

Corn: Micro and Secondary Nutrients



- Effect of Added Micronutrients on Corn Yield (1996)
- Effect of Micronutrients Added to Corn Planter Fertilizer (2004)
- Sulfur Addition to Corn Planter Fertilizer (2005)
- Manganese Fertilizer Applications on Corn (2008)
- Micronutrient Programs for Corn (2008)
- Planter Fertilizer Micronutrient Additives (2009)

Experiment: Effect of Added Micronutrients on Corn Yield

Year: 1996 (96-07)

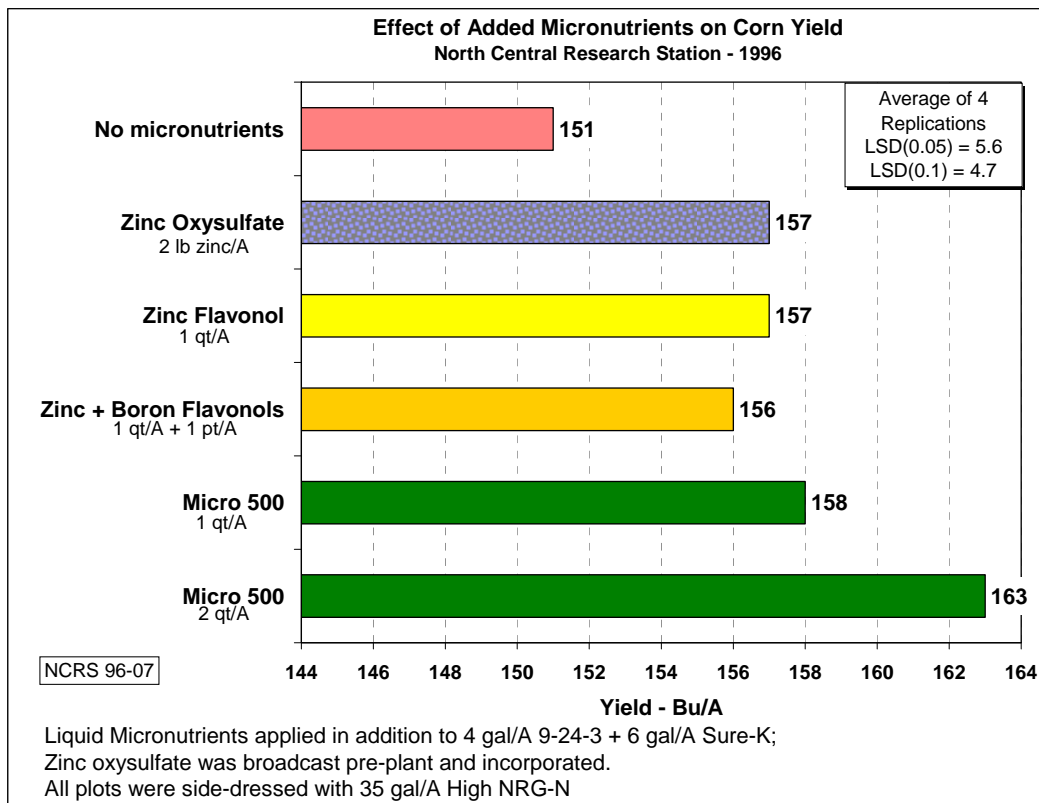
Date of Planting/Harvest: May 14 / October 29

Plot Size: 4 row x 50 ft (4 replications)

Agro-Culture Liquid Fertilizers promotes a complete crop nutrient program, including micronutrients as needed. This experiment conducted in 1996 shows the benefits of micronutrient application, particularly Micro 500, with the regular planter fertilizer program. The regular program was 4 gal/A of Pro-Germinator 9-24-3 + 6 gal/A Sure-K. Field soil test micronutrient levels are in the following table.

Soil test micronutrient levels and interpretations			
zinc	2.2 ppm (low)	manganese	32 ppm (high)
iron	56 ppm (high)	copper	1.1 ppm (medium)
boron	0.4 ppm (low)		

With varying micronutrient levels, this appears to be a job for Micro 500. A comparison of several micronutrient applications, including dry (broadcast zinc oxysulfate for 2 lb/A of zinc) appear below. The regular planter fertilizer and nitrogen (36 gal/A of High NRG-N) program was the same for all treatments.



