Objective: Determine the most efficient type of lawn grass fertilization program.
Another season of turfgrass research has been completed at the North Central Research Station. 2006 evaluated different nitrogen sources and equal rates to examine which product would provide the best turf color and quality along with testing the longevity of the products. Five nitrogen sources were used in this experiment:

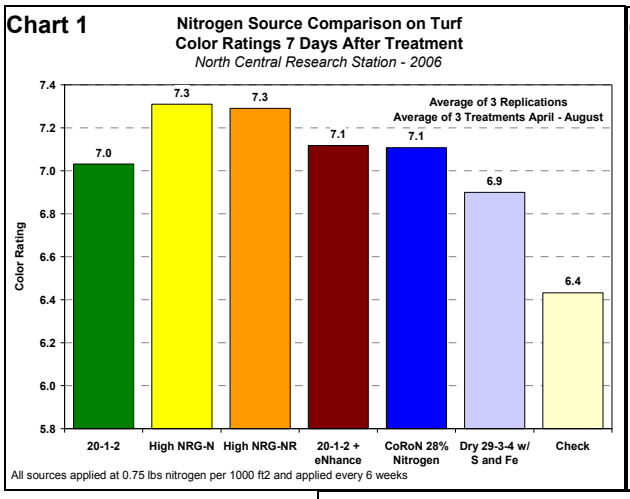
- High NRG-N (27% N)
- High NRG-NR (24% N)
- 20-1-2: a combination of Agro-Culture Liquid Fertilizers
- CoRoN (28% N): Conventional Liquid Nitrogen source
- Scotts Turf Builder (29-3-4 with S and B): Conventional dry fertilizer
- An second treatment of 20-1-2 with the addition of eNhance for increased sulfur

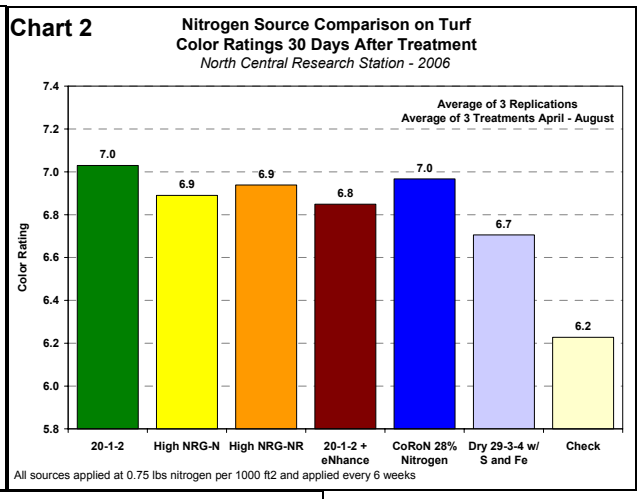
All products were applied at 0.75 lbs (actual) of nitrogen per 1000 ft^2 every 6 weeks. Beginning in April and continuing through August. Liquid fertilizers were applied with a tractor mounted sprayer and sprayed at 40 gallons per acre. Dry fertilizer was applied with hand spreaders. Irrigation was run within 24 hours if rainfall did not occur. Turf color was rated using a Turf Color Meter, 1 week (7 days) , 4 weeks (30 days), and 6 weeks (42 days) after application. A rating of 7 and above is considered acceptable turf quality. Below, charts 1 – 3 show the average of all ratings made at the 3 listed timings.

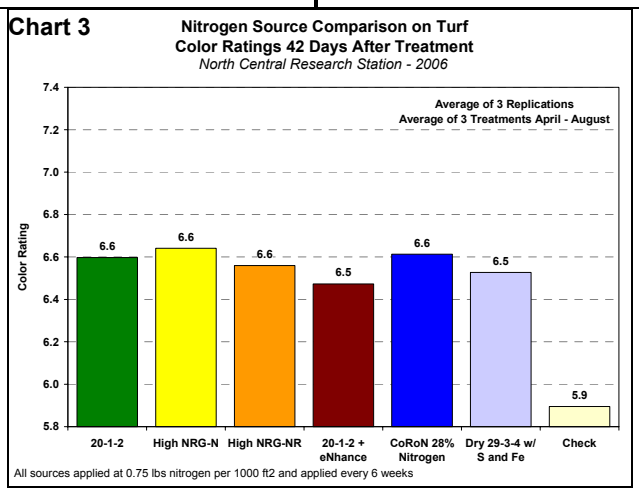
Application Notes:

- Use caution when spraying grass when dew is present as injury is likely to occur in the tire tracks. (see picture below)
- Burn potential greatly increases in areas of over application, such as around buildings and trees.
- Agro-Culture Liquid Fertilizers can be mixed with most herbicides (if the herbicide's label permits); it is best to always do a jar test prior to mixing herbicides with fertilizers.

Appling nitrogen to turf while dew is present may cause temporary burn in the wheel tracks as seen in the picture to the left. Injury was seen 1 day after application.







Conclusions:

- All liquid nitrogen sources provided adequate turf color readings 1 week after application.
- High NRG-N and High NRG-NR gave the quickest green up and best color 1 week after application.
- 20-1-2 provided the most consistent color over the 6 weeks.
- The no fertilizer check provided inadequate turf color and quality throughout the entire season.
- By 4 weeks after application, turf color with most sources was just below the adequate level; this would be an indication for the next application to be applied. Agro-Culture Liquid Fertilizers' normal recommendation has been to make applications every 4 weeks.
- All liquid sources provided similar turf color ratings at the 4 week timing; the dry source was slightly lower.
- By week 6, turf color had greatly decreased with all sources, again proving that an application should be made before 6 weeks to keep high turf color and quality.
- Addition of eNhance to the 20-1-2 program did not increase turfgrass color.

Fertilization of Oklahoma Bermudagrass

Dr. Jerry L. Wilhm, Research Manager
Agro-Culture Liquid Fertilizers

A field experiment was conducted in 2006 near Shawnee, OK to evaluate different fertilizer formulations for growth enhancement effects on common bermudagrass. An established hay field was used for the small plot evaluations comparing N sources urea, 28-0-0-5S + *eNhanceTM*, High NRG-N (27-0-0-1S) and High NRG-NR (24-0-0-1S). The eNhance is a nutrient material that is added to UAN solutions for nitrogen stabilization plus enhanced nitrogen efficiency. High NRG-N is a multi-form, stabilized, controlled release nitrogen solution. High NRG-NR is a urea-based nitrogen solution. Plots were 4 feet by 20 feet. Prior to applications, the entire plot area was mowed to a height of approximately 4 inches to simulate a cutting. Liquid applications were made with a push type small plot sprayer with a ground driven pump to deliver the solution through either flat fan or stream type nozzles. The Liquid nitrogen treatments were combined with Pro-Germinator 9-24-3 and Sure-K to achieve the total application target rate. The dry fertilizer was a blend of urea and 15-15-15. The dry fertilizer application was made with a hand-held spinner type spreader which spread the granules evenly over the plot. Fertilizer applications were made on June 8 and harvested 42 days later on July 20. Harvest measurements were made with a lawn mower and a bagger. Bagged clippings were weighed using a gram scale. Samples from each plot were submitted to Midwest Laboratories of Omaha, NE for feed analysis. Plot application and harvest pictures appear below.

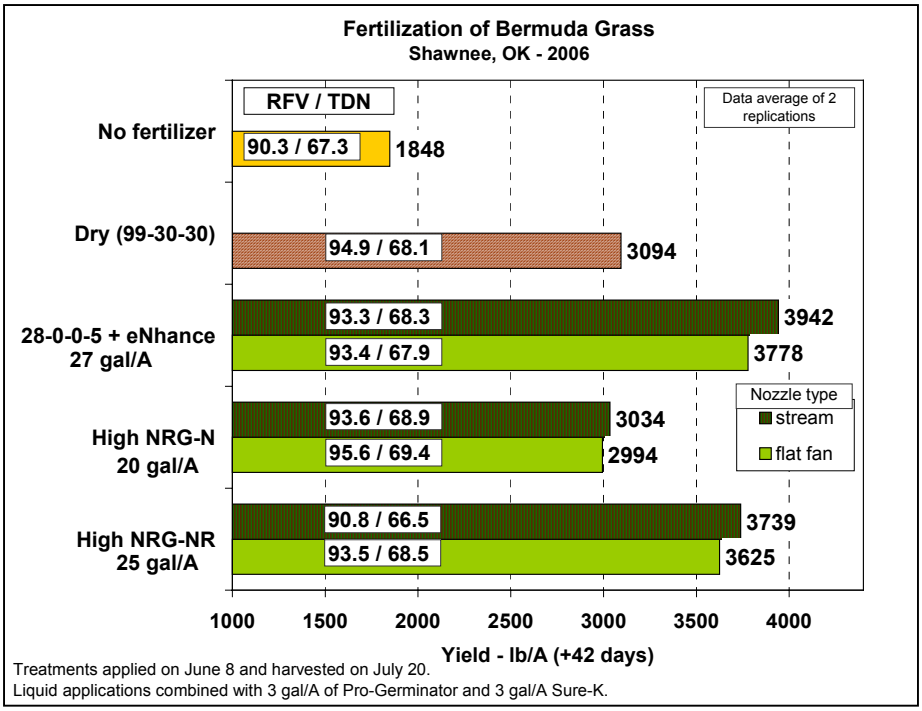
Bermuda grass plot layout.

Application of Liquid fertilizer to plots

Application of dry fertilizer to plots

Mowing plots to determine yield

The target application rates in pounds per acre of nitrogen - phosphate – soluble potash was 100 – 30 – 30. These rates for the Agro-Culture Liquid Fertilizers were applied at rates said to be "equivalent" in performance based on higher nutrient usability and efficiency. There were two replications of treatments. As is often the case in Oklahoma, it was hot and dry following application. Although 3.5 inches of rain fell between application and harvest, nearly half of that was in one rainfall event. Daytime temperatures were regularly in excess of 90 degrees with six days over 100 degrees. Harvest data appear in the following chart.



- Highest yield was obtained with the 27 gal/A rate of 28-0-0-5 + *eNhanceTM,* followed by High NRG-NR, then the dry and High NRG-N being very close to each other.
- There appeared to be a small advantage to the stream nozzles over the flat fan nozzles.
- Fertilization had minimal effects on hay quality expressed as Relative Feed Value and Total Digestible Nutrients. Perhaps nutrient effects were diluted over the larger biomass. The no-fertilizer check did have lower values, although only slightly so.
- The lower yield with the High NRG-N relative to the other liquid sources may have been due to slower release of nitrogen from it's chelated form. Although more likely is the fact that a higher gallonage may be necessary to better achieve "equivalence".
- It is our goal for future testing to continue with further evaluation of rates and multiple applications and cuttings.

The help of Mr. Jacob Nowakowski, Sales Account Manager for Agro-Culture Liquid Fertilizers is appreciated for the building of the Liquid plot applicator and for his field plot assistance on family farm ground.

Experiment: Cantaloupe
Year (Experiment Number): 2006 (06-201)
Date of Planting/Harvest: May 23, 2006 / Mid-July to mid Sept
Hybrid: Superstar
Plot Size (replications): 5' x 15', 3 reps

Soil Test Levels (ppm)	
pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

The objective for this trial was to compare the yield and quality of cantaloupe produced with various Agro-Culture Liquid Fertilizer programs. A comparison of Agro-Culture Liquid Fertilizer programs with conventional fertilizer products was also made.

Cantaloupes were first introduced to North America by Christopher Columbus on his second voyage to the New World in 1494 (www.Wikipedia.org). Since that time the acreage has steadily increased until now there are nearly 91,000 acres of cantaloupes produced in the US with a value of over $300 million (2005 USDA Ag Statistics Vegetable Summary). Still, greater yields and higher quality melons are continuously sought by today's producers.

- The entire plot area received the equivalent of 20 tons/Acre of dairy manure prior to being plowed to a depth of 6" during fall tillage. In the spring, a tractor mounted rotor-tiller was used to prepare the plots for planting.
- "Superstar" cantaloupes were directly seeded into the research plot area on May 23, 2006. Each plot was 5' x 15' and consisted of five hills with 36" in-row spacing.
- Granular fertilizers for the conventional treatment were broadcast across selected plots and incorporated into the soil prior to planting. The Agro-Culture Liquid Fertilizers were banded with a fertilizer knife that placed the products two inches below the soil surface and just to the side of the seed row. On June 13th the same applicator was used to sidedress nitrogen into all the plots. These applications were placed 2" deep and 4-5" to the side of the plant row as vines were starting to run.
- Foliar fertilizer applications started with the initial fruit set on July 14th. Treatments were reapplied every 7-10 days until September 5th when the last application was made. A total of eight applications for each foliar treatment were made during the growing season. All applications were made with a backpack sprayer and hand boom equipped with flat fan nozzles. These fertilizer mixtures were diluted with water and applied at a total volume of 15 gallons per acre. Fungicides and insecticides were applied separately, but in a similar manner as needed through out the season.
- Cantaloupes were harvested continuously every 7-10 days starting on Aug. 17th. Each melon was deemed mature when the tendril on the vine nearest the melon turned brown. Mature melons were harvested by hand and weighted individually until a final harvest on Sept 11th.
- PTS in treatment #3 is Protriastim, a protein cell carrier with a tri-alcohol growth stimulant that boosts the crops ability to store energy for the photosynthetic process.

Granular fertilizers were applied according to published guidelines from Michigan State University's Nutrient Recommendations for Vegetable Crops in Michigan. Ext Bulletin E2934, 2004

Table C1. Fertility Programs for 2006 season Cantaloupe Trial

Treatment / Products		Rate (gal./A)	Application
1	High NRG-N + Pro-Germ. + Sure-K + Micro 500	2 + 2 + 8 + 2 qt	1.5" below seed
	High NRG-N	18	Sidedress
2	High NRG-N + Pro-Germ. + Sure-K + Micro 500	2 + 2 + 8 + 2 qt	1.5" below seed
	High NRG-N	18	Sidedress
	Sure-K + Nutritional Foliar	2 + 1	weekly foliar
3	High NRG-N + Pro-Germ. + Sure-K + Micro 500	2 + 2 + 8 + 2 qt	1.5" below seed
	High NRG-N	18	Sidedress
	Sure-K + Nutritional Foliar + PTS	2 + 1 + 2 oz	weekly foliar
4	High NRG-N + Pro-Germ. + Sure-K + Micro 500	2 + 2 + 8 + 2 qt	1.5" below seed
	High NRG-N	18	Sidedress
	Experimental Foliar #1	3	Weekly Foliar
5	0-0-60	180#	Broadcast
	18-46-0	50#	Broadcast
	28% UAN	30	Sidedress

RESULTS:

- Total cantaloupe yield for all Agro-Culture Liquid Fertilizer treatment were substantially greater than the Conventional fertilizer program, with 1.9 to 11.6 tons/Acre increases (Table C2).
- The largest individual harvest for all treatments typically occurred at the second picking and all subsequent harvests typically exhibited lower yields. However, the basic Agro-Culture Liquid fertility program (Trt. 1) alone and with foliar treatments (Trt. 2) both exhibited relatively stable yield for all seven harvests.
- The average melon size was increased from the regular use of Sure-K and Nutritional foliar combinations (Trt. 2) compared to the conventional fertilizer program. Average melon size was increased as much as 1.5 lbs over the conventional program and 0.7 lb. over the Agro-Culture Liquid program (Trt 1).
- The use of PTS (Protriastim - Trt 3), promoted earliness and greater yields in the initial harvests of this trial. Average melon size was also increased compared to the conventional fertilizer program.

Table C2. Effect of fertility programs on Cantaloupe yields by harvest date.

		Harvest 1	Harvest 2	Harvest 3	Sum Harvest 4-6	Final Harvest	**Total Yield**	Average Melon Size*
Treatment		**Yield (tons / Acre)**						**Lbs.**
1	Plant/SD	3.5	3.4	2.0	15.5	0.7	25.1	**5.7 a**
2	Plant/SD/ Foliar	3.4	7.1	3.4	6.4	3.6	23.9	**7.1 a**
3	Plant/SD/ Foliar w/ PTS	6.0	5.6	1.3	3.7	1.6	18.1	**6.2 b**
4	Plant/SD/Exp Foliar #1	7.0	6.7	1.4	9.2	3.5	27.8	**6.4 b**
5	Dry Program	3.8	7.4	1.8	2.0	1.1	16.2	**5.6 b**

*Values with different letters are significantly different according to Duncan's Multiple Range Test ($P \leq 0.10$)

- Total cantaloupe yield was significantly increased and the average melon size was improved by 0.8 lbs/melon for the Experimental Foliar #1 compared to the conventional fertilizer program. Enhanced total yield came primarily from a greater number of melons harvested per plant, 15.6% more than observed for the conventional fertilizer program (data not shown). Additionally, the largest impact from this treatment program occurred early in the season. Approximately 25% of the total yield was picked in each of the first two harvests (Over 50% total yield by the second harvest). Still, yields from the following 5 harvests were comparable to the other foliar fertility program utilized in treatment 2.

