Corn:
Foliar Applications

AGRO-CULTURE LIQUID FERTILIZERS

- Foliar Fertilization of Corn (2005)
- Foliar Fertilization of Corn (2006)
- Foliar Nitrogen Applications on Corn (2008)
- Foliar Applications on Corn (2009)

Experiment: Foliar Fertilization of Corn
Year (Experiment Number): 2005 (05-18)
Date of Planting/Harvest: May 2 / Oct. 27
Hybrid: Pioneer 37R71
Plot Size (replications): 4 row x 465 ft. (2)
Previous crop: Winter wheat

Soil Test Levels
pH: 7.6 C.E.C.: 8.1
OM: 2.1% P1: 26 ppm
K: 118 ppm (3.7% BS)

Foliar application of fertilizer is a convenient and effective method of nutrient application for many crops. However, in our research at the North Central Research Station and elsewhere, a regularly effective foliar program for corn has not been established. But we keep trying. An experiment was established to evaluate several different foliar treatments for corn.

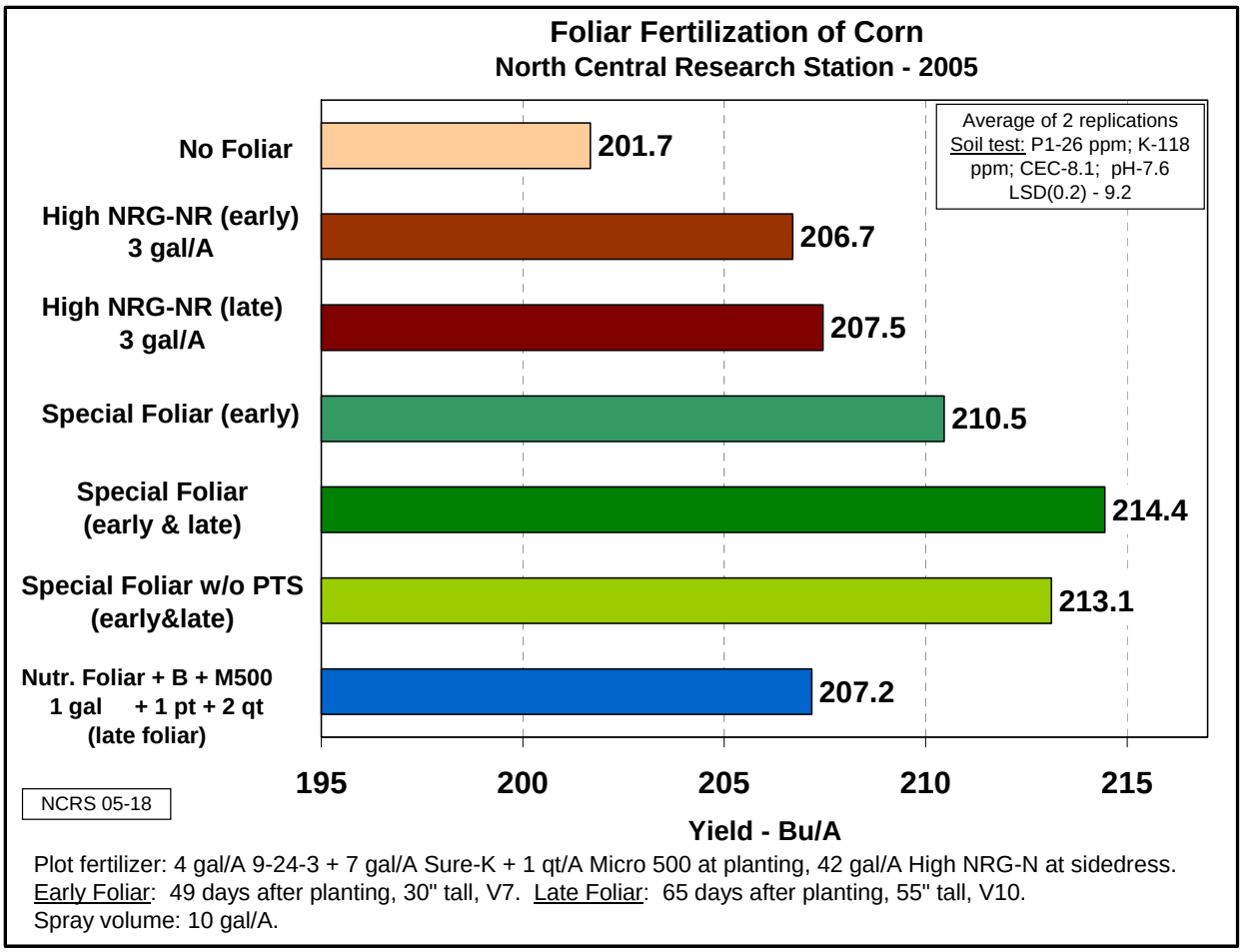
Fertilizer treatments are listed in the following table.