- Application of micronutrients did increase corn yield.
- Highest yield was from application of Micro 500, even though there was less zinc in Micro 500 than in the Zinc Flavonol. This shows the advantage of the synergism between the five nutrients in Micro 500.

Experiment: Effect of Micronutrient Addition to Corn Planter Fertilizer

Year: 2004 (04-06)

Date of Planting/Harvest: May 4 / November 6

Plot Size: 4 rows x 210 feet (5 replications)

The benefits of micronutrient application on corn yield have been well documented. Agro-Culture Liquid Fertilizers produces all the micronutrients necessary for optimum crop growth with the advantage of excellent compatibility with planter fertilizer Pro-Germinator 9-24-3 and Sure-K.

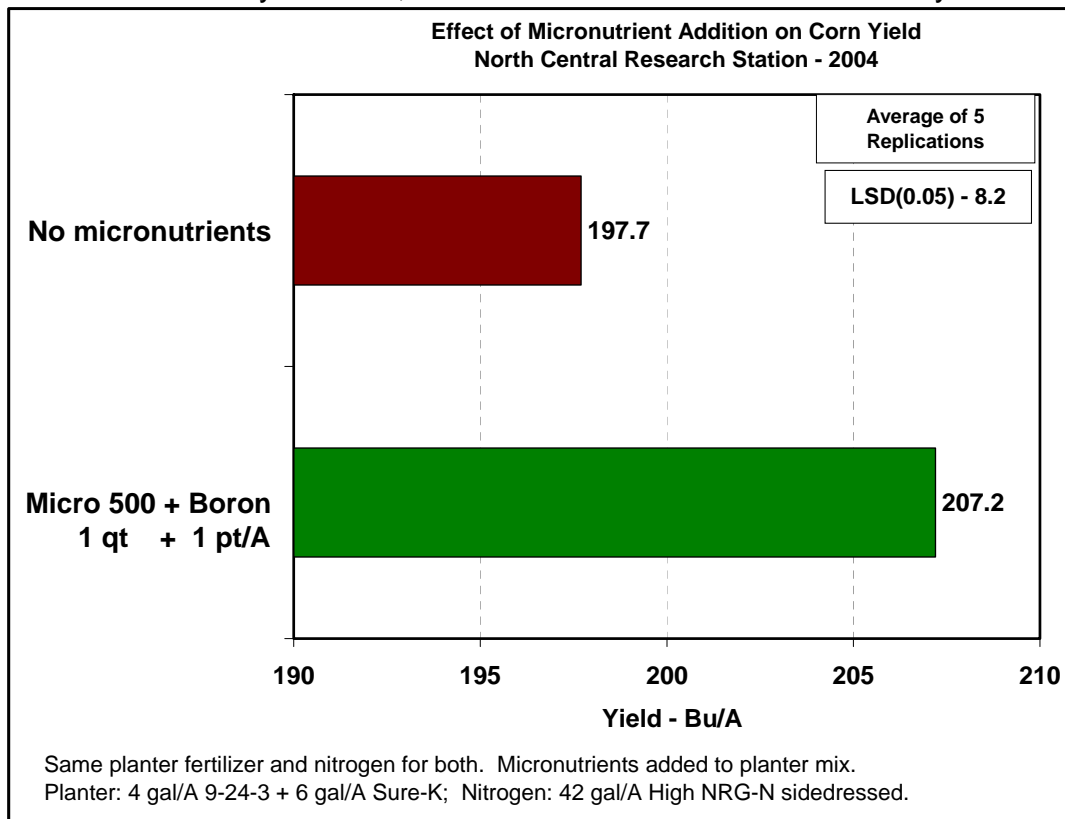
Objective:

Evaluate effect of micronutrient addition to planter fertilizer on corn yield.