Conclusions:
The Agro-Culture Liquid Fertilizer programs enhanced the total yield and average size of the cantaloupes. Foliar fertilizers had the greatest impact cantaloupe size and the yields from the initial harvests were promoted
.

Experiment: Cantaloupe Fertility Programs – 2 year summary
Year: 2005 &2006 (05-31, 06-201)
Date of Planting/Harvest: June 2 / Aug 17 – Sept 7, 2005
May 23 / Aug 17 – Sept 12, 2006
Plot Size: 5 ft x 15 ft, 3 reps

Soil Test Levels (ppm)

pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

Cantaloupe Fertility Program Yield Results
North Central Research Station
2 year Average (2005 & 2006)

	Total Melons/A			Total Wt. (tons/A)			Average Size (lb./melon)		
Fertilizer Program	**2005**	**2006**	**Avg.**	**2005**	**2006**	**Avg.**	**2005**	**2006**	**Avg.**
Agro-Culture Liquid	8712	7550	8131	30.6	25.1	**27.0**	7.0	5.7	**6.4**
ACLF & Foliar	8712	6195	7454	31.2	23.9	**27.6**	7.2	7.1	**7.1**
Conventional Fert.	7938	5421	6680	28.3	16.2	**25.0**	7.1	6.2	**6.7**
LSD* (P≤0.20)	1417	868		5.4	3.2		0.7	1.4	

*LSD is for yield parameters by year (within each column) only.

The objective for these trials was to compare the yield and quality of cantaloupe produced with various Agro-Culture Liquid Fertilizer programs and conventional fertilizer products.

- Liquid Fertilizer was placed in a band next to the seed at planting. Sidedress was placed in a band next the row and two inches below the surface. Dry fertilizer was broadcast and incorporated before planting.
- Foliar applications were made with a backpack sprayer equipped with flat-fan nozzles and application volume of 15 gallons per acre.
- Hand harvest of the plots began in mid-August and continued thru early September. As fruit ripened melons were counted and weighed individually to calculate yield.

Results:

- All Agro-Culture Liquid Fertilizer programs increased the number of melons and total cantaloupe yield over the conventional fertilizer program.
- Highest yielding program was the Agro-Culture Liquid Fertilizers program with in season foliar applications. The two year average for total yield was 2.6 tons/A higher and 0.4 lb./melon heavier than the conventional fertility program.
- The addition of foliar applications to the Agro-Culture Liquid Fertilizer soil program did not produces more melons per acre; however, the melons receiving foliar treatments were larger and harvested earlier in the season, therefore total tons/acre and crop value were both increased.

Table C1. Fertility Programs for 2005 & 2006 season Cantaloupe Trials.

Treatment / Products		Rate (gal./A)	Application
1	High NRG-N + Pro-Germ. + Sure-K + Micro 500	2 + 2 + 8 + 2 qt	1.5" below seed
	High NRG-N	18	Sidedress
2	High NRG-N + Pro-Germ. + Sure-K + Micro 500	2 + 2 + 8 + 2 qt	1.5" below seed
	High NRG-N	18	Sidedress
	Sure-K + Nutritional Foliar	2 + 1	weekly foliar
3	0-0-60	180#	Broadcast
	18-46-0	50#	Broadcast
	28% UAN	30	Sidedress

Conclusions:
Cantaloupes grown with the Agro-Culture Liquid Fertilizer programs exhibited higher melon set and total yield per acre. Melon size was also promoted with the regular foliar applications of Sure K and Nutritional Foliar.

Experiment: Tomatoes
Year (Experiment Number): 2006 (06-202)
Date of Planting/Harvest:
Hybrid: Celebrity
Plot Size (replications): 7.5' x 5', 3 reps

Soil Test Levels (ppm)	
pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

The objective for this trial was to possibly expand this successful fertility program with two different Agro-Culture Liquid Fertilizer foliar fertilizers, PTS and Experimental Foliar #2. Additionally, a comparison with conventional dry fertilizer products was made. Tomato research trials at the North Central Research Station have previously demonstrated the yield benefit of Premium Calcium as a foliar application on tomatoes.

- "Celebrity" variety tomatoes were transplanted into the plot area on May 24, 2006. Each plot was 7.5' x 5' and consisted of ten tomato plants (two rows with 18" spacing between rows and between plants within rows).
- The entire plot area received the equivalent of 20 tons/Acre of dairy manure prior to being plowed to a depth of 6" during fall tillage. In the spring, a tractor mounted rotor-tiller was used to prepare the plots for planting.
- Granular fertilizers for the conventional treatment were broadcast across selected plots and incorporated into the soil prior to trans-planting. Transplant solutions containing the described Agro-Culture Liquid fertilizers or 10-34-0 were applied in a total water volume of 4 oz per plant (~150 gallons per acre) at the time of transplanting. On June 13th sidedress applications were made to apply additional fertilizer into all the plots as described. A custom built sidedress applicator equipped with a fertilizer knife placed the treatments 2" deep and mid-way between the two tomato rows for each plot. On June 20th, a second sidedress application was made 14 days later in the same manner.
- Foliar fertilizer applications started at initial fruit set on July 14th. A second application of these foliar treatments was re-applied to selected plots on July 28th. All foliar applications were made with a backpack sprayer and hand boom equipped with flat fan nozzles. These fertilizer mixtures were diluted with water and applied at a total volume of 15 gallons per acre. Fungicides and insecticides were applied separately, but in a similar manner as needed through out the season.
- PTS in treatment #2&3 is Protriastim, a protein cell carrier with a tri-alcohol growth stimulant that boosts the crops ability to store energy for the photosynthetic process.
- The earliest tomatoes to mature were hand harvested from each plot on Aug 14, 2006. On August 25th, the entire plot area was treated with Ethrel® (Ethephon) to advance maturity of all remaining green fruit. On August 30th, all tomatoes were harvested, sorted according to color, and the yield by color was determined for fully

red, partially red (breaks) & green tomatoes. Rotten tomatoes and green tomatoes smaller than 2" in diameter were left in the plots and not included in the harvest evaluations.

Table T1. Tomato Fertility Programs utilized in 2006 research trial.

Treatment		Rate/ A (gal.)	Method of Application
1	Sure-K + Pro-Germ + Micro 500	10 + 2.5 + 2 qt	transplant
	Sure-K + High NRG-N	10 + 16	Sidedress #1
	High NRG-N	16	Sidedress #2
	Premium Ca + SK + NF	(1 qt + 2 + 1) x 2	foliar x 2
2	Sure-K + Pro-Germ + Micro 500	10 + 2.5 + 2 qt	transplant
	Sure-K + High NRG-N	10 + 16	Sidedress #1
	High NRG-N	16	Sidedress #2
	Premium Ca + SK + NF + PTS	(1 qt + 2 + 1 + 2 oz) x 2	foliar x 2
3	Sure-K + Pro-Germ + Micro 500	10 + 2.5 + 2 qt	transplant
	Sure-K + High NRG-N	10 + 16	Sidedress #1
	High NRG-N	16	Sidedress #2
	Premium Ca + SK + PTS + Exp #2	(1 qt + 2 + 2 oz + 1) x 2	foliar x 2
4	0-0-60	520#	broadcast
	10-34-0	9 gal	transplant
	28% UAN	26.5 & 26.5	sidedress 1&2

SK = Sure-K, NF= Nutritional Foliar, PTS= Protriastim, Exp #2 = Experimental Foliar #2

RESULTS:

- Marketable tomato yields (early, reds, & breaks) for all Agro-Culture Liquid Fertilizer treatments (treatment 1-3) were significantly greater than the conventional fertilizer program. However, there were no statistical differences among the three Agro-Culture Liquid foliar treatments for marketable yield.
- All three Agro-Culture Liquid Fertilizer treatments had significantly more red fruit than was produced for the conventional fertilizer treatment.
- Total yield from the various Agro-Culture Liquid fertility programs was approximately 35% greater than the conventional fertility program.

Table T2. Effect of various foliar fertilizer programs on the yield and quality of tomatoes.

Treatments		Early	Reds	Breaks	Greens	Total Marketable
		Tons/Acre*				
1	Nutritional foliar & Premium Ca	6.4 abc	23.9 b	29.0 ab	17.9 a	59.4 b
2	Nutritional foliar, Prem-Ca &PTS	7.5 bc	24.3 b	28.3 ab	17.9 a	60.0 b
3	Nutritional foliar, Prem-Ca, PTS & EXP Foliar #2	9.0 c	26.3 b	27.3 ab	22.6 a	61.0 b
4	Conventional Fertilizers	6.0 ab	17.1 a	21.3 a	18.3 a	44.5 a

* Values followed by different letters are significantly different within each column according to Duncan's Multiple Range Test (P< 0.10)
Ethrel® is a product of Bayer Crop Science, Research Triangle Park, NC

- The program utilizing Experimental Foliar#2 had numerically the highest marketable yield of all treatments and significantly greater yield of early tomatoes than the conventional fertilizer treatment. This program also had the highest yield of red and [illegible] use of a higher rate of Ethrel may have [illegible]ld with this treatment.

Conventional fertilizers were applied according to published guidelines from Michigan State University's Nutrient Recommendations for Vegetable Crops in Michigan. Ext Bulletin E2934, 2004

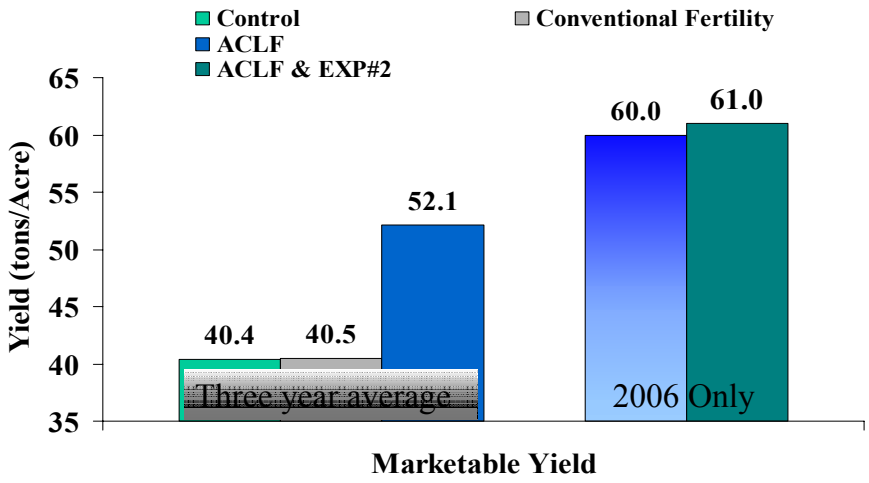
- PTS and Experimental foliar #2 each advanced the maturity, promoted numerically greater yields, increased the quantity of red fruit produced by the tomatoes treated with these products.

Conclusions:
All Agro-Culture Liquid fertilizer products utilized in this trial promoted yield and the quality of the tomatoes produced. PTS and the Experimental foliar #2 each added to the early yield and red tomato yields. Therefore, these products promoted the overall yield and quality of the tomatoes in this trial beyond the use of the base liquid foliar program.

Experiment: Three-Year Evaluation of Different Fertilizer Sources for Field Production Tomatoes
Year: 2004-2006
Date of Planting/Harvest: transplant 5-12-04/ 9-2-04
transplant 5-9-05/ 8-18-05
transplant 5-23-06/ 8-29-06
Plot Size: 5 ft. x 5 ft. (2005) & 5 ft x 7.5 ft. (2006)

Soil Test Levels (ppm)	
pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

The objective for this trial was to validate prior successes for tomato yield enhancement with fertility programs from Agro-Culture Liquid Fertilizer foliar fertilizer treatments.



- Dry fertilizer was broadcast and incorporated prior to planting. Agro-Culture Liquid Fertilizers (ACLF) were placed in a band two inches to the side and two inches below transplant placement. Sidedress applications were applied in a band along the side of the row
- Harvest was completed by hand; tomatoes were sorted by color and weighed to calculate yield and percent damage.
- Ethrel® (Ethephon) was used in 2006 to advance maturity of all green fruit prior to harvest.

Treatment		Rate/ A (gal.)	Method of Application
1	Sure-K + Pro-Germ + Micro 500	10 + 2.5 + 2 qt	transplant
	Sure-K + High NRG-N	10 + 16	Sidedress #1
	High NRG-N	16	Sidedress #2
	Premium Ca + SK + NF	(1 qt + 2 + 1) x 2	foliar x 2
2	Sure-K + Pro-Germ + Micro 500	10 + 2.5 + 2 qt	transplant
	Sure-K + High NRG-N	10 + 16	Sidedress #1
	High NRG-N	16	Sidedress #2
	Premium Ca + SK +Exp #2	(1 qt + 2 + 1) x 2	foliar x 2
4	0-0-60	520#	broadcast
	10-34-0	9 gal	transplant
	28% UAN	25 & 25	sidedress 1&2

RESULTS:

- All fertilizer application increased tomato yields and deceased fruit loss over the untreated check.
- Three-year average of the Agro-Culture Liquid Fertilizer program significantly increased tomato yields (11^{+} Ton/Acre average increases) over the conventional fertilizer program.

- The addition of Premium Calcium to the ACLF program was a very dramatic improvement in terms of yield and fruit quality. Fruit loss due to tomato damage such as blossom end rot and over ripening was nearly 1.5% lower with the Agro-Culture Liquid Fertilizers program compared to the conventional fertilizer source. (2004 & 2005 data only)
- In 2006, Experimental Foliar #2 was added to the Agro-Culture Liquid Fertilizer program and yields were increased above all other treatments evaluated. In addition to greater yields, maturity of the fruit was also enhanced compared to all other treatments.

Conclusions:

All Agro-Culture Liquid fertilizer products utilized in these trials promoted yield and the quality of the tomatoes produced. The use of premium calcium and other Agro-Culture Liquid fertilizer foliar products promoted the overall yield and quality of the tomatoes in these trials well above the conventional fertilizer program.

Experiment: Bell Peppers
Year (Experiment Number): 2006 (06-203)
Date of Planting/Harvest: May 23 / July-Mid Sept
Hybrid: Boynton
Plot Size (replications): 5' x 5', 4 reps

Soil Test Levels (ppm)	
pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

This trial was established to compare various Agro-culture Liquid Fertilizer fertility programs on the yield of bell peppers. Additionally, a comparison with conventional dry fertilizer program was made. Bell Pepper consumption in the U.S. has doubled since 1986. Greater demand for fresh market peppers is the main driving force behind this increase. Off-season greenhouse production has continued to supply fresh peppers to the US consumers all year, thus maintaining demand beyond the historically seasonal supply. It is very likely this market segment will continue to grow into the near future.

- "Boynton" variety peppers were transplanted into the research plot area on May 23, 2006. Each plant was approximately 5-6" tall at this time. The plots were 5' x 5' with a single row of five plants down the center with 12" in-row spacing.
- The entire plot area received the equivalent of 20 tons/Acre of dairy manure prior to being plowed to a depth of 6" during fall tillage. In the spring, a tractor mounted rotor-tiller was used to prepare the plots for planting.
- Products for the dry fertilizer treatment were broadcast across selected plots and incorporated prior to planting. The Agro-culture Liquid Fertilizer products were banded with a fertilizer knife so that the products were placed two inches below and just to the side of the transplants. The same applicator was used for side dressing all nitrogen products on June 13th. However, these applications were placed about

Table BP1. Bell Pepper Fertility programs for 2006.

Treatment		Rate/A	Method of Application
1	Pro-Germ + Sure-K + Micro 500	2 + 7 + 2 qt	Band
	High NRG-N	18	Sidedress
2	Pro-Germ + Sure-K + Micro 500	2 + 7 + 2 qt	Band
	High NRG-N	18	Sidedress
	Sure-K + Nutr. Foliar	2 + 1	Weekly
3	Pro-Germ + Sure-K + Micro 500	2 + 7 + 2 qt	Band
	High NRG-N	18	Sidedress
	Sure-K + Nutr. Foliar + PTS	2 + 1 + 2 oz	Weekly
4	Pro-Germ + Sure-K + Micro 500	2 + 7 + 2 qt	Band
	High NRG-N	18	Sidedress
	Experimental Foliar #1	3	Weekly
5	0-0-60	140#	Broadcast
	18-46-0	50#	Broadcast
	28% UAN	30	Sidedress
6	Untreated Control	(none)	

3-4 inches to the side of the planted row.