Treatment	Rate per acre	Timing
1. No foliar		
2. High NRG-NR	3 gal	Foliar 1
3. High NRG-NR	3 gal	Foliar 2
4. Special Foliar:		Foliar 1
Sure-K	2 gal	
High NRG-NR	1 gal	
Micro 500	1 qt	
Boron	1 pt	
PTS	1 oz	
5. Special Foliar (same as above)		Foliar 1
Followed by:		Foliar 2
Sure-K	1 gal	
High NRG-NR	2 gal	
Carbo	1 qt	
PTS	1 oz	
6. Special Foliar without PTS (same as trt. 5)		Foliar 1,2
7. Micro 500	2 qt	Foliar 2
Boron	1 pt	
Nutritionall Foliar	1 gal	

Application timing:
Foliar 1: 6/20, 49 days after planting. Corn 22 in. tall/V6
Foliar 2: 7/6, 65 days after planting. Corn 55 in. tall/V10
Total spray volume: 10 gal/A (fertilizer + water),
Nozzle: Turbojet 11002, 25 psi.

Corn in foliar plot 4 days after Foliar 1.

Applications were made with a high-clearance sprayer.
Yield results appear in the following chart.



- The two applications of the Special Foliar treatment resulted in statistically significant yield increases. Application without the PTS did not reduce yield.
- The Special Foliar did increase yield, although cost of nutrients plus application is a consideration.
- There was some slight leaf burn with the High NRG-NR, although it was minor. (See picture. No other treatment caused any injury.

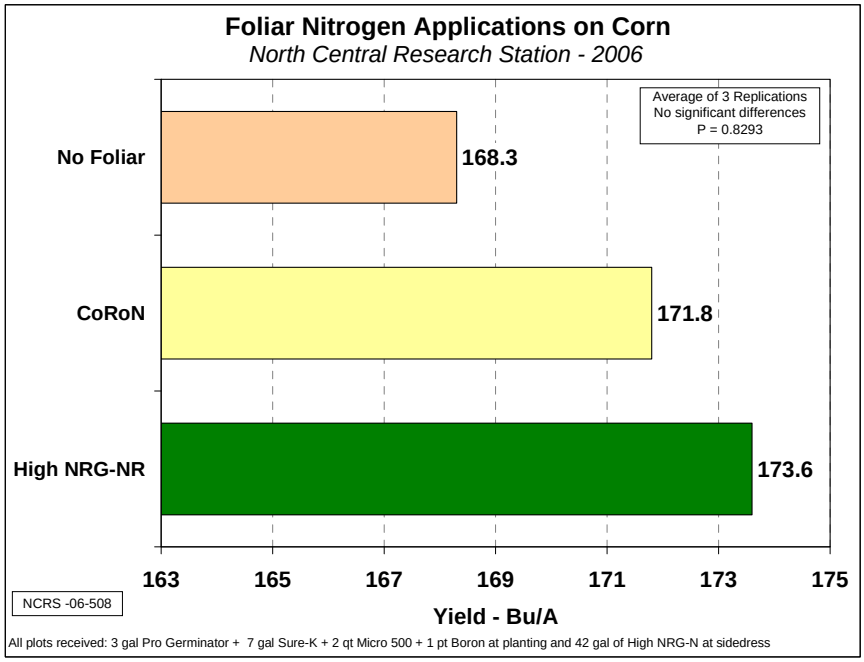
Minor leaf burn four days after application of 3 gal/A High NRG-NR.

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: Foliar Nitrogen Applications on Corn
Year (Experiment Number): 2008 (08-305, 08-515)
Date of Planting/Harvest: April 25/May 2 / October 22/15
Variety: DEKALB 5044
Plot Size: 15 ft. x 130/210 ft. (5 reps) 15 ft. x 50 ft. (4 reps)

Soil Test Levels (305/515)
pH: 7.2 / 6.9 C.E.C.: 4.5 / 13.0
OM: 1.8 / 2.7% P1: 34 / 30 ppm
K: 59 / 100 ppm (3.4 / 2.0% BS)

Objective: Evaluation of partial nitrogen sidedress rates with supplemental foliar nitrogen applications on corn.