The soil test in this particular field indicated low micronutrient levels:

Zinc: 0.5 ppm, Manganese: 10 ppm, Iron: 22 ppm, Copper: 0.4 ppm, Boron: 0.4 ppm

Micro 500 would have an excellent fit for this soil. However, due the low soil test for boron, an important corn nutrient, it would be advisable to combine a **1 qt/A Micro 500** application with a **1 pt/A application of Boron**. Based on a yield goal of 200 Bu/A, this micronutrient combination should be planter-applied with 4 gal/A of Pro-Germinator 9-24-3 + 6 gal/A of Sure-K, and 42 gal/A of High NRG-N applied at side-dress. The graph below shows the yield effects of this application either with or without the micronutrient combination. With a significant increase of nearly 10 Bu/A, the benefits of micronutrients are very clear.

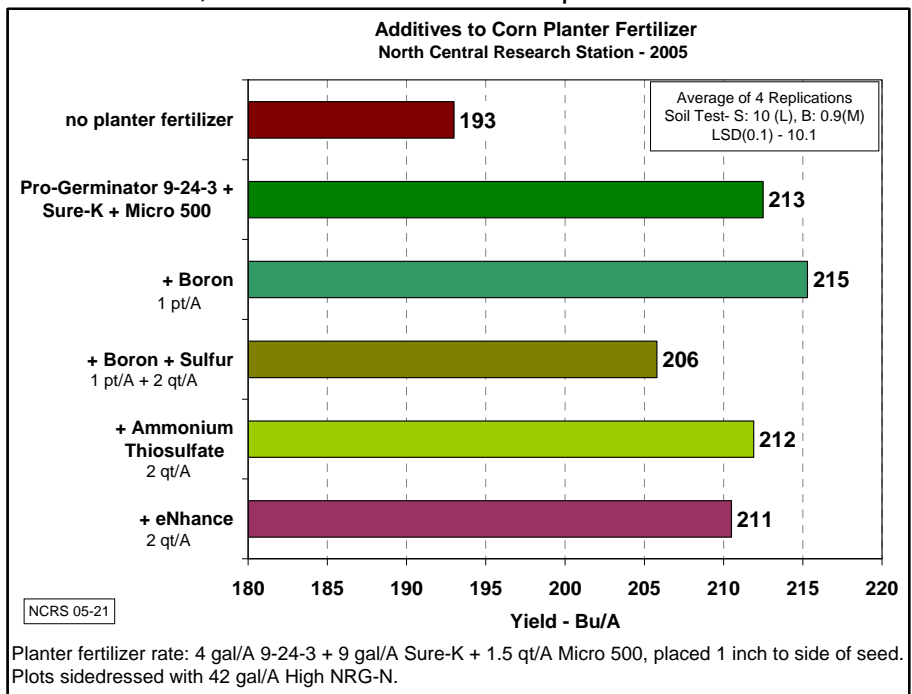


Experiment: Sulfur Addition to Corn Planter Fertilizer
Year (Experiment Number): 2005 (05-21)
Date of Planting/Harvest: May 10 / Oct. 27
Hybrid: Northrup King N43-C4
Plot Size (replications): 4 row x 130 ft. (4)
Previous crop: soybeans

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

Sulfur is an important nutrient for all crops, particularly corn. It is often an added input in planter-applied fertility programs. An experiment was conducted to determine effects on corn yield from several different sulfur fertilizer additions. This particular site was thought to be a good one for this test since the soil sulfur level was only 10 ppm, which is interpreted as low.

The same base fertilizer program was used for all treatments: 4 gal/A Pro-Germinator 9-24-3 + 9 gal/A Sure-K + 1.5 qt/A Micro 500 applied at planting an inch to the side of the seed. All plots were sidedressed with 42 gal/A of High NRG-N 38 days after planting. Additives tested were 6% Sulfur Flavonol, 5% Boron Flavonol (for comparison), eNhance (9% Sulfur) and ammonium thiosulfate (12-0-0-26S). The eNhance is not normally used as a planter-applied fertilizer, since it is designed for enhancement of conventional UAN solutions. But with a sulfur content of 9%, it was included in this experiment. Yield results appear in the following chart.