- The foliar fertilizer applications started on July 7th with initial fruit set of the peppers. Treatments were reapplied every 7-10 days until September 5th when the last application was made. A total of eight applications for each foliar treatment were made during the growing season. All foliar applications were made with a backpack sprayer and hand boom equipped with flat fan nozzles. These fertilizer mixtures were diluted with water and applied at a total volume of 15 gallons per acre. Fungicides and insecticides were applied separately, but in a similar manner as needed through out the season.
- PTS in treatment #3 is Protriastim, a protein cell carrier with a tri-alcohol growth stimulant that boosts the crops ability to store energy for the photosynthetic process.
- Peppers were harvested every 7-10 days beginning on July 19th and ending on Sept 11th. All peppers were hand harvested, counted and weighted as they matured.

RESULTS:

- Pepper yields for all Agro-culture Liquid Fertilizer treatments were numerically greater than the plots that received no fertilizer. Pepper production for the Conventional program was similar to the Agro-culture Liquid Fertilizer soil only program, but less than all Agro-culture Liquid Fertilizer programs that utilized foliar treatments (Table BP2).
- All peppers were hand harvested based on size, therefore, the average size of the harvested peppers should have been very similar. However, picking was based on a minimum size and some peppers grew faster than others. Therefore statistical differences were noticed between several of the treatments ($P \leq 0.15$). All fertility programs except treatment #3 produced statistically larger peppers than the untreated control program. Peppers treated with the Experimental Foliar program average 1.6 oz per pepper larger than the Untreated and 1.2 oz/pepper larger than the conventional fertility program average over the entire season. Average peppers size for all Agro-Culture Liquid fertility programs (trt 1-4) were statistically similar to the conventional fertility program. Still, if a producer could realize a premium for larger sized peppers, the experimental foliar program may provide greater value per acre even with yields similar to the other fertility programs.
- Yield of the peppers on individual harvest dates were statistically similar for all treatments over the entire season. Still, there was a noticeable increase in the early yields. More marketable peppers were produced with the ACLF programs during the two initial harvests compared to the conventional fertilizer and the untreated.
- The use of PTS (trt. #3) promoted early ripening and approximately 46% of the total production from the first three of eight harvests was produced by this treatment program. (Table BP3). Yield for most other fertility programs was only about ~38% of their total production for this same time.

d Fertilizer Nutritional Foliar and Sure-K tons/Acre compared to the conventional

Conventional fertilizers were applied according to published guidelines from Michigan State University's Nutrient Recommendations for Vegetable Crops in Michigan. Ext Bulletin E2934, 2004

fertilizer program utilized in this trial. Because the pepper size was similar for these two treatments, the yield increase occurred due to greater fruit set with the foliar fertilizer applications. The two year average for this Agro-culture Liquid Fertilizer was a yield increase of nearly 1.4 tons /Acre. Despite any statistically difference, these treatment differences have been consistently in favor of this fertility program.

Table BP2. Yield and average size of bell peppers produced over eight harvests during 2006.

Treatment		Harvest 1	Harvest 2	Harvest 3	Harvests 4-8 (cumulative)	Total Yield*	Avg. Wt* (oz./pepper)
		Yield (tons / Acre)					
1	Plant/SD	3.98	2.58	1.81	14.0	22.4 ab	6.2 bc
2	Plant/SD/Foliar	4.47	3.15	2.77	17.1	27.5 b	5.6 bc
3	Plant/SD/Foliar & PTS	4.46	3.64	2.24	11.9	22.2 ab	5.4 ab
4	Plant/SD/Exp Foliar #1	4.43	2.98	2.31	16.1	25.8 ab	6.9 c
5	Conventional Program	3.46	3.61	3.06	16.1	26.2 ab	5.7 bc
6	Untreated Control	3.42	1.84	3.34	11.2	19.8 a	5.3 a

* Treatments with the same letter are statistically similar according to Duncan's Multiple Range Test (P<0.20)

Table BP3. Effect of Fertility Program on yield distribution by harvest for peppers.

Treatment		Harvest 1	Harvest 2	Harvest 3	Harvests 4-8 (total)
		Percentage of total yield by harvest			
1	Plant/SD	17.8%	11.5%	8.1%	62.5%
2	Plant/SD/Foliar	16.3%	11.5%	10.1%	62.2%
3	Plant/SD/Foliar & PTS	20.1%	16.4%	10.1%	53.6%
4	Plant/SD/Exp Foliar #1	17.2%	11.6%	9.0%	62.4%
5	Conventional Program	13.2%	13.8%	11.7%	61.5%
6	Untreated Control	17.3%	9.3%	16.9%	56.6%

Conclusions:

The addition of foliar fertilizers to the basic liquid fertility program promoted yield and size of the treated peppers. Additionally, the foliar fertilizers promoted maturity and therefore, yields from the earliest harvests were increased.

Experiment: Three-Year Summary - Fertility Programs on Bell Peppers
Year: 2004 (04-33); 2005 (05-33); 2006 (06-203)
Date of Planting/Harvest: transplant 5-12-04/ 7-04 thru 9-04
transplant 5-9-05 / 7-05 thru 9-05
transplant 5-23-06 / 7-06 thru 9-06
Plot Size: 5 ft. x 5 ft.

2004

Soil Test Levels (ppm)	
pH ~ 6.4	P1 ~ 52
CEC ~ 5	K ~ 121
OM ~ 1.5%	(6.2% K)

2005 & 2006

Soil Test Levels (ppm)	
pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

These trials were established to compare various Agro-culture Liquid Fertilizer fertility programs with conventional dry fertilizer program on the yield and quality of bell peppers.

Table BP1. Bell Pepper Fertility programs for 2004, 2005 & 2006.

	Treatment	2004 Rate/A	2005 & 2006 Rate/A	Method of Application
1	High NRG-N Pro-Germ + Sure-K + Micro 500	7+ 6 + 7 + 2 qt	0 + 2 + 7 + 2qt	Band
	High NRG-N	6 + 6	18	Sidedress
2	Pro-Germ + Sure-K + Micro 500	7+ 6 + 7 + 2 qt	2 + 7 + 2 qt	Band
	High NRG-N	6 + 6	18	Sidedress
	Sure-K + Nutr. Foliar	2 + 1	2 + 1	Weekly
3	Pro-Germ + Sure-K + Micro 500	7+ 6 + 7 + 2 qt	2 + 7 + 2 qt	Band
	High NRG-N	6 + 6	18	Sidedress
	Sure-K + Nutr. Foliar + PTS	2 + 1 + 2oz	2 + 1 + 2 oz	Weekly
4	Pro-Germ + Sure-K + Micro 500	NA	2 + 7 + 2 qt	Band
	High NRG-N		18	Sidedress
	Experimental Foliar #1		3	Weekly
5	0-0-60	235	140#	Broadcast
	18-46-0	290	50#	Broadcast
	28% UAN	9 + 9	30	Sidedress
6	Untreated Control	(none)	none	

In the fall of 2004 Michigan State University developed a new Vegetable Crop Fertility Guide. Bell Peppers were one of the many crops were noticeable changes in nutrient recommendations were made. For all growing seasons, a complete Agro-Culture Liquid Fertilizers program was compared to an equal conventional fertility program. Although these programs are different between 2004 and the two other years, comparisons between years are the same. (Fertility Programs listed above)

- Band fertilizer applications were made after transplanting in a band next to the row. Sidedress nitrogen was applied on in mid-June in a band along the side of the plants. All plots were irrigated as needed, see irrigation logs for specific details.
- Dry fertilizer was broadcast and lightly incorporated prior to transplanting.
- Foliar applications were made every 7-10 days, with a pressurized backpack sprayer. A total spray volume of 15 gal/A was used.
- Harvest was completed by hand from mid-July thru late September most years. Mature peppers were hand harvested, counted and weighed to calculate yield.

Fertilizer Effects on Bell Pepper Production and Quality. North Central Research Station 2004-2006								
	Total Yield (tons/Acre)				Pepper Size (oz/pepper)			
Fertility Program	2004	2005	2006	Avg. Yield	2004	2005	2006	Avg. Size
ACLF	13.1	14.6	22.4	16.7	6.6	6.1	6.2	6.3
ACLF & Foliar	13.0	16.6	27.5	19.0	6.4	6.6	5.6	6.2
Conventional Fertility	12.2	14.2	22.3	16.2	6.2	6.3	5.7	6.1
LSD* (P≤ 0.20)	4.3	3.7	0.7		0.61	0.46	1.6	

*LSD is specific to individual yield criteria by year (within column) of evaluation only.

Results:

- All Agro-Culture Liquid Fertilizer programs increased bell peppers yields over Conventional Fertilizer Program.
- There was no significant difference in bell pepper size when averaged over three years. Since peppers were hand harvested based on size, this was expected.
- Agro-Culture Liquid Fertilizer programs produced higher pepper yields than the conventional fertilizer program.
- Highest yield was achieved with the Agro-Culture Liquid Fertilizers program with the addition of foliar applications during harvest. By applying additional nutrition during the harvest season when there is a high demand of fruit production, productivity was greatly increased producing greater fruit set better quality bell peppers.
- Although soil test values varied for one year to the next, changing the fertilizer program to meet the soils needs proved to be efficient as yields were similar for both years.

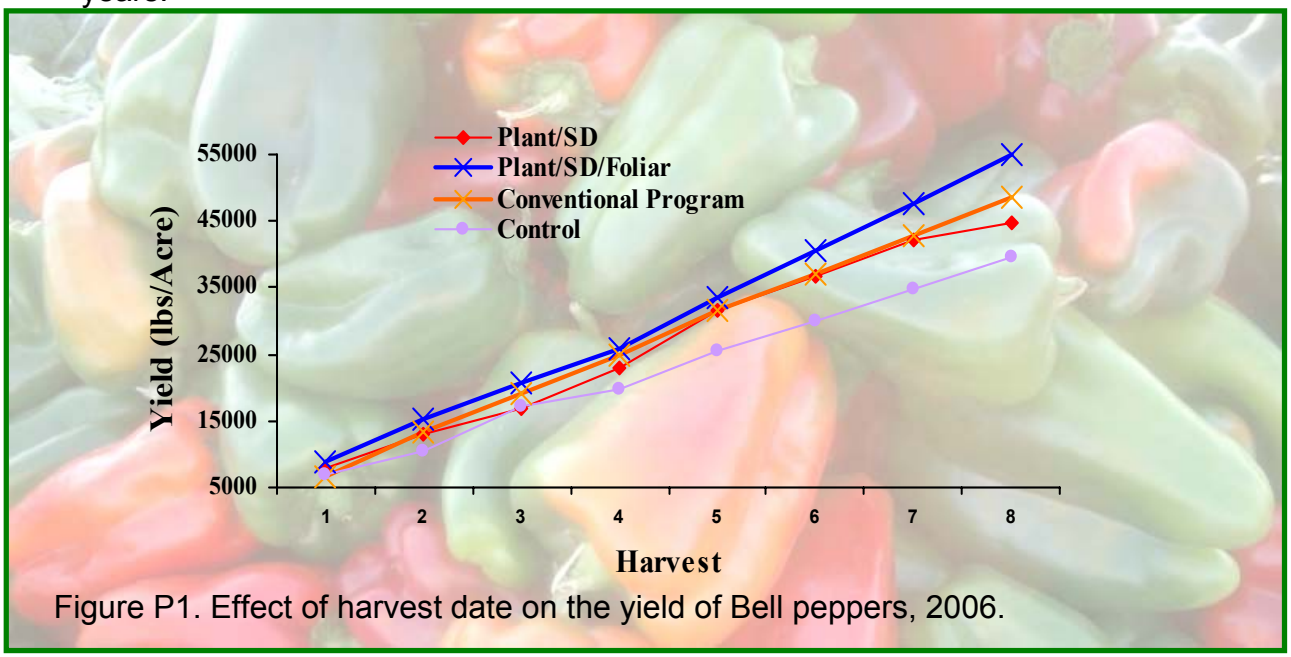


Figure P1. Effect of harvest date on the yield of Bell peppers, 2006.

Conclusions:

Foliar fertilizers added to the total yields observed by promoting pepper set and size on the treated plants. Yields were established and maintained at higher levels when foliar fertilizers were used.

Experiment: Watermelons
Year (Experiment Number): 2006 (06-204)
Date of Planting/Harvest: May 24 / Aug & Sept
Hybrid: Crimson Sweet
Plot Size (replications): 15' x 5', 3 Reps

Soil Test Levels (ppm)	
pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

The objective for this trials was to compare various Agro-Culture Liquid Fertilizer programs that were developed to promote early yield of watermelon as well as maximize total season production. Comparison with a conventional fertilizer program was also made.

US Watermelon acreage was just over 150 K acres in 2006. The July 4th holiday weekend is the single largest market opportunity for watermelons. Planting for this date and producing a higher percentage of the marketable melons at the earliest harvests will typically offer the greatest value per acre to the producers. However, watermelons are consumed almost all summer long and staggered plantings and/or multiple harvests are commonly used to extend growers watermelon production capacity and profitability. Maintaining an established crop is much less expensive than establishing a new one. Still, high quality melons must be continuously produced for each successive harvest to justify maintaining a field and to offset harvest costs. Therefore, The use of foliar fertilizer programs to promote maturity and sustain high quantities of marketable quality melons were evaluated.

- "Crimson Sweet" watermelons were transplanted into the research plots on May 24, 2006. Each plot was 15' x 5' and consisted of five plants (36" between plants).
- The entire plot area received the equivalent of 20 tons/Acre of dairy manure prior to being plowed to a depth of 6" during fall tillage. In the spring, a tractor mounted rotor-tiller was used to prepare the plots for planting.
- The Agro-Culture Liquid Fertilizer products were banded by a custom built application cart with a fertilizer knife that placed them two inches below and two inches to the side of the plants just after transplanting. The same applicator was used for side dressing additional nitrogen on June 13th. However, the vines were just starting to run, so the application was made about 6-8" to the side of the planted row.

Table W1. Watermelon Fertility Programs and application methods for 2006.

	Treatment	Rate/A (gal.)	Method of Application
1	High NRG-N + Pro-Germ + Sure-K + Micro 500	2 + 2 + 11 + 2 qt	Band at planting
	High NRG-N	18	Sidedress
2	High NRG-N + Pro-Germ + Sure-K + Micro 500	2 + 2 + 11 + 2 qt	Band at planting
	High NRG-N	18	Sidedress
	Sure-K + Nutritional Foliar	1 + 2	Weekly foliar
3	High NRG-N + Pro-Germ + Sure-K + Micro 500	2 + 2 + 11 + 2 qt	Band at planting
	High NRG-N	18	Sidedress
	Sure-K + Nutritional Foliar + PTS	1 + 2 + 2 oz	Weekly foliar
4	High NRG-N + Pro-Germ + Sure-K + Micro 500	2 + 2 + 11 + 2 qt	band at planting
	High NRG-N	18	Sidedress
	Experimental Foliar #1	3	Weekly Foliar
5	0-0-60	230#	Broadcast
	18-46-0	50#	Broadcast
	28% UAN	30	Sidedress

- Dry fertilizer was broadcast and incorporated prior to trans-planting as show.
- The foliar applications utilized for this trial were started with initial fruit set on July 7th Treatments were reapplied every 7-10 days, until September 5th when the last application was applied. A total of eight applications for each foliar treatment were made during the growing season. All foliar applications were made with a backpack sprayer and hand boom equipped with flat fan nozzles. These fertilizer mixtures were diluted with water and applied at a total volume of 15 gallons per acre. Fungicides and insecticides were applied separately, but in a similar manner as needed through out the season.
- PTS in treatment #3 is Protriastim, a protein cell carrier with a tri-alcohol growth stimulant that boosts the crops ability to store energy for the photosynthetic process.
- Watermelons were harvested on a regular basis beginning on August 3rd and continued until Sept 28th. Each mature melon was harvested by hand and weighted individually at maturity. Each melon was deemed mature when the tendril on the vine nearest the melon turned brown.

RESULTS:

- Watermelon yield for all Agro-Culture Liquid Fertilizer treatments were numerically greater than the Conventional fertilizer program. (Table W2)
- The addition of Sure-K and Nutritional Foliar (trt. 2) resulted in melons that averaged 2.0 lb. (14%) heavier than the standard Agro-Culture Liquid Fertilizer program (trt.1) on average. Still, the average size of the melons harvested was statistically similar for all treatments.
- There was also a noticeable difference in the maturity or earliness of some treatments. The use of the Agro-Culture Liquid Fertilizer products (trt 1-3) resulted in over 31% of the total yield occurred at the first of six harvests compared to only 21.1% for dry fertility treatment (Table W3).