With nitrogen prices on the rise, many growers are looking at ways to cut back on expenses and still produce satisfactory corn yields. Coron 25-0-0 plus 0.5% Boron, a Helena product, has been promoted to help with this situation. According to their label, foliar applied Coron can be used as a partial sidedress nitrogen replacement when applied to corn at the V6-V8 growth stage. See rate structure below.

Coron partial sidedress replacement rates

3 gal = 37.5 lbs of nitrogen
4 gal = 50.0 lbs of nitrogen
5 gal = 64.0 lbs of nitrogen

Agro-Culture Liquid Fertilizers product, High NRG-NR is a low salt urea based nitrogen source, with an analysis of 24-0-0 with 1% sulfur. This product works well as a foliar application. For comparison, applications were made using the same rate structure as Coron, to determine the differences between the two nitrogen products foliar applied.

Two experiments were established at the North Central Research Station evaluating reducing the sidedress nitrogen program by 50 equivalent pounds per acre and replacing it with a foliar application at the V7 growth stage of either 4 gal/A High NRG-NR or 4 gal/A Coron.

At each site, the corn was planted with an in-furrow application of Pro-Germinator, Sure-K and micronutrients according to soil test *(see Table 1 below).* Two different sidedress nitrogen sources were used, one at each site. Both sites were sidedressed with 210 pounds of equivalent nitrogen for the standard sidedress and 160 pounds of equivalent nitrogen for the partial sidedress. Please note, because the nitrogen sources are being applied at "equivalent" rates of nitrogen, these plots were only reduced by 39 pounds of actual nitrogen with 28% + eNhance and 30 pounds of actual nitrogen with High NRG-N. Rather than the 50 pounds per acre as suggested by the Coron label. Therefore, more actual nitrogen is being applied with foliar applications than recommended on the label. Sidedress was done on June 11th and both fields of corn were in the V5 growth stage and between 12-14 inches tall. Fertilizer sources and rates by site appear on Table 1 below.

Table 1: Fertilizer Rates By Site

	Site 1 *(08-305)*	Site 2 *(08-515)*
Planter Fertilizer	2 gal Pro-Germ. + 8 gal Sure-K + 2 qt Micro 500 + 1 pt B	3 gal Pro-Germ. + 6 gal Sure-K + 2 qt Micro 500
Standard Sidedress	56 gal 28% + eNhance	42 gal High NRG-N
Partial Sidedress	43 gal 28% + eNhance	32 gal High NRG-N

Treatments were the same at each site, with the only difference being the source and rate of sidedress nitrogen. Treatments are listed in the box below.

Treatments:

1. **Standard Sidedress**
2. Partial Sidedress
3. **Standard Sidedress** + 4 gal High NRG-NR
4. Partial Sidedress + 4 gal High NRG-NR
5. **Standard Sidedress** + 4 gal Coron
6. Partial Sidedress + 4 gal Coron

Foliar applications were made with self-propelled plot sprayer with a total volume of 10 gal/A at 40 psi. Applications were made on June 24th; the corn was in the V7 growth stage and between 22-24 inches tall.
See application pictures 1 and 2 below.

Picture 1. Foliar applications made at the V7 growth stage.