- Addition of sulfur to the standard planter fertilizer did not result in yield increase. (The Boron + Sulfur treatment yield, although lower, was not significantly so.)
 - The sulfur in the High NRG-N may have met the sulfur requirement by the corn.
- Regardless of lack of sulfur effect on yield, there was a significant effect of the planter fertilizer vs. no planter fertilizer.

Experiment: Manganese Fertilizer Applications on Corn
Year (Experiment Number): 2008 (08-101)
Date of Planting/Harvest: May 20 / October 20
Variety: DeKalb 5044
Plot Size (replications): 15 ft x 177/249 ft (2 replications)

Soil Test Levels	
pH: 6.9	C.E.C.: 6.9
OM: 1.7%	P1: 23 ppm
K: 122 ppm	Mn: 4 ppm

Objective: Determine if supplemental applications of Agro-Culture Liquid Fertilizer’s 4% Manganese fertilizer will have a positive effect on corn yield on a soil testing very low in manganese.

Previous research on soybeans at the North Central Research Station and elsewhere has shown a positive yield response with applications of Manganese, especially as a foliar application. However research has been limited in producing similar effects on corn. An experiment was conducted with corn in a soil testing very low in manganese to measure yield responses to planter and foliar applications of manganese.

Planter-applied treatments: In-furrow application of 2 gal/A of Pro-Germinator + 5 gal/A Sure-K + 2 qt/A Micro 500 with and without 2 qt/A Manganese.

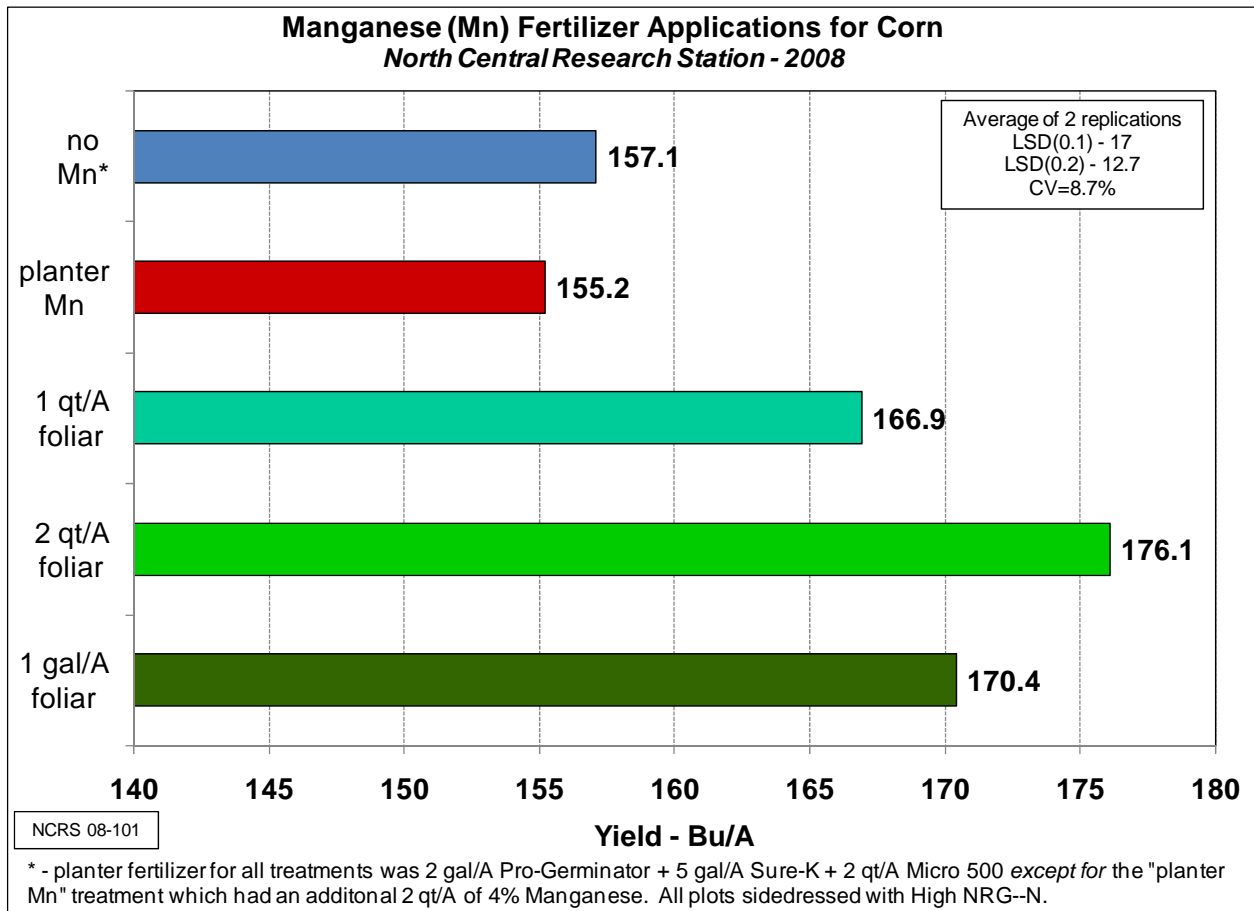
Foliar applications: Foliar applications were made on July 9 when the corn was in the V9 stage of growth and approximately 5 feet tall (see picture). Applications were made with a high clearance sprayer at a total spray volume of 10 gal/A. Manganese rates of application were 1qt, 2qt, and 1 gal/A.