Table W2. Effect of Fertility programs on individual harvests, total watermelon yield and average watermelon size from 2006 trial.

Treatment		Harvest 1	Harvest 2	Harvest 3	Harvests 4-6 (total)	Total Yield	Avg. Wt (lb./melon)
		Yield (tons / Acre)					
1	Plant/SD	11.0	9.8	3.3	10.1	34.1	13.9
2	Plant/SD/Foliar	10.7	6.4	3.0	12.3	32.4	15.9
3	Plant/SD/Foliar & PTS	8.5	6.8	5.5	15.6	27.7	13.0
4	Plant/SD/Exp Foliar #1	8.8	6.7	5.7	13.7	34.8	15.6
5	Conventional Program	5.8	11.0	2.9	7.6	27.4	14.9

Table W3. Effect of Fertility Program on yield distribution by harvest for watermelons.

Treatment		Harvest 1	Harvest 2	Harvest 3	Harvests 4-6 (total)
		Percentage of total yield by harvest			
1	Plant/SD	32.3%	28.7%	9.5%	29.5%
2	Plant/SD/Foliar	33.1%	19.8%	9.2%	37.9%
3	Plant/SD/Foliar & PTS	30.7%	24.6%	19.9%	24.8%
4	Plant/SD/Exp Foliar #1	25.2%	19.2%	16.3%	39.4%
5	Conventional Program	21.1%	40.3%	10.7%	27.9%

Conventional fertilizers were applied according to published guidelines from Michigan State University's Nutrient Recommendations for Vegetable Crops in Michigan. Ext Bulletin E2934, 2004

Conclusions:

Agro-Culture Liquid Fertilizer programs that were utilized in this trial promoted total yields and resulted in higher yields in the initial harvest compare to the conventional fertilizer program. This was most obvious for programs which incorporated foliar fertilizer applications.

Experiment: Two year Summary – Watermelon Fertility Trials
Year: 2005 (05-34) and 2006 (06-204)
Date of Planting/Harvest: transplant 5-24-05 / 8-17 thru 9-15
5-23-06 / 8-13 thru 9-9
Plot Size: 5 ft. x 15 ft.

Soil Test Levels (ppm)	
pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

The objective of these trials was to use foliar fertilizer programs to promote maturity and sustain high quantities of marketable quality watermelons were evaluated. Comparison with a conventional fertilizer program was also made.

Last year at the North Central Research Station "Jubilee" an oblong melon typically weighing around 20 pounds each was used. However, "Crimson Sweet" watermelons were used in 2006. This variety is was more of a round or basketball shaped melon. When looking at local production along with past research please note that comparisons between years/variety yields can not be made; however, differences between treatments should be relative to one another.

- Watermelon harvest was completed by hand beginning in mid to late July and continued through mid-September. Each melon was weighed and counted to calculate harvestable yield.
- Dry fertilizer was broadcast and incorporated prior to planting. Agro-Culture Liquid Fertilizers was placed in a band two inches to the side and two inches below transplant placement. Sidedress applications were applied about one month after planting in a band two inches deep and to the side of the row as the melons were just beginning vine run.

Table W1. Watermelon Fertility Programs and application methods for 2006.

	Treatment	Rate/A (gal.)	Method of Application
1	High NRG-N + Pro-Germ + Sure-K + Micro 500	2 + 2 + 11 + 2 qt	Band at planting
	High NRG-N	18	Sidedress
2	High NRG-N + Pro-Germ + Sure-K + Micro 500	2 + 2 + 11 + 2 qt	Band at planting
	High NRG-N	18	Sidedress
	Sure-K + Nutritional Foliar	1 + 2	Weekly foliar
5	0-0-60	230#	Broadcast
	18-46-0	50#	Broadcast
	28% UAN	30	Sidedress

As with many other crops, variety plays a huge roll in overall yield capability this very important to remember, especially when working with watermelons. Each variety produces different size and shaped melons. Location also plays a roll in melon production. Most watermelons grown in the northern part of the country are smaller shaped melons which produce lower yields than those grown in southern states.

RESULTS:

- Fertilizer programs comparing Agro-Culture Liquid Fertilizers to a conventional dry

Effects of Fertilizer Program on Watermelon Yields

North Central Research Station 2005-2006

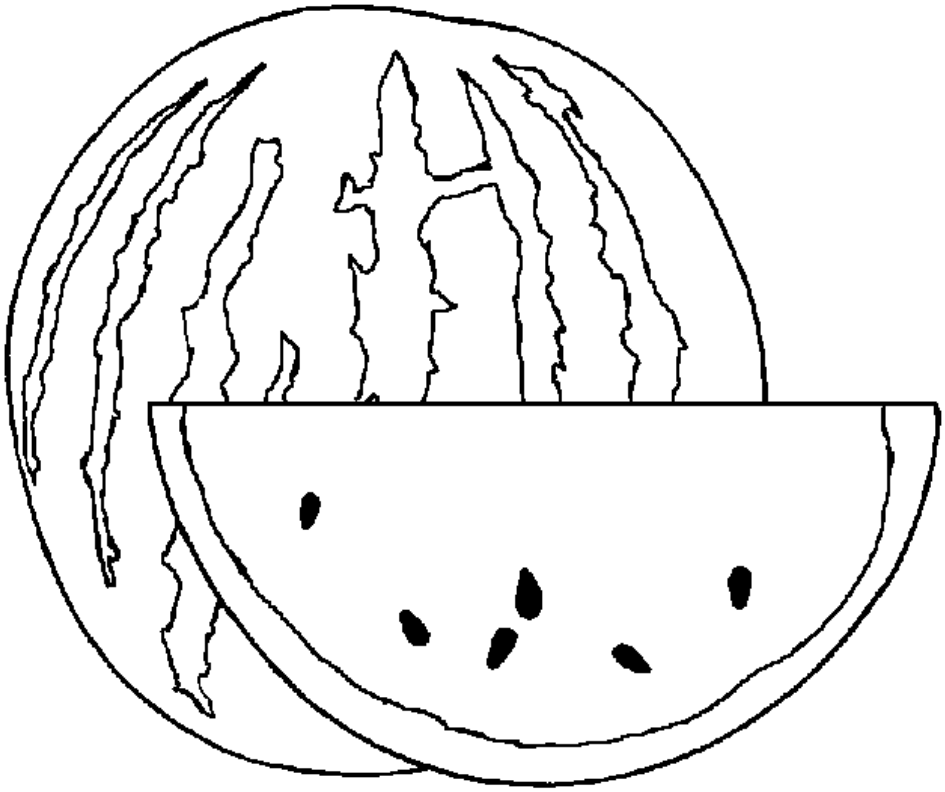
	Melons (number/Acre)			Melon Size (lb/fruit)			Total Yield (tons/Acre)		
Fertility Program	**2005**	**2006**	**Avg. No.**	**2005**	**2006**	**Avg. Size**	**2005**	**2006**	**Avg. Yld.**
ACLF	4259	4453	4356	22.5	15.3	18.9	47.8	34.1	41.0
ACLF & Foliar	5614	4066	4840	24.7	15.9	20.3	68.2	32.4	50.3
Conventional Fertility	4453	3678	4066	22.0	14.9	18.5	49.0	27.4	38.2
LSD (P=0.20)	1925	1512		2.5	2.3		22.3	14.8	

program were evaluated. ACLF fertilizer programs increased production, weight, and melon size compared to the convention fertility program. Melon counts, melon size and total yield were lowest with the conventional fertilizer program.

- A foliar program of 2 gal/A Sure-K + 1 gal/A Nutritional Foliar applied regularly (every 7-10 days) with a pressurized backpack sprayer made in addition to the complete Agro-Culture Liquid Fertilizer Program at transplant and sidedress had the largest melons and greatest yield produced of any fertility program evaluated. The average Watermelon yield was increased by over 10 and 12 tons/A per acre compared to the convention fertility program.

Conclusions:

Regular foliar applications ACLF fertilizers showed very positive results, greatly increasing watermelon size and overall yields both years of these trials at the North Central Research Station.



Experiment: Pumpkins
Year (Experiment Number): 2006 (06-205)
Date of Planting/Harvest:
Hybrid: "Magic Lantern
Plot Size (replications): 15' x 10', 3 reps

Soil Test Levels (ppm)	
pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

The primary objective for this trial was to support the best treatments for pumpkin yields from prior trials.

Pumpkins now come in many different shapes, sizes and even colors. This market has shown a steady increase in volume over the last several years. The USDA vegetable survey shows commercial growers planted nearly 50,000 acres of pumpkins that resulted in a record 1.09 billion pounds of pumpkin with a value of more than $105 million dollars in 2005. While quantity of pumpkins is important to crop value, the quality of pumpkins produced can also impact the profitability and long-term marketing relationships for pumpkin growers. The treatments selected compared two basic Agro-Culture Liquid Fertilizer programs. One with only soil applications and the other had soil applications plus foliar fertility. Additionally a conventional fertilizer program was included for comparison of pumpkin yields and quality.

- "Magic Lantern" pumpkins, a variety with very good disease resistance ratings, were planted into the research plots on June 2nd, 2006. Each plot was 15' x 10' and consisted of five hills that were thinned to one plant per hill (36" between plants) at two weeks after initial emergence.
- The entire plot area received the equivalent of 20 tons/Acre of dairy manure prior to being plowed to a depth of 6" during fall tillage. In the spring, a tractor mounted rotor-tiller was used to prepare the plots for planting.
- The Agro-Culture Liquid Fertilizer products were banded by a custom built application cart with a fertilizer knife that placed them two inches below the planted row immediately prior to planting. The same applicator was used for side dressing additional nitrogen on June 20th. However, the application was made about 6-8" to the side of the planted row as the vines beginning to run.
- Dry fertilizer was broadcast across selected plots and incorporated prior to planting.
- The foliar applications utilized for this trial were started with initial fruit set on July 19th Treatments were reapplied every 7-10 days until September 5th when the last application was made. A total of six foliar applications were made during the growing season. All applications were made with a backpack sprayer and hand boom equipped with flat fan nozzles. These fertilizer mixtures were diluted with

Conventional fertilizers were applied according to published guidelines from Michigan State University's Nutrient Recommendations for Vegetable Crops in Michigan. Ext Bulletin E2934, 2004

water and applied at a total volume of 15 gallons per acre. Fungicides and insecticides were applied in a similar manner as needed through out the season.

- PTS in treatment #2 is Protriastim, a protein cell carrier with a tri-alcohol growth stimulant that boosts a crops ability to store energy for the photosynthetic process.
- Pumpkins were harvested on Sept 30th. All pumpkins were collected, weighted and graded for maturity. Any pumpkins with over 25% green flesh were classified as immature at this time.

Table P1. Fertility Treatment Programs for Pumpkins, 2006.

#	Treatment	Rate/ Acre (gal)	Method of Application
1	High NRG-N + Pro-Germ + Sure-K + Micro 500 High NRG-N	2 + 2.5 + 15 + 2 qt 14	2" x 2" sidedress
2	High NRG-N + Pro-Germ + Sure-K + Micro 500 High NRG-N Sure-K + Nutr. Fol. + PTS	2 + 2.5 + 15 + 2 qt 14 2 + 1 + 2 oz	2" x 2" sidedress weekly foliar
3	0-0-60 18-46-0 28% UAN	340# 65# 24	broadcast broadcast sidedress

RESULTS:

- Pumpkin yield for both ACLF treatments were numerically greater than the dry fertilizer program. (Table P1)
- The addition of foliar fertilizers (trt. 2) resulted in pumpkins that weighted more (1.3 lb. or 8.1% heavier) than the standard Agro-Culture Liquid Fertilizer program (trt.1) on average. Still, the average size of the pumpkin harvested was statistically similar for all treatments.
- The percentage of green pumpkins in the foliar treatment was higher than the other treatments. Because these plants received additional nutrients, they continued to bloom and set new pumpkins after the other treatments. Had the growing season been extended by planting earlier or delaying harvest, higher marketable yields for this treatment could have been realized.
- Pumpkin yield for the conventional dry fertility program was statistically less than the foliar treatments at the 25% level of significance.

Conclusions: There was a noticeable increase in number of marketable pumpkins associated with the use of the foliar fertilizer applications. This increase in pumpkin set along with a slightly heavier pumpkin resulted in a substantial yield increase, over 12 tons per acre (48%) increase compared to the conventional fertilizer program. Marketable yields were increased by 9.3 tons per acre.

Table P2. Pumpkin yield and size information, 2006.

Treatment		lbs./plot	Total Tons/Acre	Marketable Tons/Acre	Avg. Wt (lb./pumpkin)	Green %
1	Plant/SD	118.3	27.4 a	26.0 a	15.1	5.1
2	Plant/SD/Foliar	266.7	38.7 b	33.7 b	16.5	13.1
3	Conventional Program	180.0	26.1 a	24.3 a	15.9	7.0

* Treatments with the same letter are statistically similar according to Duncan's Multiple Range Test (P<0.20)

Experiment: Two year Summary - Pumpkin Fertility Programs
Yield: 2005 & 2006 (05-35, 06-205)
Date of Planting/Harvest: 6-02-05 / 9-20-05
6-15-06 / 9-30-06
Plot Size: 10 ft. x 15 ft.

Soil Test Levels (ppm)	
pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

The primary objective for this trial was to support the best treatments for pumpkin yields from prior trials.

- Dry fertilizer was broadcast and incorporated prior to planting. Agro-Culture Liquid Fertilizers was placed in a band two inches to the side and two inches below transplant placement. Sidedress applications were applied in a band along the side of the row about one month after planting and were made at vine run.
- Harvest was done by hand in late September, pumpkins were counted and weighed to calculate yield.

#	Treatment	Rate/ Acre (gal)	Method of Application
1	High NRG-N + Pro-Germ + Sure-K + Micro 500 High NRG-N	2 + 2.5 + 15 + 2 qt 14	2" x 2" sidedress
2	High NRG-N + Pro-Germ + Sure-K + Micro 500 High NRG-N Sure-K + Nutr. Fol. + PTS	2 + 2.5 + 15 + 2 qt 14 2 + 1 + 2 oz	2" x 2" sidedress weekly foliar
3	0-0-60 18-46-0 28% UAN	340# 65# 24	broadcast broadcast sidedress

RESULTS:

- Both ACLF fertilizer programs increased pumpkin yield over the conventional fertilizer program.
- Highest yield was achieved with the Agro-Culture Liquid Fertilizers Foliar program, increasing production by nearly 14 tons/acre over the conventional program.
- The foliar applications showed the greatest impact on pumpkin set, producing significantly more pumpkins per plot both years. Foliar applications also increased the average pumpkin size by about one-pound. Therefore, higher set did not reduce pumpkin size with this fertility program.
- The percent unmarketable fruit was typically lower with the basic Agro-Culture Liquid Fertilizer program compared to the conventional program (data not show). The addition of foliar fertilizer dramatically increased marketable yields, but several immature pumpkins were produced. Extending the growing season should minimize this effect.

Effects of Fertilizer Program on Pumpkin Yields

North Central Research Station 2005-2006

	Pumpkins (number/Acre)			Pumpkin Size (lb/fruit)			Total Yield (tons/Acre)		
Fertility Program	**2005**	**2006**	**Avg. No.**	**2005**	**2006**	**Avg. Size**	**2005**	**2006**	**Avg. Yld.**
ACLF	3630	3582	3606	16.9	15.3	16.0	30.6	27.3	29.0
ACLF & Foliar	4937	4646	4792	18.4	16.7	18.0	44.7	38.7	41.7
Conventional Fertility	3388	3386	3387	17.7	15.4	17.0	30.1	26.1	28.1

Conclusions:

Pumpkins responded very well to foliar fertilizer applications. Total yields and pumpkins size were both promoted during both years of evaluation.

Experiment: Pickles
Year (Experiment Number): 2006 (06-206)
Date of Planting/Harvest: May 24 / July 7
Hybrid: Eureka
Plot Size (replications): 2.5' x 15', 4 reps

Soil Test Levels (ppm)	
pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

This trial was established to compare various Agro-Culture Liquid Fertility programs with conventional fertilizers for promoting yields and quality of pickling cucumbers.