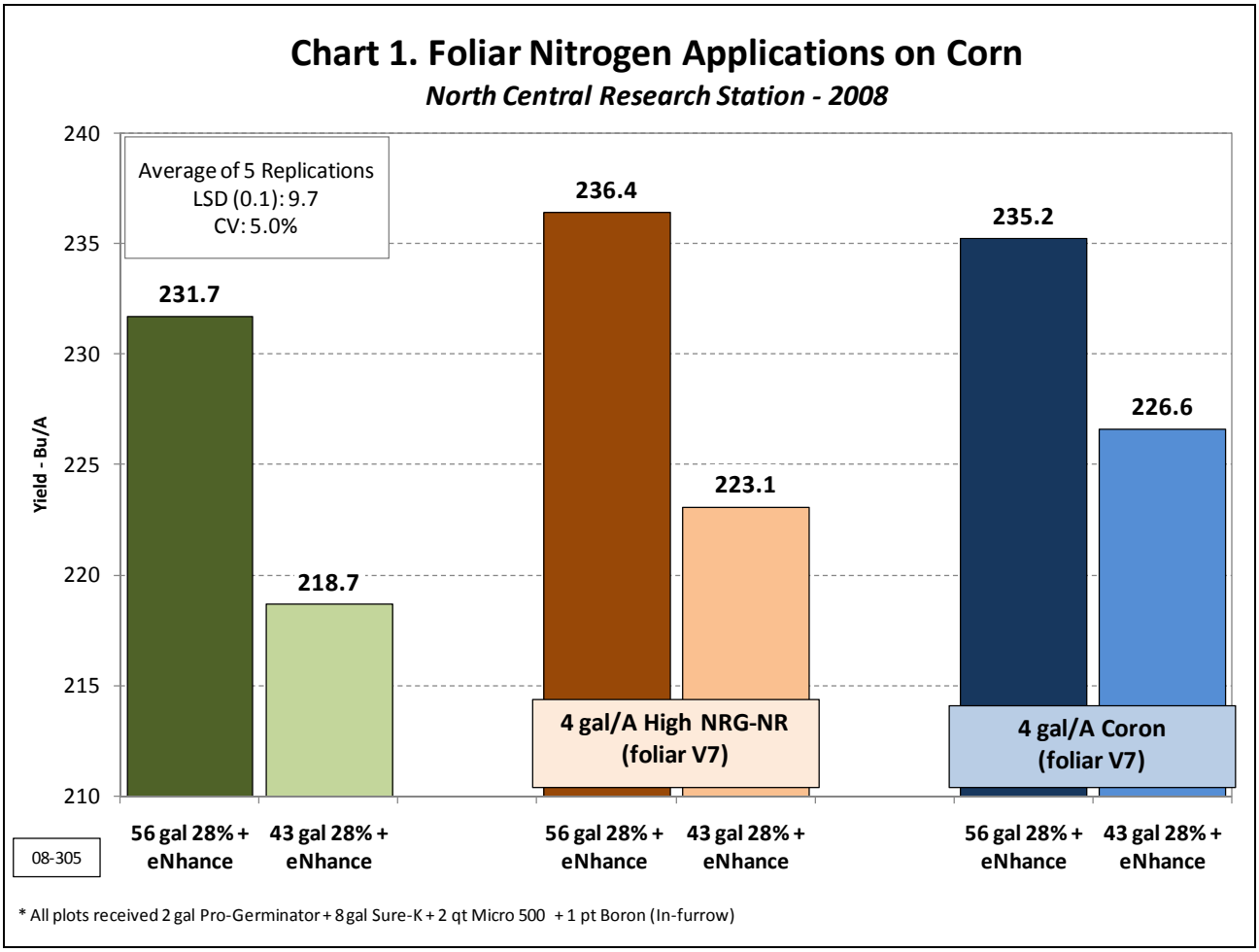
Picture 2. Uniform application of spray droplets immediately after application.

Visual evaluations were made on July 8th, which was 2 weeks after application. There was no noticeable tissue burn on the Coron treated plots. However, slight speckling was seen on the High NRG-NR treated plots. *(See picture 3 to the right)* The injury was noticed on what would have been the upper most fully developed leaf at the time off application with no injury seen on the newly developed leaves above it. The speckling was determined to be slight tissue burn from the High NRG-NR droplets that would have no effect on yield as the plant seemed to develop normally with good growth and color after application. When comparing **Picture 2**, the droplets after application to **Picture 3**, the tissue burn note that not all of the High NRG-NR droplets caused tissue burn.

Picture 3. Tissue burn, two weeks after application of High NRG-NR. No yield decreases occurred.

Yields for each site appear on *Chart 1* (site 1) and *Chart 2* (site 2) below.