Leaf samples were collected 2 days before and 19 days after foliar application and submitted to Midwest Labs for tissue analysis of manganese. Tissue analysis results for ppm manganese appear in the following chart.

Leaf tissue manganese (ppm) before and after application		
RATE	before	after
0	24	44.5
1 qt	21.5	53.5
2 qt	25	52.5
1 gal	18.5	107.5
(data average of 2 replications)		

There was a strong response in leaf tissue manganese from the 1 gal/A rate. This level was twice that of the other two rates of applied manganese, and response numbers were consistent across the two replications. As you could imagine, we were anxious for harvest and the anticipated high yield in response to the elevated manganese tissue level. Sadly, this was not the case, as shown in the yield chart.



- Foliar application of 2 qt/A Manganese significantly out-yielded the no foliar treatments.
- Despite the high leaf tissue manganese levels obtained with the 1 gal/A application, the resulting yield was not significantly different than the two lower rates of application.
- Addition of 2 qt/A of Manganese to the planter fertilizer did not result in higher yield.
- Foliar applications may be a suitable method of applying manganese to corn in soils with low manganese levels.
- It is not known if there is a potential for manganese interaction in corn with glyphosate herbicide as has been reported in soybeans by some researchers. But this would be a good topic for further investigation.

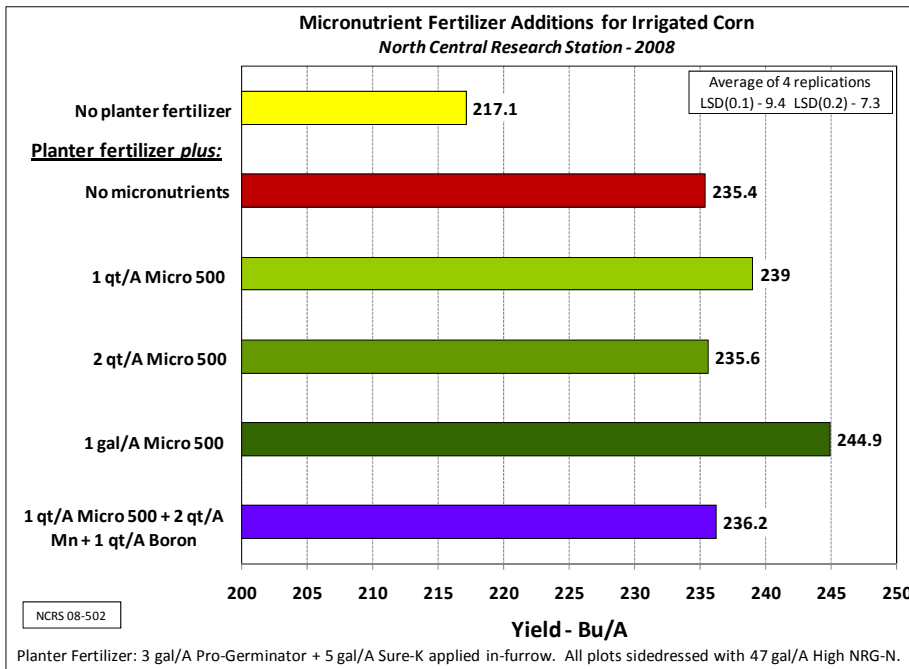
Experiment: Micronutrient Programs for Corn
Year (Experiment Number): 2008 (08-502)
Date of Planting/Harvest: May 5 / October 16
Variety: DeKalb 4660
Plot Size (replications): 15 ft x 90 ft (4 replications)