In 2005, Michigan produced 38,500 of the 166,600 acres of pickles planted that year in the United States (USDA 2005 Vegetable Summary). This crop matures rather quickly compared to many other vegetables. However, like many other vegetables the quality of yield is almost as important as the quantity of yield. Foliar fertilizer treatments were evaluated as they can benefit this crop, but the short growing season requires alert monitoring for the correct application timing(s) and to capture this value at harvest.

- "Eureka" variety pickles were planted into the research plots on May 24th, 2006. Each plot was 2.5' x 15' and planted with approximately 2" spacing between seeds.
- The entire plot area received the equivalent of 20 tons/Acre of dairy manure prior to being plowed to a depth of 6" during fall tillage. In the spring, a tractor mounted rotor-tiller was used to prepare the plots for planting.
- The Agro-Culture Liquid Fertilizer products were banded by a custom built application cart with a fertilizer knife that placed them two inches below the planted row immediately prior to planting. The same applicator was used for side dressing additional nitrogen just to the side of each row on June 13th.
- Dry fertilizer was broadcast and incorporated prior to planting.
- PTS in treatment #5 is Protriastim, a protein cell carrier with a tri-alcohol growth stimulant that boosts plants ability to store energy for the photosynthetic process.
- The foliar applications utilized for this trial were started with initial fruit set on June 28th. A second application was made on July 7th.
- Pickles were hand harvested and grading according to USDA tandards on July 11th. The harvest was based on pickle maturity in the conventional fertilizer plot.

RESULTS:

- Pickles in the Agro-Culture Liquid Fertilizer plots were more mature than the conventional fertilizer plots as evidenced by the high percentage of oversized cucumbers harvested from these plots. Commercially, these pickles should have been harvested sooner, but relative differences are still valid.
- The total yield for the various Agro-Culture Liquid Fertilizer treatments was over 3.0 tons/Acre greater than the conventional fertilizer treatments (trt. 6).
- Substitution of Sure-K for dry potash (0-0-60) and the addition of Micro 500 as a side dress application (trt. 5) to the conventional dry fertility program dramatically increased the pickle yields compared to the total dry fertility program (trt. 6) in the medium and oversized grade categories. Therefore, amending the standard fertility program with Agro-Culture Liquid Fertilizer products can have a dramatic impact on pickle yields.

Conventional fertilizers were applied according to published guidelines from Michigan State University's Nutrient Recommendations for Vegetable Crops in Michigan. Ext Bulletin E2934, 2004

- The use of Sure-K and Nutritional Foliar or Experimental Foliar #2 increased the medium grade and reduced the yield of large grade pickles compared to the Agro-Culture Liquid Fertilizer soil only applications. Yield results for the foliar treatment that included PTS were similar, but the yield in the large grade category was also increased. Therefore, these foliar treatments promoted additional flowering, fruit set and maturity on the treated vines.

Table P1. Fertility programs for promoting yield and quality of pickling cucumbers, 2006.

Treatment		Rate/A (gal.)	Application
1	High NRG-N + Pro-Germ + Sure-K + Micro 500 High NRG-N	2 + 2 + 5 + 2 qt 10	2 x 2 band Sidedress
2	High NRG-N + Pro-Germ + Sure-K + Micro 500 High NRG-N Sure-K + Nutritional Foliar	2 + 2 + 5 + 2 qt 10 1 + 2	2 x 2 band Sidedress weekly foliar
3	High NRG-N + Pro-Germ + Sure-K + Micro 500 High NRG-N Sure-K + Nutritional Foliar + PTS	2 + 2 + 5 + 2 qt 10 1 + 2 + 2 oz	2 x 2 band Sidedress weekly foliar
4	High NRG-N + Pro-Germ + Sure-K + Micro 500 High NRG-N Experimental Foliar #2	2 + 2 + 5 + 2 qt 10 3	2 x 2 band sidedress weekly foliar
5	18-46-0 Sure-K + Micro 500 28% UAN	50# 5 + 2 qt 16	broadcast 2 x 2 band sidedress
6	0-0-60 18-46-0 28% UAN	160# 50# 16	broadcast broadcast sidedress

Table P2. Yield and average size of pickles produced during 2006.

Treatment		Small	Medium	Large	Oversize	Total Yield*
		Yield (tons / Acre)				
1	At Plant & Sidedress only	0.33	4.00	2.67	2.96	9.96 ab
2	At Plant, Sidedress, Sure-K+ Nut. Foliar	0.30	4.95	1.46	2.39	9.11 ab
3	At Plant, Sidedress, Sure-K+ Nut. Foliar w/ PTS	0.56	4.06	3.12	2.62	10.36 qb
4	At Plant, Sidedress, Exp Foliar #2	0.31	6.24	2.47	2.82	11.84 b
5	18-46-0@planting, Sure-K & Micro Sidedress w/ 28%	0.32	5.28	1.63	2.91	10.15 ab
6	Dry @ planting & 28% Sidedress	0.35	4.22	1.74	2.29	8.60 a

* Treatments with the same letter are statistically similar according to Duncan's Multiple Range Test (P<0.15)

Conclusions:

PTS and Experimental foliar #2 each offer the producer an opportunity to capture greater pickle yields. Because these products promote maturity their use must be combined with proper monitoring to capture the greatest value at harvest.

Experiment: Two year Summary - Pickling Cucumber Fertility
Year: 2005 & 2006 (05-38, 06-206)
Date of Planting/Harvest: June 2 / July 22, 2005
May 24/ July 10, 2006
Plot Size: 2.5 ft. x 15 ft.

Soil Test Levels (ppm)	
pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

This trial was established to compare various Agro-Culture Liquid Fertility programs with conventional fertilizers for promoting yields and quality of pickling cucumbers.

- Pickling cucumbers standards are used for determining the quality of cucumbers that are used for pickling. Cucumbers should show characteristic color and which are fairly well formed, fresh and firm, but not full grown or ripe; which are free from decay and from damage caused by dirt, freezing, sunburn, mosaic or other disease, insects, or mechanical or other means. (Taken from: United States Standards for Grades of Pickling Cucumbers). Cucumbers that meet the above quality standards are than sorted into grades by size. US#1 are the highest graded cucumbers followed by US#2 and US#3. The cull cucumbers are those that are oversized and or do not fit the quality standards. The grades are listed below.
- Dry fertilizer was broadcast incorporated prior to planting. Agro-Culture Liquid Fertilizers was placed in a band two inches to the side and two inches below transplant placement. Sidedress applications were applied in a band along the side of each row as appropriate.

	Treatment	**Rate/A (gal.)**	**Application**
1	High NRG-N + Pro-Germ + Sure-K + Micro 500 High NRG-N	2 + 2 + 5 + 2 qt 10	2 x 2 band Sidedress
2	High NRG-N + Pro-Germ + Sure-K + Micro 500 High NRG-N Sure-K + Nutritional Foliar	2 + 2 + 5 + 2 qt 10 1 + 2	2 x 2 band Sidedress weekly foliar
3	High NRG-N + Pro-Germ + Sure-K + Micro 500 High NRG-N Sure-K + Nutritional Foliar + PTS	2 + 2 + 5 + 2 qt 10 1 + 2 + 2 oz	2 x 2 band Sidedress weekly foliar
4	18-46-0 Sure-K + Micro 500 28% UAN	50# 5 + 2 qt 16	broadcast 2 x 2 band sidedress
5	0-0-60 18-46-0 28% UAN	160# 50# 16	broadcast broadcast sidedress

- A single harvest was done for determination of yield.
- Harvest date was determined by the average size of cucumber in the conventional fertilizer plots. However, after harvest was complete it was decided that the harvest date should have been earlier or possibly later as the number of US#1 cucumbers was very low and the oversized culls was too high. Harvesting sooner or slightly later due to very active bloom may have favorably changed the ratio of pickle grades. This trend was uniform amongst all treatments and both years for these treatments.
- Cucumber grades are determined by size, shape, and quality. Factors influencing quality included color, sunscald, scars, sunburn, cuts, bruises, and damage from

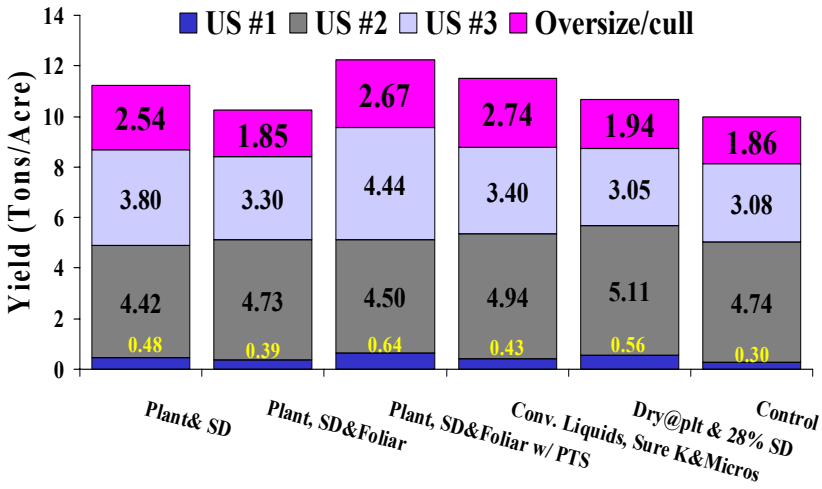
disease and/or insects. After sorting, each grade was counted and weighed to calculate yield.

RESULTS:

- All fertilizer programs out yielded the no fertilizer check at each of the cucumber grades.
- Highest yield was achieved with the Agro-Culture Liquid Fertilizers program with the addition of the foliar application with PTS. PTS (Protriastim) is a protein cell carrier with a tri-alcohol growth stimulant that boosts the crops ability to store energy for the photosynthetic process. This program out-yielded the check by an average of 2.3 ton/A, the conventional by 1.6 ton/A, and the Agro-Culture Liquid Fertilizers program without the foliar application by 1 ton /Acre.
- Applying Sure-K with the conventional program in place of the potash, increased overall average yield by 0.7 tons/A vs. conventional fertilizer.

Pickle Harvest

2 year average

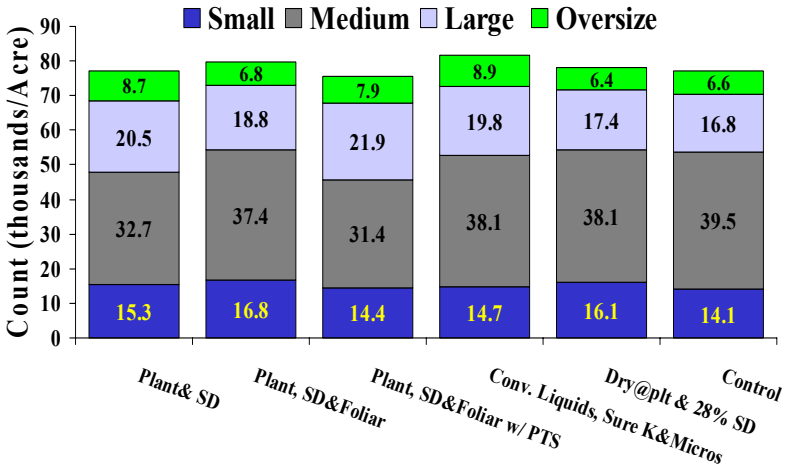


Conclusions:

The use of Sure K as part of a total liquid fertility program or combined with conventional dry fertilizers offered a great benefit to pickle yields consistently over the two years this trial was conducted.

Pickle Counts by Size

2 year average



Experiment: Onions
Year (Experiment Number): 2006 (06-207)
Date of Planting/Harvest: Apr 19 / Sept 10
Hybrid: Millennium
Plot Size (replications): 10' x 2.5', 4 reps

Soil Test Levels (ppm)	
pH ~ 7.3	P1 ~ 61
CEC ~ 6.3	K ~ 87
OM ~ 1.8%	(3.5% K)

The objective of this trial was to utilize various Agro-Culture Liquid Fertilizer programs to enhance onion size and yields.

Onions are a crop which can be grown from seeds as well as transplanted from onion sets. In both cases, establishment and early season development are important to the yield and quality of the onions produced. Inputs of phosphorus and potassium are commonly made prior to planting and nitrogen is very often applied as split applications during the growing season. Sure-K application timings and the use of eNhance® to stabilize 28% UAN were some of the treatments. Comparisons with conventional dry fertilizer products were also made.

- "Millennium" variety onions were planted into the research plots on April 19, 2006. Each plot was 10' x 2.5' and consisted of two paired rows with a 4" spacing between rows.
- The entire plot area received the equivalent of 20 tons/Acre of dairy manure prior to being plowed to a depth of 6" during fall tillage. In the spring, a tractor mounted rotor-tiller was used to prepare the plots for planting.
- Granular fertilizers for the conventional dry fertilizer treatment were broadcast across selected plots and lightly incorporated into the soil prior to planting. Solutions containing the described Agro-Culture Liquid Fertilizers or the conventional liquid fertilizer treatment were applied using a fertilizer knife that placed the treatments 2" below each row of the plot. Two sidedress fertilizer applications were made. The initial treatment was on June 13th and second on June 20th to the north and south sides of the double row, respectively.
- Stand counts for each plot were taken on June 28th to quantify the relative differences in plant populations and spacing.
- Foliar fertilizer applications were made at bulb swell (~1.25" diameter) on June 28th and then a second application of the same treatments was made on July 7th. All foliar applications were made with a backpack sprayer and hand boom equipped with flat fan nozzles. These fertilizer mixtures were diluted with water and applied at a total volume of 15 gallons per acre. Fungicides and insecticides were applied separately, but in a similar manner as needed through out the season.
- PTS in treatment #5 is Protriastim, a protein cell carrier with a tri-alcohol growth stimulant that boosts the ability to store energy for the photosynthetic process.
- The onions were lifted by hand on September 10, 2006 and the tops were allowed to cure for 10 days prior to harvest. On September 20th the tops were cut by hand,

the onions were collected, sorted according to size, then counted and weighed by size category.

Table O1. Fertility Programs Utilized for Onion Production, 2006.

	Treatment	Rate/A	Method of Application
1	High NRG-N + Pro-Germ + SK + Micro 500 + Mn High NRG-N	5 + 7 + 16 + 1 qt + 1 qt 14 & 14	**Band over row** Side dress #1 & #2
2	High NRG-N + Pro-Germ + SK + Micro 500 + Mn High NRG-N	5 + 7 + 16 + 1 qt + 1 qt 14 & 14	**2" below seed** Side dress #1 & #2
3	High NRG-N + Pro-Germ + SK + Micro 500 + Mn High NRG-N SK	5 + 7 + 10 + 1 qt + 1 qt 14 & 14 3 x 2	2" below seed Side dress #1 & #2 Foliar #1 & #2
4	High NRG-N + Pro-Germ + SK + Micro 500 + Mn High NRG-N SK + PTS	5 + 7 + 10 + 1 qt + 1 qt 14 (3 + 2 oz) x 2	2" below seed Side dress #1 & #2 Foliar #1 & #2
5	High NRG-N + Pro-Germ + SK + Micro 500 + Mn High NRG-N + SK High NRG-N	5 + 7 + 10 + 1 qt + 1 qt 14 + 6 14	2" below seed Side dress #1 Side dress #2
6	eN + Pro-Germ + SK + Micro 500 + Mn 28% + eNhance	6.67 + 7 + 16 + 1 qt + 1 qt 18.76	2" below seed Top Dress #1 & #2
7	Potash 18-46-0 Mn-Sulfate (4# Mn) Urea	350 lbs 200 lbs 15 lbs 150 lbs + 150 lbs.	broadcast 2" below seed 2" below seed Top Dress #1 & #2

RESULTS:

- Onions that received applications of Agro-Culture Liquid Fertilizer products at planting followed by a side dress treatments of High NRG-N and Sure-K (treatment #5) had the highest yield. Additionally, just over one-third of all the onions produced in this treatment were graded as jumbos or larger.
- The onion yields for the fertility programs receiving foliar treatments (trt. 3&4) out-yielded similar treatments where all the fertility was applied early season as pre-plant and sidedress applications (trt. 1 & 2).
- Following planting, soil conditions were very wet and cool and the establishment of the onions in portions of many plots was poor. While onion yields from these small plot trials were highly dependent the plant population and variability in the onion populations reduced the total onion yields for this trial. The observed population differences were not statistically significant for total yield or onion sizing in this trial. Total yields for all treatments were statistically similar.
- The utilization of 28% UAN that was stabilized with eNhance® (Trt. 6) was among the top yielding fertility programs in this trial. The onion sizing and yield shows that sufficient nitrogen was provided to these onions, despite lower fertilizer application rates then the urea that was utilized for the conventional fertility program.
- Fertility programs significantly impacted the percentage of Jumbo and larger onions produced in this trial. Treatments 1, 2, & 4 had significantly fewer Jumbo sized onions than the remaining treatments. While the yield of Jumbo sized onions for the conventional fertility was similar to the three remaining fertility programs (treatments 3, 5, &6) the yield of boiler and medium grade onions was the lowest observed for any individual fertility program. On a percentage basis, the grade distribution for the

Conventional fertilizers were applied according to published guidelines from Michigan State University's Nutrient Recommendations for Vegetable Crops in Michigan. Ext Bulletin E2934, 2004

conventional fertilizer would look good, but because of the lower total yields the actual profitability would be low.