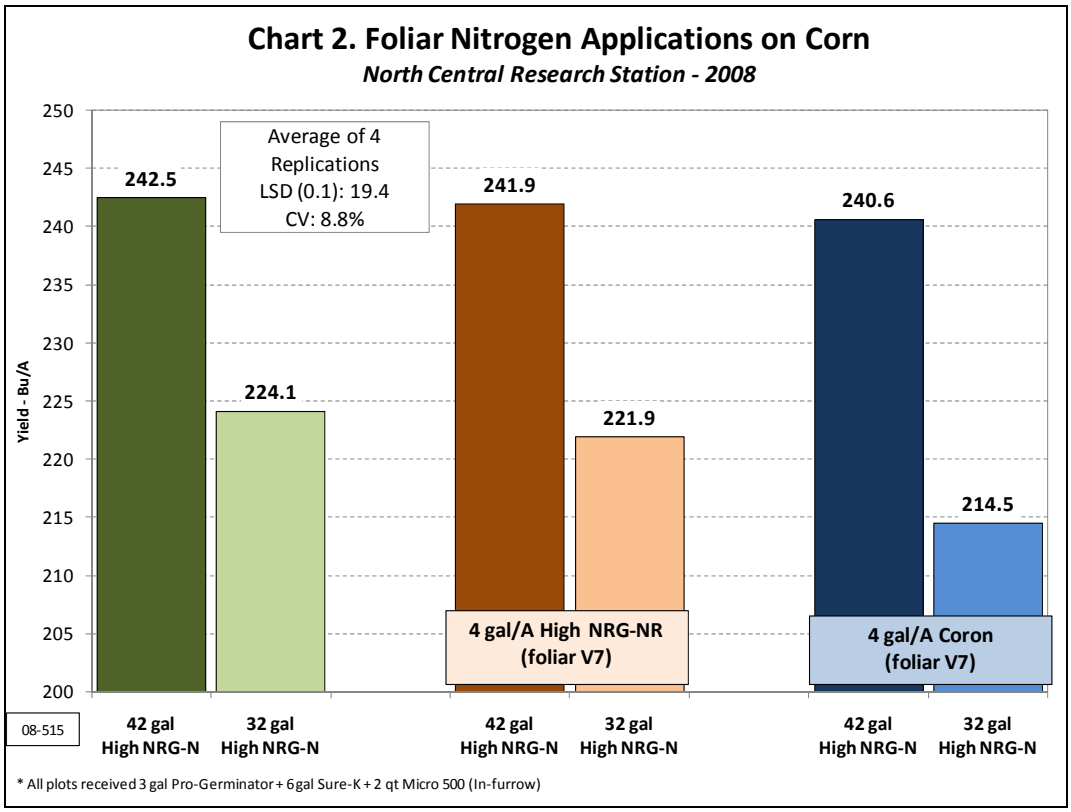
Site 1 (08-305)



Site 1 Results:

- The partial sidedress rate (160 lbs equivalent N) yielded significantly lower, than the standard sidedress rate (210 lbs equivalent N) in each comparison. (No foliar: 13 bu/A, High NRG-NR: 13.3 bu/A and Coron: 8.6 bu/A.)
- The addition of 4 gal High NRG-NR increased corn yield by over 4 bu/A for both sidedress nitrogen rates.
- Coron applied at 4 gal/A increased corn yield over 4 bu/A at both nitrogen rates compared to the no foliar applications.
- As seen with the High NRG-NR the partial sidedress rate with foliar Coron did not achieve a yield as high as the standard sidedress rate.
- Little difference in yield was seen with each set of three treatments with the same sidedress nitrogen rate *(56 gal: 231.7 bu, 236.4 bu, 235.2 bu and 43 gal: 218.7 bu, 223.1 bu, 226.6 bu).* Therefore, it can be concluded that the slight tissue burn seen with High NRG-NR did not affect corn yield.

Site 2 (08-515)



Site 2 Results:

- The partial sidedress rate (160 lbs N) yielded significantly lower, than the standard sidedress rate (210 lbs N) in each comparison. (No foliar: 18.4 bu/A, High NRG-NR: 20 bu/A and Coron: 26.1 bu/A.)
- At this site, no yield increase was seen with either foliar applied High NRG-NR or Coron for both of the sidedress rates.
- The addition of High NRG-NR foliar applied to the partial sidedress yielded significantly lower than the standard sidedress rate, over 20 bu/A.
- Similarly, a foliar application of Coron yielded 28 bu/A lower than the standard sidedress rate of 42 gal/A High NRG-N
- Little difference in yield was seen with each set of three treatments with the same sidedress nitrogen rate *(42 gal: 242.5 bu, 241.9 bu, 240.6 bu and 32 gal: 224.1 bu, 221.9 bu, 214.5 bu).* Therefore, it can be concluded that the slight tissue burn seen with High NRG-NR did not affect corn yield.

Summary:

It is obvious by these two studies that more work needs to be done to determine the effects and advantages of partial sidedress nitrogen applications with supplemental with foliar nitrogen.