Soil Test Levels (ppm)
 pH: 7.0 C.E.C.: 11.1
 OM: 3.1% P1: 18 ppm
 K: 52 ppm (1.2% B.S.)
Micronutrients (ppm):
 Zinc: 1.1; Mn: 2; Iron: 63
 Copper: 0.9; Boron: 0.7

Objective: Determine optimal Agro-Culture Liquid Fertilizers micronutrient application for corn growing in soil with low micronutrient soil test levels.

Micronutrients are an important, but often overlooked part of complete nutrient balance for growing crops. Agro-Culture Liquid Fertilizers produces the highest quality and most usable formulations of micronutrients available today. This experiment was established in an area known to have low soil test levels for all micronutrients except iron, which tested high. Treatments were established to see if 1.) there would be a yield response to increased application rates of Micro 500 and, 2.) if there would be a yield response to supplementation of Micro 500 with additional individual micronutrient products Manganese and Boron. This irrigated field was in sugarbeets in 2007.

The STEF program (based upon the *Tri-State Fertilizer Recommendations*) for a 210 Bu/A yield goal calls for 260-33-172 lb/A of N – P₂O₅ – K₂O plus 6 lb/A manganese, 2 lb/A zinc and 1 lb/A boron. As part of the potassium requirement, a pre-plant broadcast application of 200 lb/A of 0-0-62 was applied and incorporated. A base planter program of 3 gal/A Pro-Germinator + 5 gal/A Sure-K was applied in-furrow, and plots were sidedressed with 47 gal/A of High NRG-N on June 12. Yield data appears in the following chart.



- Corn yield responded strongly to the application of planter fertilizer, with an 18+ Bu/A response in these conditions.
- Of the micronutrient treatments, only the 1 gal/A rate of Micro 500 yielded significantly higher than the no micronutrient treatment. This is a much higher rate of application than the normal 1 to 2 qt/A. However, for yields this high, and I consider 245 Bu/A high, then higher rates may be required.
- Addition of manganese and boron separately did not enhance performance of Micro 500.