- The addition of Sure-K to the sidedress nitrogen application and the use of eNhance with standard UAN fertilizers both offered enhanced yield and sizing of the onions.

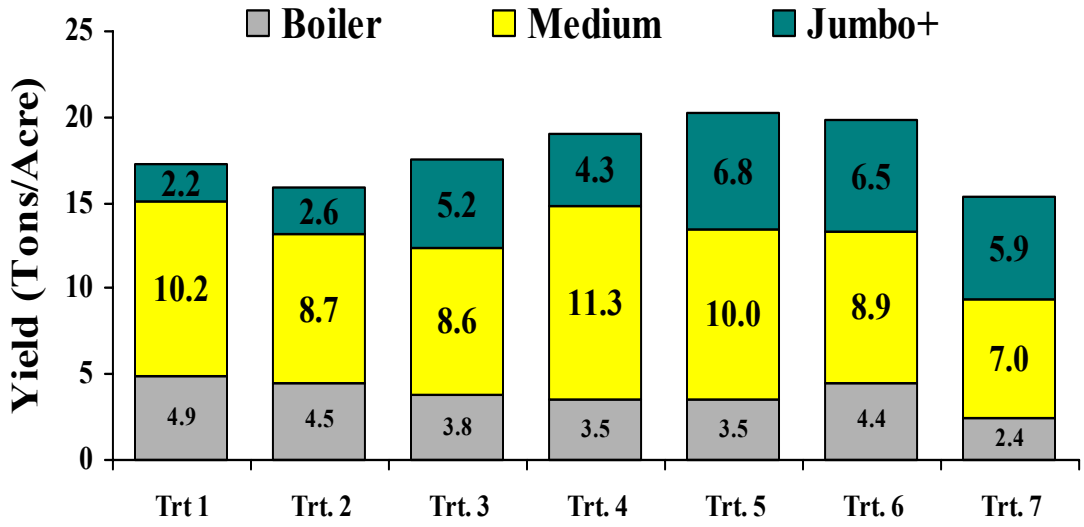


Figure O1. Effect of fertility programs on the yields and size distribution of onions.

Table O2. Onion yield by grade and total for various fertility programs.

Treatment	Boilers	Medium	Jumbo	Total
	Tons Per Acre			
1	4.9	10.2	2.2	17.3
2	4.5	8.7	2.6	15.9
3	3.8	8.6	5.2	17.6
4	3.5	11.3	4.3	19.1
5	3.5	10.0	6.8	20.3
6	4.4	8.9	6.5	19.9
7	2.4	7.0	5.9	15.3

Conclusions:

Onions responded very well to the use of eNhance® with the 28% UAN as a method to stabilize the nitrogen supply through-out the entire growing season. Sure-K applied in the soil performed better than foliar treatments of this product this year.

A Report Regarding the Application of Agro-Culture Liquid Fertilizers to Lemons for the 2005-06 Season[1]

Dr. Glenn C. Wright
Citrus and Date Palm Specialist
University of Arizona

Note: the Citrus Foliar fertilizer used is a combination of Agro-Culture Liquid Fertilizers with an analysis of 4-8-1-0.4Zn-0.4Mn-0.4Fe-0.2B. Also in Figure 2 there is reference of gpa rates of High NRG-NR being applied "per tree", which is incorrect.

Introduction:

Our first experiments with Agro-Culture liquid fertilizers were initiated in 2003 as a response to the question of how the products would affect citrus yield, packout and interior quality when applied to mature lemon trees. As compared with past years, there was a change in emphasis for 2005-06. Beginning with this year, we wanted to determine if foliar applications of Agro-Culture nitrogen products could successfully substitute for conventional N sources commonly used in Arizona citriculture. This report is for the first year of the new experiment, the 2005-06 season.

Methodology:

The new experiment was conducted on lemon (*Citrus limon*) and was laid out on 22 March 2005 at the University of Arizona Yuma Mesa Agriculture Center at Yuma, AZ, in Block 27. This field consisted of 9-year old 'Limoneira 8A Lisbon on *Citrus volkameriana* rootstock. Trees spacing was 25 x 25 feet (70 trees per acre). All trees were 'Limoneira 8A Lisbon' lemon on *Citrus volkameriana* rootstock.

The experiment was a randomized complete block design, with five treatments and six blocks; a total of 90 trees (Figure 1). Each treatment unit consisted of a block of 3 trees. Guard trees surrounded each treatment unit, and separated each from adjacent treatment units.

Treatments for 2005-06 were as follows:

1. No foliar fertilizer + 2.0 lb. N per tree annually applied to the soil.
2. Citrus Foliar @ 3.125 gpa + 2.0 lb. N per tree annually applied to the soil.
3. Citrus Foliar @ 3.125 gpa + 5 gpa High NRG-NR + 1.0 lb. N per tree annually applied to the soil.
4. Citrus Foliar @ 3.125 gpa + 10 gpa High NRG-NR + no additional N applied to the soil.
5. Desert Crops Mix @ 2 qt. /ac + 2.0 lb. N per tree annually applied to the soil.

All nitrogen, except that included in Agro-Culture products, was applied to the soil in the form of urea ammonium nitrate 32-0-0, Nitro-sul 20-0-0-40S, or Ammonium Phosphate 10-34-0. Desert crops mix is manufactured by Monterey Ag Resources (Fresno, CA), and contains 4% S, 2%, Mn, 2% Fe and 4% Zn.

[1] Product was supplied and the cost of this project was defrayed by financial support from *Agro-Culture Liquid Fertilizers,* PO Box 150, St. Johns, MI 48879, (1-800-678-9029). The contributions of Dr. Michael Read, as well as Mr. Marco Peña and Mr. José Arturo Moreno are also appreciated.

Foliar applications

The first foliar application date was 3/30/05. Applications were made with a small airblast sprayer at 80 gpa, with complete coverage to wet. For rates, see above. Three additional foliar applications were made on 4/21, 6/1 (except High NRG applications made subsequently on 6/6), and 6/13. All foliar materials were applied in approximately 100 gpa water volume.

Soil applications

Prior to the commencement of the experiment, all trees received two applications (1/14 and 2/23) of 11 gallons per acre of liquid urea-ammonium-nitrate (32-0-0) (Unocal Agricultural Products, Brea, CA) applied through the flood irrigation waters. Also, all trees received one 11 gallon per acre application of Nitro-Sul (20-0-0-40S) (Tessenderlo Kerley Inc., Phoenix, AZ) on 3-20 applied in the flood irrigation. Additionally, all trees received an additional 11 gallons per acre application of liquid ammonium phosphate (10-34-0) applied in the flood irrigation water on 4/12. Together, these applications totaled 0.87 lb N per tree, 0.63 lbs P_2O_5 per tree and 0.59 lb. S per tree in addition to the amounts of N, P_2O_5 and S noted in Table 1. Therefore, we did not apply additional N to the soil of treatments 3 or 4.

Treatments 1, 2 and 5 received an additional 0.33 lbs/N per tree per application in the form of soil-applied liquid urea-ammonium nitrate on 4/21, 6/1 and 6/13. Treatments were applied in a total of 102 gallons per acre. Soil nitrogen applications were made using a tractor mounted boom sprayer.

Leaf Analysis.

Leaves were collected for nutritional analysis on 8-22-05. Leaves were dried at 60C, ground to a fine powder, then shipped to a commercial laboratory for analysis (Ward Labs, Kearney, NE).

Harvest

Fruit were harvested on 11-23-05. Fruit from each tree was harvested by hand using professional pickers from a local packinghouse. For the harvest, only fruit with diameters above $2\ ^{21}/_{64}$ inches were harvested (#8 ring). Fruit of the three trees from each treatment unit was pooled and was harvested into wooden bins, each holding approximately 1050 lbs. Yield data is presented as lbs. fruit per tree. Although not all the fruit was harvested at this time, there was no additional harvest because market conditions did not justify an additional harvest later in the year.
Approximately 90 to 100 lbs of fruit was selected from the bins for each treatment unit. This sub-sample of fruit was optically sorted using a completely automated photographic sorter (Autoline, Inc., Reedley, CA). This sorter is trailer-mounted so that it can be towed to the citrus orchard study site. Each fruit that passed through the sorter was photographed and weighed. Weight, color, exterior quality (% blemish) and fruit diameter data was collected for each fruit. Fruit were not physically sorted, but the data collected was stored in a laptop computer that is an integral part of the sorter. Data collected from the sorter were later analyzed and the percentage of fruit from the eight fruit sizes (75 to 285 fruit per packed carton) fruit shape, fruit color and fruit grades (fancy, choice and juice) were determined.

Results and Discussion:

Leaf Nutrient Concentration: There were no significant effects of the treatments upon leaf nutrient concentration (Fig. 2). Leaf nutrient concentrations for most of the treatments were well within the sufficiency range. However, all the treatments were low in nitrogen, ranging from 1.67 to 1.87%, while the sufficiency range is from 2.5 to 2.8%. Also, all the treatments, except the Desert Crop Mix (Treatment 5 at 23 ppm) exhibited low Zn levels, ranging from 12 to 17 ppm, while the sufficiency range is from 19 to 50 ppm. Additionally, all the treatments resulted in low leaf Cu levels, ranging from 4.2 to 4.68 ppm, just under the lower limit of the sufficiency range which is from 5 to 15 ppm.

Yield. Yields for the experiment are shown in Figure 3. Treatment 3 had the greatest yields, about 510 lbs of fruit per tree. Treatment 4 followed at 495 lbs. per tree, then treatments 1 and 2 at 467 lbs. per tree, then treatment 5 at 394 pounds per tree. Treatment 3 had about a 29% greater yield than did treatment 5. However, because of variability, there were no significant differences among the treatments.

Packout: Packout for the experiment is shown in Figure 4. Fruit size was generally large because of the late harvest. There was no significant difference in packout among the treatments. Packout for fruit size class 75 ranged from 9% to 15%, for size class 95 it ranged from 41% to 45%, for size class 115 the range was from 20% to 25%, for size class 140 the packout ranged from 14% to 16%, and for size class 165 the packout ranged from 6% to 8%. Packout for each of the smaller sizes was less than 1%.

Fruit Grade, Color and Shape: We did not note any significant difference in fruit grade due to the treatments (Fig. 5). In general, fruit quality ranged from 73% to 78% fancy, about 14% to 18% choice, and about 8% to 9% juice. There was no effect of the treatments upon fruit color or shape.

Conclusions

It is evident that there is may be a positive effect of the Agro-Culture treatments upon fruit yield. The treatments likely improve yield by improving fruit retention which leads to greater overall yield, rather than improving fruit size or quality. However, lack of statistical significance to support this conclusion means that additional years of experimentation will be necessary. This conclusion is similar to our results from last year.

It is unclear at this point whether Agro-Culture products may be used as a suitable substitute for soil-applied N. Since leaf analysis showed that all treatments had lower than sufficient N levels, no conclusions can be drawn at this point. Confounding the experiment is the fact that some of the N applied to the trees was applied prior to experimental commencement. This will not be the situation in 2006.

	2005 Agroculture Experiment Plot Plan										Block 27										
Road	Tree↓	Ditch																			
	1	G	Block 1	G	Block 1	G	Block 1	G	Block 1	G	Block 1	G	Block 4	G	Block 4	G	Block 4	G	Block 4	G	Block 4	G
	2	G		G		G		G		G		G		G		G		G		G		G
	3	G	Trt. 3	G	Trt. 1	G	Trt. 5	G	Trt. 2	G	Trt. 4	G	Trt. 2	G	Trt. 1	G	Trt. 5	G	Trt. 4	G	Trt. 3	G
	4	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
	5	G	Block 2	G	Block 2	G	Block 2	G	Block 2	G	Block 2	G	Block 5	G	Block 5	G	Block 5	G	Block 5	G	Block 5	G
	6	G		G		G		G		G		G		G		G		G		G		G
	7	G	Trt. 5	G	Trt. 3	G	Trt. 2	G	Trt. 4	G	Trt. 1	G	Trt. 2	G	Trt. 4	G	Trt. 1	G	Trt. 3	G	Trt. 5	G
	8	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
	9	G	Block 3	G	Block 3	G	Block 3	G	Block 3	G	Block 3	G	Block 6	G	Block 6	G	Block 6	G	Block 6	G	Block 6	G
	10	G		G		G		G		G		G		G		G		G		G		G
	11	G	Trt. 2	G	Trt. 4	G	Trt. 3	G	Trt. 1	G	Trt. 5	G	Trt. 1	G	Trt. 2	G	Trt. 3	G	Trt. 4	G	Trt. 5	G
	Row →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		Road																				

	Color	Treatment	
		1	No foliar fertilizer + 2.0 lb. N per tree annually
		2	Citrus Foliar @ 3.125 gpa + 2.0 lb. N per tree annually
		3	Citrus Foliar @ 3.125 gpa + 5 gpa High NRG-NR + 1.0 lb. N per tree annually
		4	Citrus Foliar @ 3.125 gpa + 10 gpa High NRG-NR + 0.0 lb. N per tree annually
		5	Desert Crops Mix as in 2004 + 2.0 lb. N per tree annually
		G	Guard Tree

Figure 1. Plot plan of the 2005-06 Agro-Culture Experiment

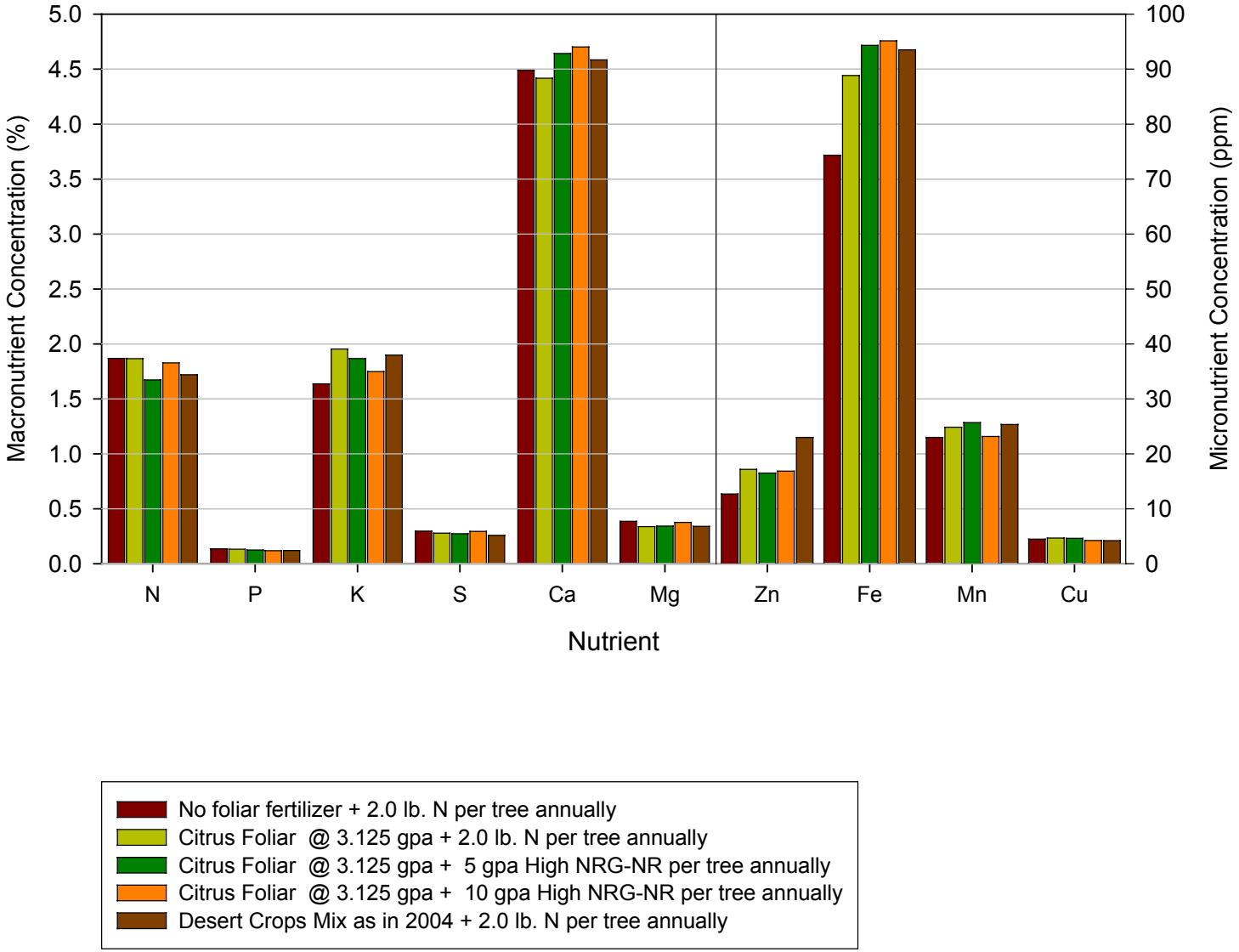


Figure 2. Effect of Foliar Nutritional Sprays on Lemon leaf nutrient concentration.