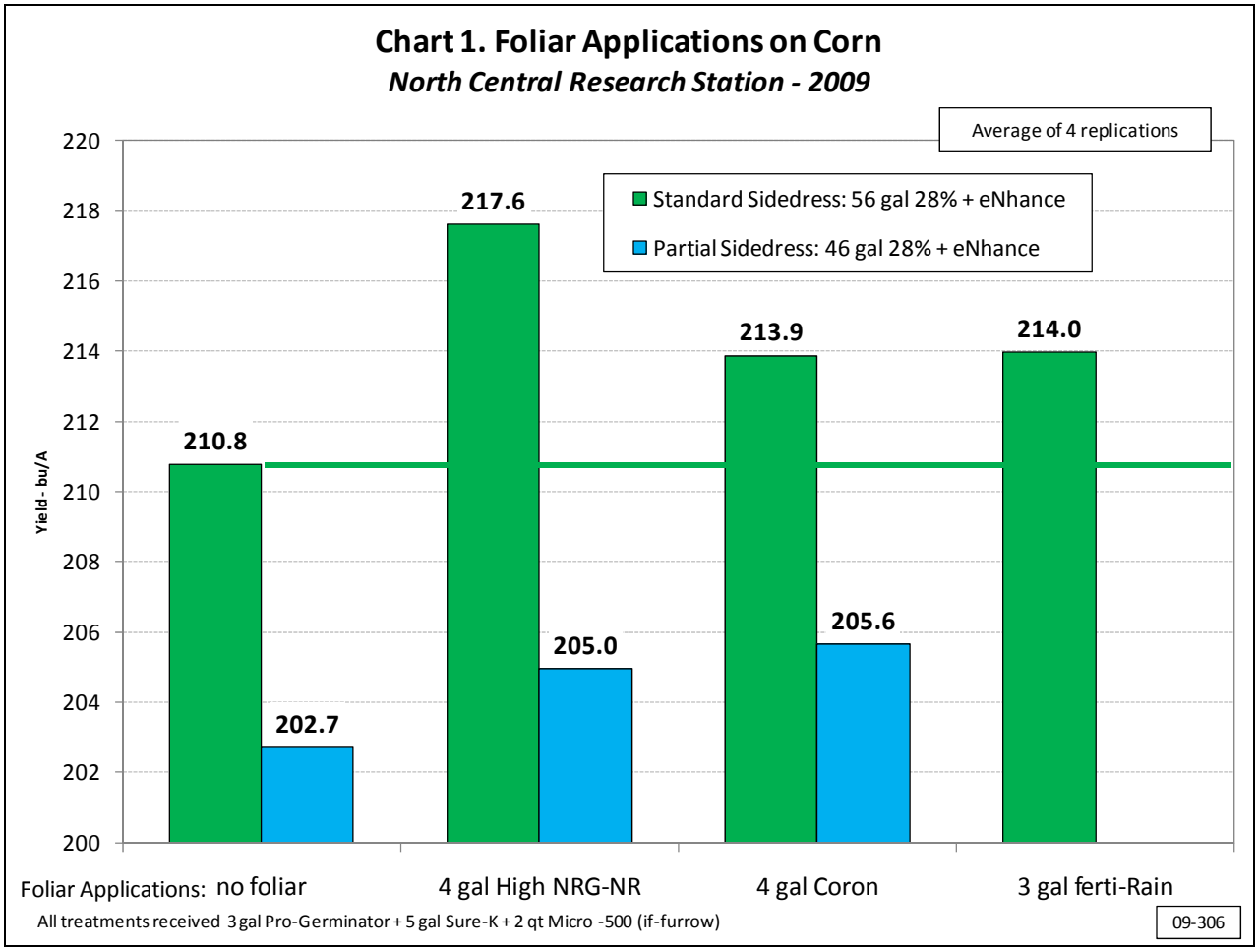
Experiment: Foliar Applications on Corn (09-306)

Planted:	5/4/09	**Hybrid:**	DKC52-59	**Population:**	33,000
Plot Size:	15' x 210'/130'	**Replications:**	5	**Harvested:**	10/28/09
Sidedress:	6/4/09	**Foliar (V7):**	6/22/09	**Foliar (V14):**	7/17/09

Soil Test Values *(ppm)*:

pH	CEC	% OM	Bicarb	K	S	% K	% Mg	% Ca	% H	% Na	Zn	Mn	B
7.2	5.8	1.2	12	53	6	2.3	16.5	80.2	0	1.0	0.6	2	0.4