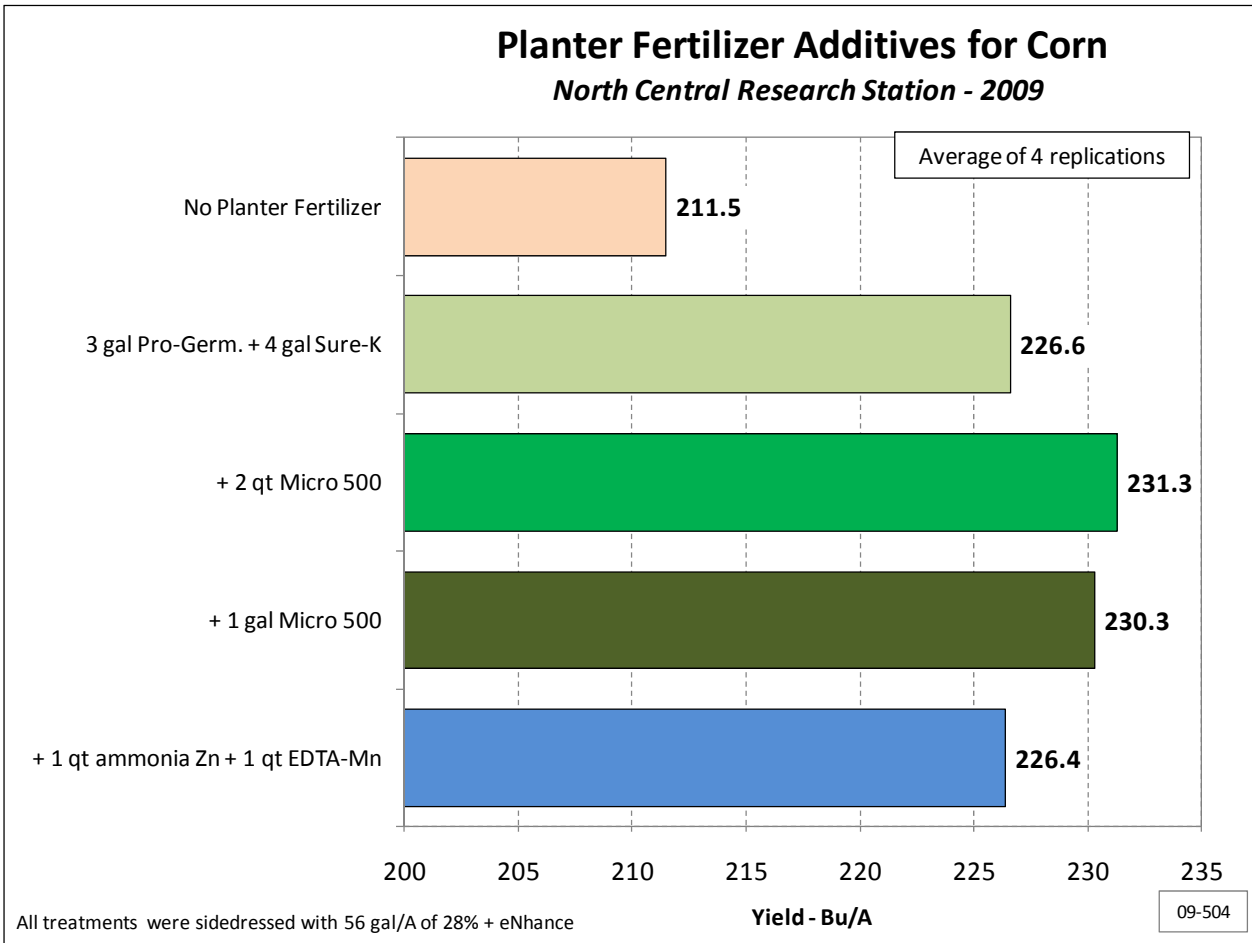
Experiment: Planter Fertilizer Micronutrient Additives (09-504)

Planted: 5/5/09	Hybrid: DKC46-60	Population: 36,000
Plot Size: 15' x 115'	Replications: 4	Harvested: 11/3/09
Sidedress: 6/5/09		

Soil Test Values (ppm):													
pH	CEC	% OM	Bicarb	K	S	% K	% Mg	% Ca	% H	% Na	Zn	Mn	B
7.3	7.7	2	23	107	9	3.6	25.3	70.4	0	0.7	1.1	9	0.5

Objectives: Measure the effects of micronutrient additives (as Micro 500) to in-furrow planter fertilizer. This soil tests fairly low in soil micronutrient levels. A micronutrient source from another supplier was included for comparison: ammonium zinc (16% N, 20% zinc) and manganese

Results:



LSD(0.01):13.4; (0.2): 5.9. CV: 4.3%

Conclusions:

- All planter-applied fertilizers resulted in a highly significant yield increase compared to no planter fertilizer.
- Highest yield was with the 2 qt/A addition of Micro 500 to the planter fertilizer which resulted in an average yield increase of 4.7 Bu/A compared to no micronutrients. The 1 gallon rate did not result in higher yield.

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