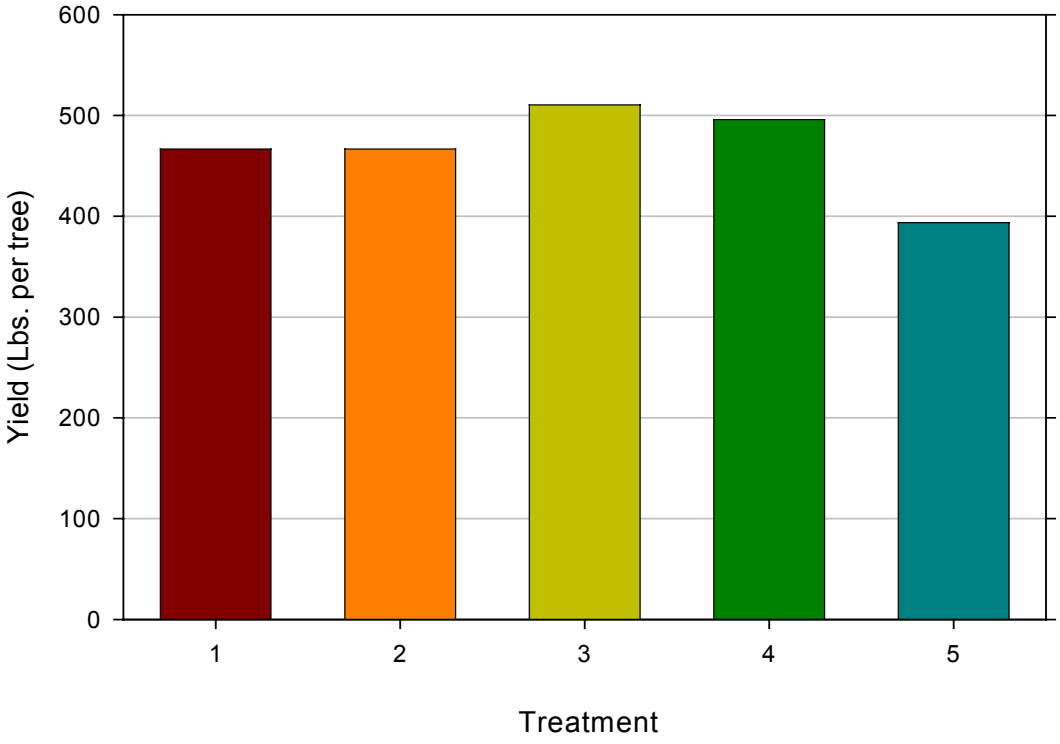


Figure 3. Effect of Foliar Nutritional Sprays on Lemon Yield.

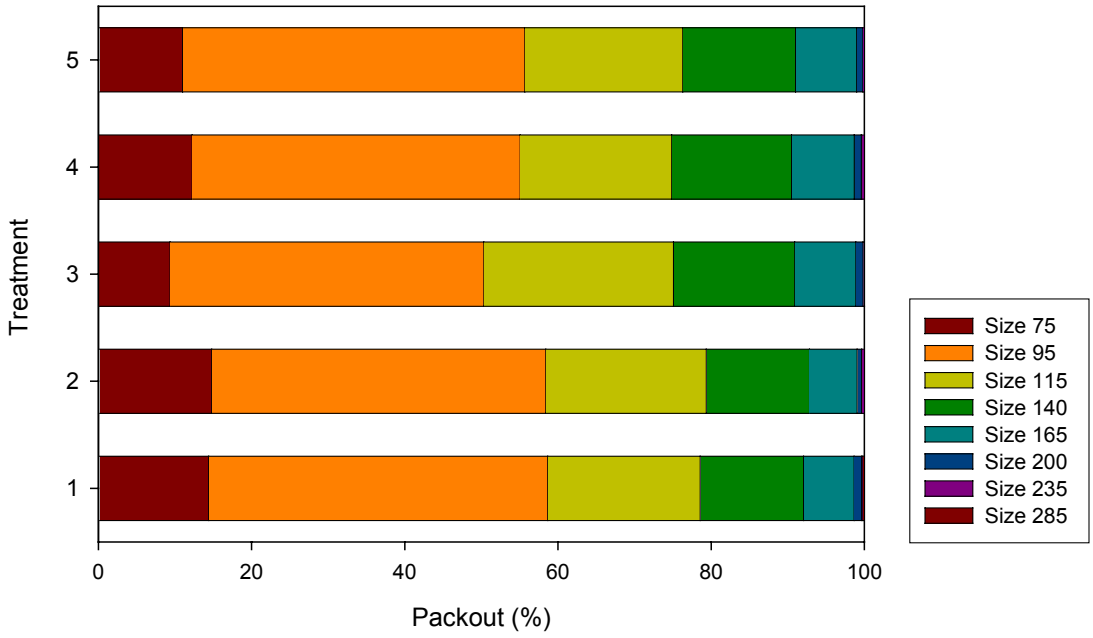


Figure 4. Effect of Foliar Nutritional Sprays on Lemon Packout.

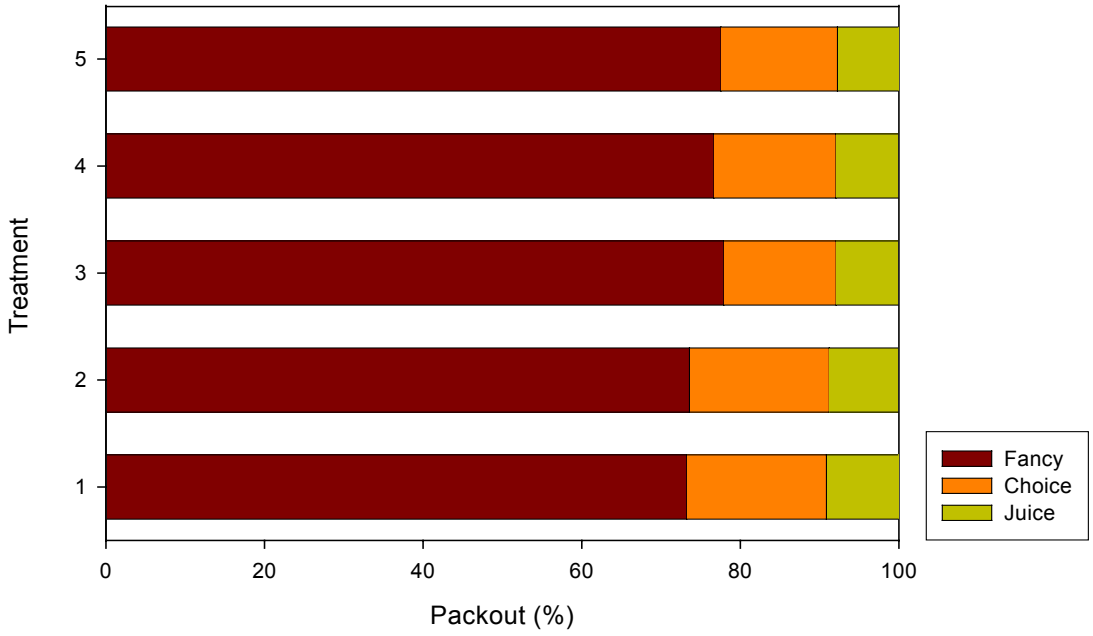


Figure 5. Effect of Foliar Nutritional Sprays on Lemon Grade.

A Report Regarding the Application of Agro-Culture Liquid Fertilizers to Lemons for the 2006-07 Season

Dr. Glenn C. Wright
Citrus and Date Palm Specialist
University of Arizona

Note: the Citrus Foliar fertilizer used is a combination of Agro-Culture Liquid Fertilizers with an analysis of 4-8-1-0.4Zn-0.4Mn-0.4Fe-0.2B. Also in Figure 2 there is reference of gpa rates of High NRG-NR being applied "per tree", which is incorrect.

Introduction:

Our first experiments with Agro-Culture liquid fertilizers were initiated in 2003 as a response to the question of how the products would affect citrus yield, packout and interior quality when applied to mature lemon trees. As compared with past years, there was a change in emphasis for 2005-06. Beginning with that year, we wanted to determine if foliar applications of Agro-Culture nitrogen products could successfully substitute for conventional N sources commonly used in Arizona citriculture. This report is for the second year of the new experiment, the 2006-07 season.

Methodology:

The new experiment was conducted on lemon (*Citrus limon*) and was laid out on 22 March 2005 at the University of Arizona Yuma Mesa Agriculture Center at Yuma, AZ, in Block 27. This field consisted of (at the time) 9-year old 'Limoneira 8A Lisbon on *Citrus volkameriana* rootstock. Trees spacing was 25 x 25 feet (70 trees per acre). All trees were 'Limoneira 8A Lisbon' lemon on *Citrus volkameriana* rootstock.

The experiment was a randomized complete block design, with five treatments and six blocks; a total of 90 trees (Figure 1). Each treatment unit consisted of a block of 3 trees. Guard trees surrounded each treatment unit, and separated each from adjacent treatment units.

Treatments for 2006-07 were as follows:

1. No foliar fertilizer + 2.0 lb. N per tree annually applied to the soil.
2. Citrus Foliar @ 3.125 gpa + 2.0 lb. N per tree annually applied to the soil.
3. Citrus Foliar @ 3.125 gpa + 5 gpa High NRG-NR + 1.0 lb. N per tree annually applied to the soil.
4. Citrus Foliar @ 3.125 gpa + 10 gpa High NRG-NR + no additional N applied to the soil.
5. Desert Crops Mix @ 2 qt. /ac + 2.0 lb. N per tree annually applied to the soil.

All nitrogen, except that included in Agro-Culture products, was applied to the soil in the form of urea ammonium nitrate 32-0-0, Nitro-sul 20-0-0-40S, or Ammonium Phosphate 10-34-0. Desert crops mix is manufactured by Monterey Ag Resources (Fresno, CA), and contains 4% S, 2%, Mn, 2% Fe and 4% Zn.

Foliar applications

Applications were made with a small airblast sprayer at 80 gpa, with complete coverage to wet. For rates, see above. The first foliar application date was 3/3/06 to treatment 2. Because of

[1]*Product was supplied and the cost of this project was defrayed by financial support from Agro-Culture Liquid Fertilizers, PO Box 150, St. Johns, MI 48879, (1-800-678-9029). The contributions of Dr. Michael Read, as well as Mr. Marco Peña and Mr. José Arturo Moreno are also appreciated.*

sprayer breakdown, first applications for treatments 3, 4 and 5 were made on 3/16. Three additional foliar applications were made on 5/2, 5/31, and 7/3. All foliar materials were applied in approximately 100 gpa water volume.

Soil applications

On 1/15 and again on 2/15/06, an application of ammonium phosphate 10-34-0, at the rate of 14 gallons per acre was made to the entire field, applied through the flood irrigation waters. Soil applications of 32-0-0 (0.33 lb. N per acre) were made to treatments 1, 2, and 5 on 4/21, 5/25, 7/5, 7/31, 8/11 and 9/14. For treatment 3, applications were made on 4/21, 5/25, and 7/5.

Treatments were applied in a total of 102 gallons per acre. Soil nitrogen applications were made using a tractor mounted boom sprayer.

Leaf Analysis.

Leaves were collected for nutritional analysis on 3-2-07. Leaves were dried at 60C, ground to a fine powder, then shipped to a commercial laboratory for analysis (Ward Labs, Kearney, NE).

Harvest

Fruit were harvested on 10-9-06. Fruit from each tree was harvested by hand using professional pickers from a local packinghouse. For the harvest, only fruit with diameters above $2\ ^{21}/_{64}$ inches were harvested (#8 ring). Fruit of the three trees from each treatment unit was pooled and was harvested into wooden bins, each holding approximately 1050 lbs. Yield data is presented as lbs. fruit per tree. Although not all the fruit was harvested at this time, there was no additional harvest because market conditions did not justify an additional harvest later in the year.

Approximately 90 to 100 lbs of fruit was selected from the bins for each treatment unit. This sub-sample of fruit was optically sorted using a completely automated photographic sorter (Autoline, Inc., Reedley, CA). This sorter is trailer-mounted so that it can be towed to the citrus orchard study site. Each fruit that passed through the sorter was photographed and weighed. Weight, color, exterior quality (% blemish) and fruit diameter data was collected for each fruit. Fruit were not physically sorted, but the data collected was stored in a laptop computer that is an integral part of the sorter. Data collected from the sorter were later analyzed and the percentage of fruit from the eight fruit sizes (75 to 285 fruit per packed carton) fruit shape, fruit color and fruit grades (fancy, choice and juice) were determined.

Results and Discussion:

Leaf Nutrient Concentration: There were no significant effects of the treatments upon leaf N, P, Ca, Zn, Fe, Mn or Cu (Fig. 2). Leaf nutrient concentrations for most of the treatments were well within the sufficiency range. However, all the treatments were low in nitrogen, ranging from 1.34 to 1.52%, while the sufficiency range is from 2.5 to 2.8%. This may be due to the late leaf collection date, but these values were not significantly lower than the values for 2005, when leaves were collected in August. For K, the trees supplied with citrus foliar + 5 gpa High NRG-NR + 1 lb N per tree had lower leaf K concentrations than the trees with 2 lb N and no additional foliar fertilizer. For S, those trees supplied with citrus foliar + 2.0 lb. N per tree had a greater leaf S concentration than the other trees. For Mg, trees supplied with citrus foliar + 2 lb N per tree had more leaf Mg concentrations than trees supplied with the citrus foliar, 5 gpa High NRG-NR and 1 lb. soil-applied N per tree, and more leaf Mg than the trees supplied with Desert Crop Mix and 2 lb. soil-applied N. Also, all the treatments, exhibited low Zn levels, ranging from 15 to 23 ppm, while the sufficiency range is from 19 to 50 ppm. Additionally, all the treatments

resulted in low leaf Cu levels, ranging from 4.0 to 4.6 ppm, just under the lower limit of the sufficiency range which is from 5 to 15 ppm.

Yield. Yields for the experiment are shown in Figure 3. Yields for 2006 were about 20% of the yields of 2005 across the entire experiment. Treatment 1 had the lowest yield of about 70 lbs. per tree, while all the trees treated with foliar fertilizers had from 80 to 90 lbs of fruit. This corresponds to about a 15 to 30% increase in yield with foliar fertilization. However, because of variability, there were no significant differences among the treatments.

Packout: Packout for the experiment is shown in Figure 4. There was no significant difference in packout among the treatments. Packout for fruit size class 75 ranged from 3% to 5%, for size class 95 it ranged from 25% to 32%, for size class 115 the range was from 21% to 25%, for size class 140 the packout ranged from 22% to 27%, and for size class 165 the packout ranged from 13% to 20%. Packout for each of the smaller sizes was less than 5%.

Fruit Grade, Color and Shape: We did not note any significant difference in fruit grade due to the treatments (Fig. 5). In general, fruit quality ranged from 82% to 89% fancy, about 9% to 13% choice, and about 2% to 5% juice. There was no effect of the treatments upon fruit color or shape.

Conclusions

It is again (just as it was last year) evident that there is may be a positive effect of the Agro-Culture treatments upon fruit yield. The treatments likely improve yield by improving fruit retention which leads to greater overall yield, rather than improving fruit size or quality. However, lack of statistical significance to support this conclusion means that more years of experimentation would be necessary. This conclusion is similar to our results from last year.

It is increasingly clear at this point that Agro-Culture products might be used as a suitable substitute for soil-applied N. However, since leaf analysis showed that all treatments had lower than sufficient N levels, no conclusions can yet be drawn at this point.