Objectives: Nitrogen fertilizer plays a large role in overall corn yield. With increasing prices and new products on the market, managing nitrogen has become more complex. One nitrogen strategy promoted by some nutrient manufacturers other than Agro-Culture Liquid fertilizers is lowering the standard sidedress nitrogen application while trying to make up the difference in yield with a foliar application. Agro-Culture Liquid Fertilizers *High NRG-NR* and *ferti-Rain* along with Coron (a Helena product) were used for the foliar applications. The standard sidedress rate was 56 gal/A 28% + eNhance, providing 210 equivalent pounds of nitrogen. A reduced rate of 46 gal/A 28% + eNhance was used as a comparison, providing 160 equivalent pounds of nitrogen.



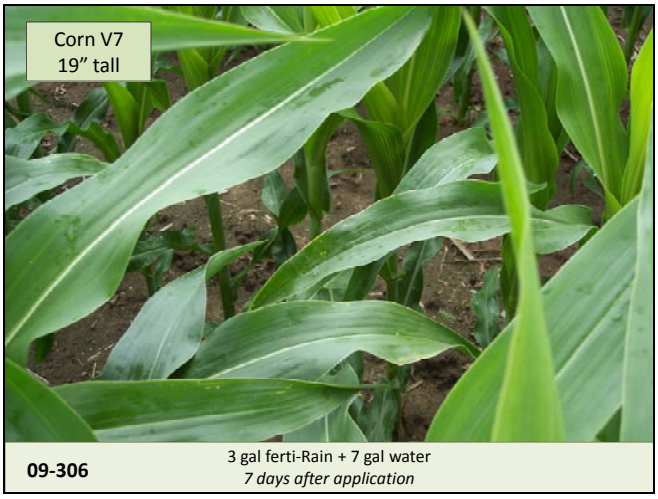
LSD(0.1): 8.8, CV:3.8%

*See *Product Descriptions* in the introduction for more information on ACLF products used.

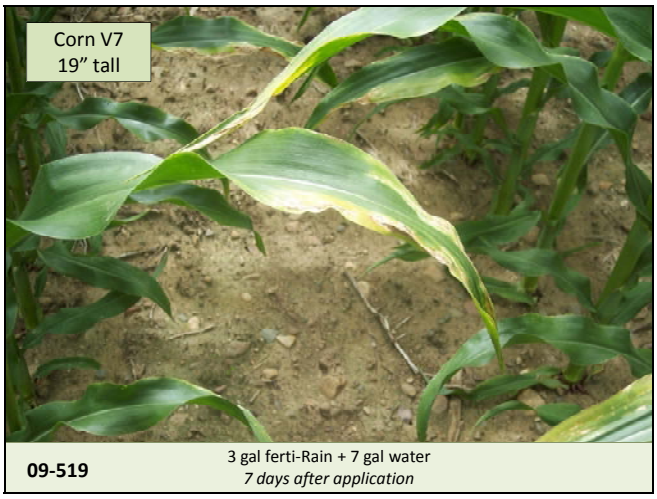
SMZ101210NRG

09-306 4 gal High NRG-NR + 6 gal water *7 days after application*

As we have seen in the past and is shown in the picture on the left, a foliar application of *High NRG-NR* does result in some slight burning of the upper leaves at the time of application. However, as shown in the above yields, this injury does not reduce yield. The later emerging leaves showed now injury.



09-306 3 gal ferti-Rain + 7 gal water *7 days after application*



09-519 3 gal ferti-Rain + 7 gal water *7 days after application*

This is the first year of observing ferti-*Rain* burn when applied as a foliar on corn. As shown in the pictures above, burn varied for minor to severe, but again later leaves were unaffected. More work will be done next year.

