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Zinc Fertilization of Corn - 2007 (Lexington, KY)

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Soils in the central and outer Bluegrass Region of Kentucky were formed in residuum of phosphatic limestone and are, therefore, naturally high in available phosphorus (P). These soils are also medium to low in available zinc (Zn). Because P and Zn are physiologically antagonistic, Zn uptake is suppressed when soil P levels are high. For these reasons, Zn fertilizer is often recommended for corn (the most responsive crop) grown in this region. With the availability of new Zn fertilizer products and potential placement strategies, there is a need for additional research.

This study was initiated in the spring of 2007 to investigate corn response to Zn fertilizer source, placement and rate.

Materials and Methods

The study was conducted on a Maury silt loam (fine, mixed, semiactive, mesic Typic Paleudalfs) located at the Spindletop Research Farm north of Lexington, Kentucky. Soil test data for samples collected in the spring, prior to planting, indicated that the soil pH was 6.8 and Mehlich III extractable P and Zn were 118 and 1.9 lbs/acre, respectively. University of Kentucky fertilizer recommendations called for either 10-15 lbs Zn/acre broadcast applied, or 2-3 lbs Zn/acre banded near the row. This study was designed to compare a new Zn fertilizer product called Wolf Trax to other fertilizer sources that are currently being used. In all treatments (Table 1), Zn fertilizer was applied either just before or during planting, and each treatment was replicated 4 times. Wolf Trax is a very finely powdered 62% Zn fertilizer that is designed to be applied as a seed coating (8 oz per 100 lbs of seed) or blended with the fertilizer (2.9 oz in place of each lb of zinc sulfate recommended by soil test). A sticking agent was used to apply twice the recommended rate of Wolf Trax Zn to the seed in treatment 2. For treatments 4 and 5, fertilizer was applied in the row through a Keeton seed firmer. A uniform rate of nitrogen, as urea, was added to all plots. A side-dress N application was made at V6 to insure adequate N nutrition (total of 180 lb N/acre).

Table 1. Treatment structure of the study.

Treatment #	Fertilizer Zn Source	Placement	Rate lb Zn/acre
1	Wolf Trax DDP	Seed	0.05
2	Wolf Trax DDP	Seed*	0.10
3	Wolf Trax DDP	Mixed with Urea - Broadcast	2.50
4	Liquid Zn EDTA	In-row	2.00
5	Liquid Zn EDTA	In-row	4.00
6	ZnSO4	Mixed with Urea - Broadcast	12.00
7	ZnSO4	Mixed with Urea - Broadcast	24.00
8	Control		0.00

* This treatment is twice as high as what is recommended by the manufacturer and was achieved using a sticking agent.

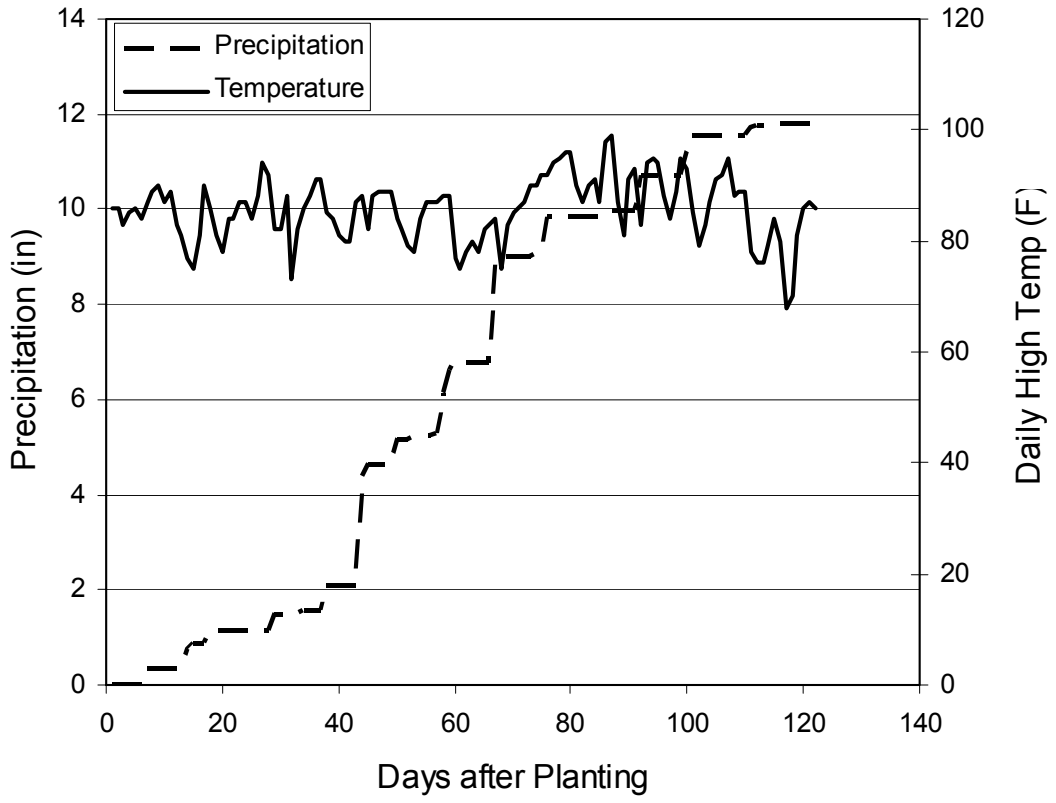


Figure 1. 2007 seasonal weather data at the experimental site.