	2005 Agroculture Experiment Plot Plan										Block 27											
Road	Tree↓	Ditch																				
	1	G	Block 1	G	Block 1	G	Block 1	G	Block 1	G	Block 1	G	Block 4	G	Block 4	G	Block 4	G	Block 4	G	Block 4	G
	2	G		G		G		G		G		G		G		G		G		G		G
	3	G	Trt. 3	G	Trt. 1	G	Trt. 5	G	Trt. 2	G	Trt. 4	G	Trt. 2	G	Trt. 1	G	Trt. 5	G	Trt. 4	G	Trt. 3	G
	4	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
	5	G	Block 2	G	Block 2	G	Block 2	G	Block 2	G	Block 2	G	Block 5	G	Block 5	G	Block 5	G	Block 5	G	Block 5	G
	6	G		G		G		G		G		G		G		G		G		G		G
	7	G	Trt. 5	G	Trt. 3	G	Trt. 2	G	Trt. 4	G	Trt. 1	G	Trt. 2	G	Trt. 4	G	Trt. 1	G	Trt. 3	G	Trt. 5	G
	8	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
	9	G	Block 3	G	Block 3	G	Block 3	G	Block 3	G	Block 3	G	Block 6	G	Block 6	G	Block 6	G	Block 6	G	Block 6	G
	10	G		G		G		G		G		G		G		G		G		G		G
	11	G	Trt. 2	G	Trt. 4	G	Trt. 3	G	Trt. 1	G	Trt. 5	G	Trt. 1	G	Trt. 2	G	Trt. 3	G	Trt. 4	G	Trt. 5	G
	Row →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		Road																				

Color	Treatment	
	1	No foliar fertilizer + 2.0 lb. N per tree annually
	2	Citrus Foliar @ 3.125 gpa + 2.0 lb. N per tree annually
	3	Citrus Foliar @ 3.125 gpa + 5 gpa High NRG-NR + 1.0 lb. N per tree annually
	4	Citrus Foliar @ 3.125 gpa + 10 gpa High NRG-NR + 0.0 lb. N per tree annually
	5	Desert Crops Mix as in 2004 + 2.0 lb. N per tree annually
	G	Guard Tree

Figure 1. Plot plan of the 2005-06 Agro-Culture Experiment

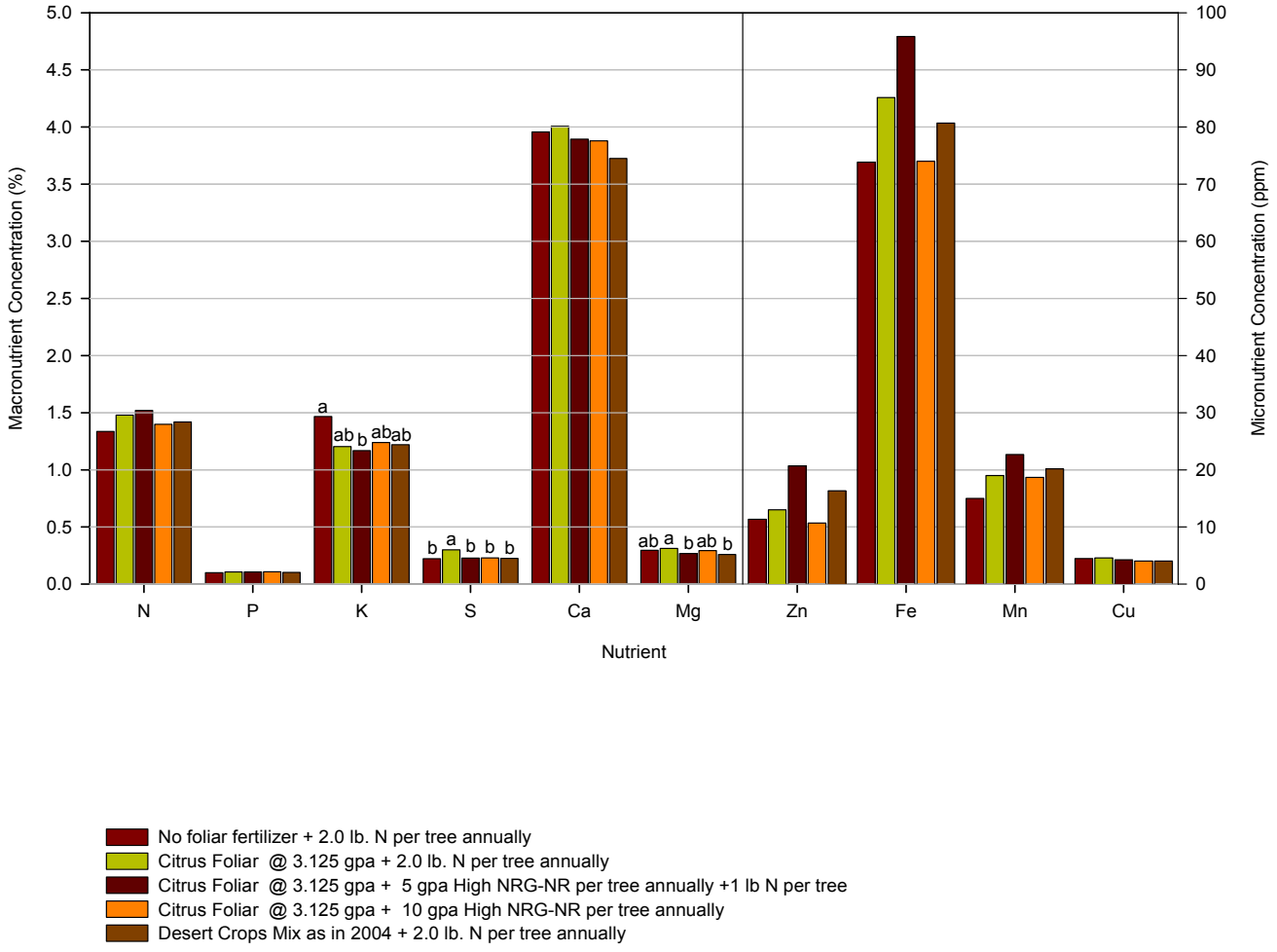


Figure 2. Effect of Foliar Nutritional Sprays on Lemon leaf nutrient concentration.

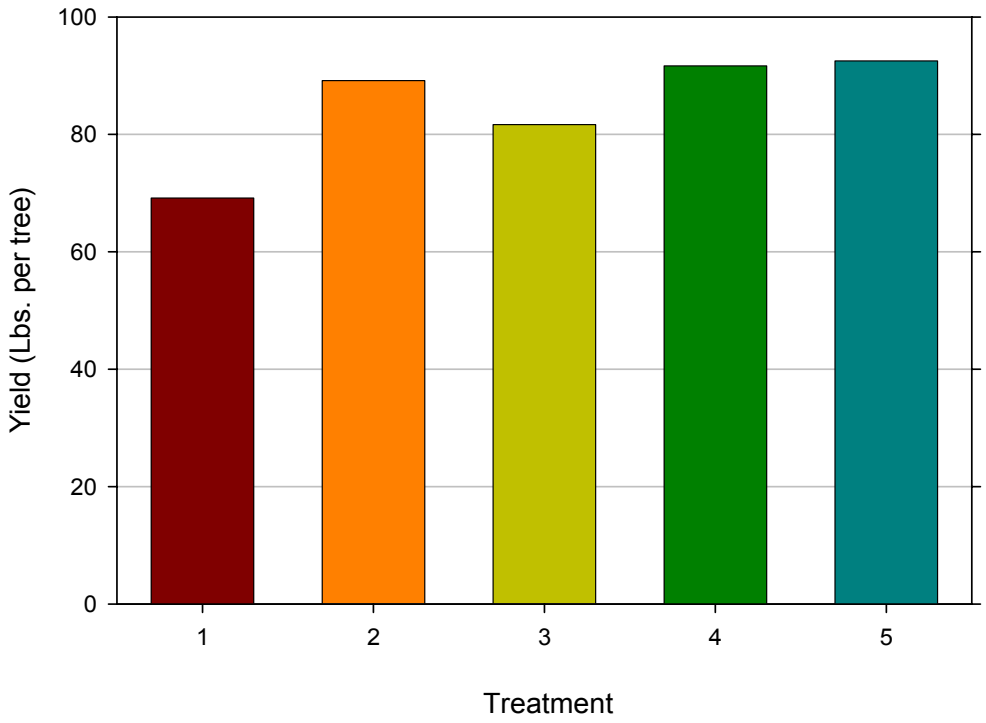


Figure 3. Effect of Foliar Nutritional Sprays on Lemon Yield.

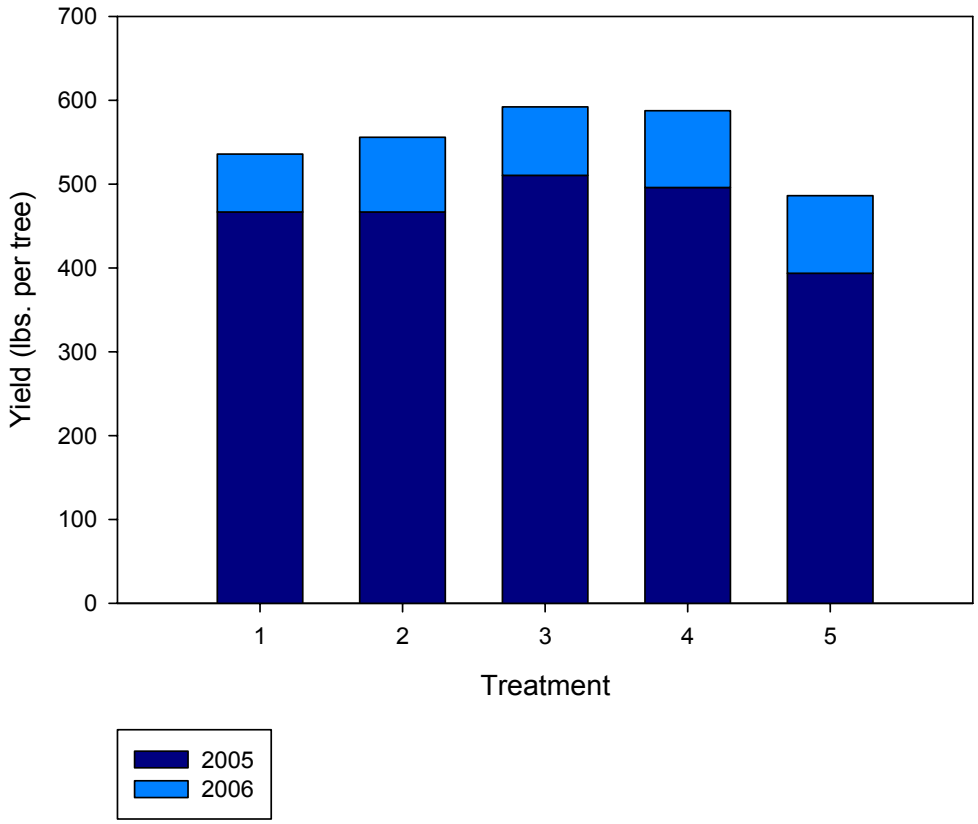


Figure 4. Effect of Foliar Nutritional Sprays on Lemon Cumulative Yield

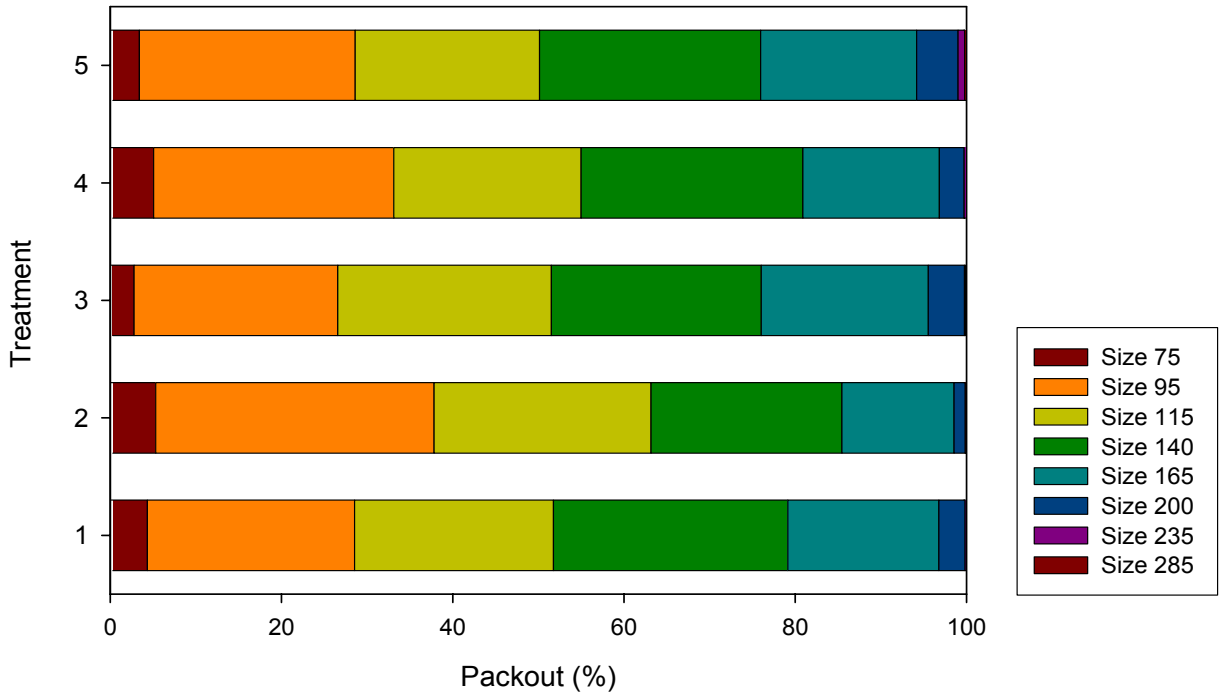


Figure 5. Effect of Foliar Nutritional Sprays on Lemon Packout.

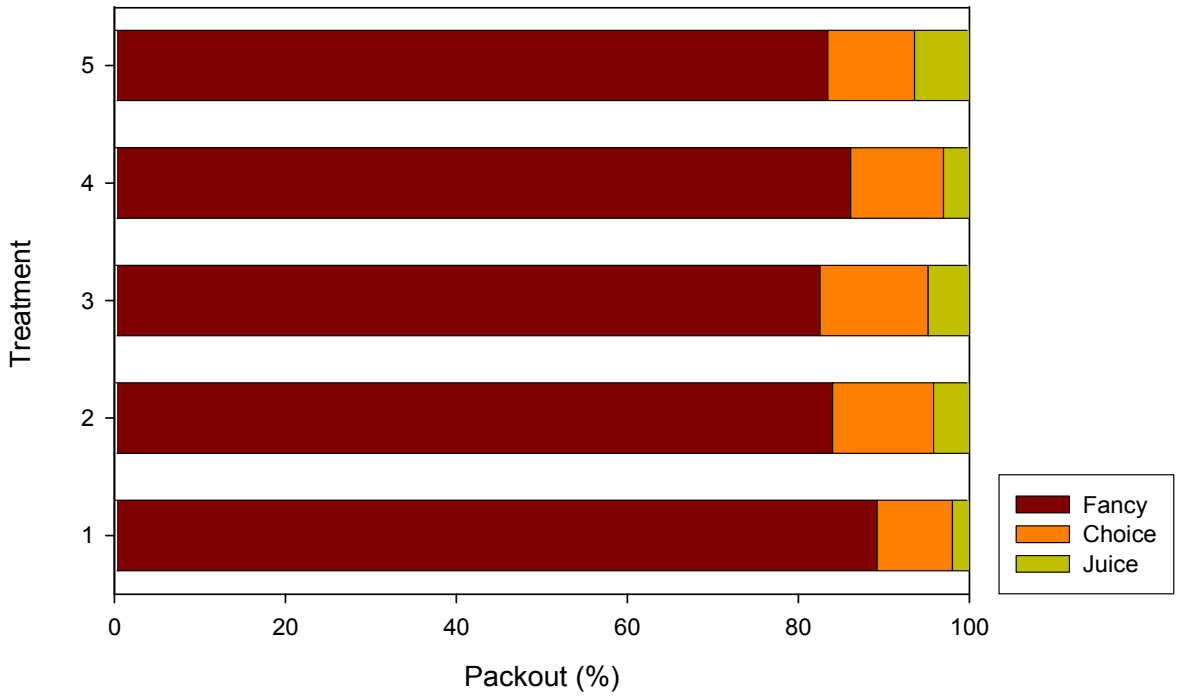


Figure 6. Effect of Foliar Nutritional Sprays on Lemon Grade.