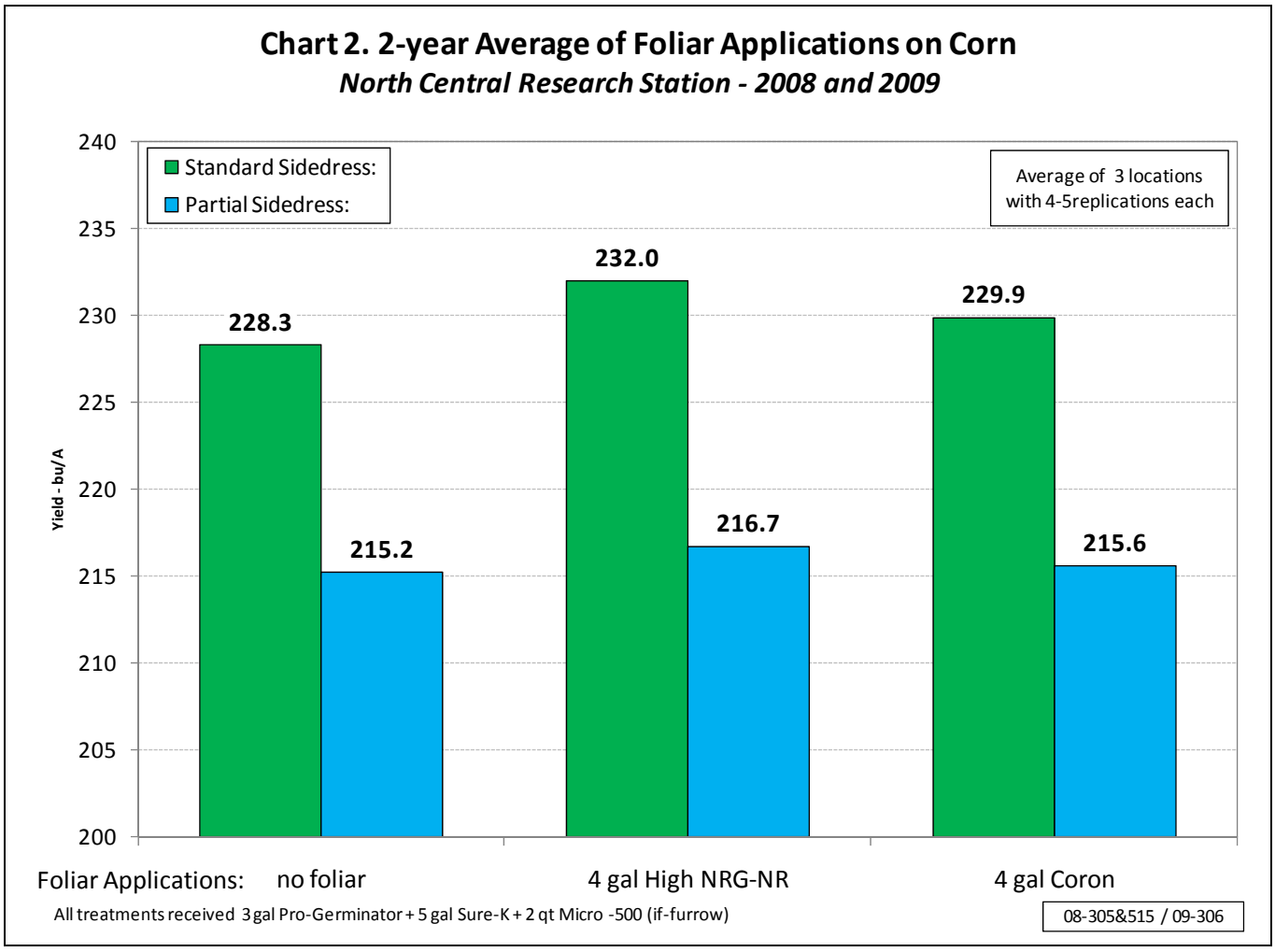
Conclusions:

- Highest yields were achieved with the standard rate of sidedress nitrogen.
- Additional foliar applications to the standard sidedress nitrogen increased yield 7 bu with *High NRG-R*, 3 bu with *ferti-Rain*, and 4 bu with Coron.
- Although yield was increased with foliar applications with the partial sidedress nitrogen rate, yields were not as high as the full sidedress rate. As shown on the chart, the blue bars needed to reach the green line in order to yield as well as the full sidedress program, however each treatment was at least 5 bu short of this goal.

*See *Product Descriptions* in the introduction for more information on ACLF products used.

2 Year Average:

This experiment was also completed in two locations in 2008. The averages of all three experiments are shown on chart 2 below.



Conclusions:

- Foliar applications, no matter which product, with a reduced nitrogen sidedress rate, have not increased yield to the same level as the standard sidedress nitrogen rate.
- Over three experiments in two years, the standard rate of sidedress nitrogen with foliar applications did not consistently show a yield increase. Foliar applications may prove to be beneficial in growing conditions with limited nitrogen uptake or as a rescue treatment.

*See *Product Descriptions* in the introduction for more information on ACLF products used.