Results and Discussion

At 14 days after planting the emerged plant population was unaffected by treatment (Table 2). The Zn tissue concentration at V3 (3 leaf stage) and V6 (6 leaf stage), as well as Zn uptake, can be found in Table 2 and 3. For the V3 sampling time, tissue Zn concentrations were significantly affected by three of the Zn treatments. Wolf Trax applied to the seed at twice the recommended rate produced the statistically highest tissue Zn concentration at V3. Wolf Trax seed treatment at the standard rate and the high rate of in furrow Zn EDTA produced the next highest tissue concentrations, while all of the other treatments were not significantly different from the control. Dry matter and Zn uptake at the V3 stage were not significantly affected by the different treatments, however it did seem as though the fertilizer applied Wolf Trax might be inferior to the other treatments in terms of dry matter and Zn uptake. This result may be due, in part, to the dry weather during the early growth period. At a latter stage of growth (V6) the treatments did not significantly affect any of the measured parameters (Table 3).

Yields were surprisingly high, given the severe early-season moisture stress. The plants likely survived on stored soil profile moisture. Yield, grain moisture and test weight were not affected by any fertilizer treatment (Table 3).

Table 2. Plant population and V3 tissue dry matter, Zn concentration and Zn uptake for the different Zn sources (averaged over Zn rates).

Treatment				V3		
Source	Placement	Rate	Population	Dry Matter	Tissue Zn	Zn uptake
		lb Zn/acre	Plants/acre	lbs/acre	ppm	g/acre
Wolf Trax DDP	Seed	0.05	29400	12	28	0.16
Wolf Trax DDP	Seed	0.1	27900	15	34	0.23
Wolf Trax DDP	Fertilizer	2.5	27400	9	24	0.11
Zn EDTA	In-row	2	28100	14	24	0.16
Zn EDTA	In-row	4	28700	14	28	0.18
ZnSO4	Broadcast	12	27400	14	24	0.16
ZnSO4	Broadcast	24	29400	14	26	0.17
Control		0	28700	17	25	0.20
	Protected LSD ($p \leq 0.1$)		NS	NS	2.1	NS

NS - Not significant

Table 3. V6 tissue dry matter, Zn concentration and Zn uptake for the different Zn sources (averaged over Zn rates).

Treatment			V6		
Source	Placement	Rate	Dry Matter	Tissue Zn	Zn uptake
		lb Zn/acre	lbs/acre	ppm	g/acre
Wolf Trax DDP	Seed	0.05	193	18	1.58
Wolf Trax DDP	Seed	0.1	159	18	1.30
Wolf Trax DDP	Fertilizer	2.5	170	18	1.43
Zn EDTA	In-row	2	168	18	1.42
Zn EDTA	In-row	4	168	20	1.49
ZnSO4	Broadcast	12	193	17	1.52
ZnSO4	Broadcast	24	201	19	1.72
Control		0	195	18	1.63
	Protected LSD (p≤0.1)		NS	NS	NS

NS - Not significant

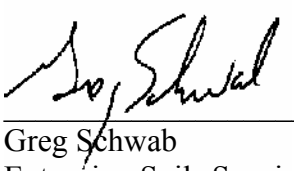
Table 4. Grain yield, moisture and test weight for the Zn treatments.

Treatment					
Source	Placement	Rate	Yield	Moisture	Test Weight
		lb Zn/acre	bu/acre	%	lbs/bu
Wolf Trax DDP	Seed	0.05	149	21	53
Wolf Trax DDP	Seed	0.1	153	20	53
Wolf Trax DDP	Fertilizer	2.5	160	20	54
Zn EDTA	In-row	2	168	21	53
Zn EDTA	In-row	4	153	20	54
ZnSO4	Broadcast	12	159	20	54
ZnSO4	Broadcast	24	159	21	53
Control		0	159	21	53
	Protected LSD (p≤0.1)		NS	NS	NS

NS - Not significant

Conclusions

The severe early-season drought suggests that agronomic conclusions from this study are limited. Wolf Trax Zn DDP applied to the seed at the recommended rate and at twice the recommended rate and 4 lb Zn/acre applied as Zn EDTA in the row increased the V3 tissue concentration of Zn, but this increase did not result in higher Zn uptake or dry matter accumulation (compared to the control). Soil test P and Zn levels indicated that this site should have been responsive to Zn fertilization, but none of the Zn fertilizer treatments increased yield. This indicates that water, rather than Zn, was the likely corn growth limiting factor at the study site. The study should be repeated to determine Zn fertilizer source/placement/rate effects under better corn growing conditions.



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