CAMERON CHEMICALS INC.

Cameron Chemicals, Inc.

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#5 Beechwood Court • Portsmouth, Virginia 23702 Phone: 757-487-0656 Fax: 757-487-1280

Zinc Sources

Research Questions

Which is the best zinc source, a sulfate, an oxysulfate? Does the quality of the zinc materials make a difference?

Research Objectives

Does the source of zinc affect the yield? Does the application of zinc on crops with adequate zinc test levels but having elevated phosphate levels produce yield responses?

Previous Investigations

Several studies on the availability of various zinc sources have been conducted in replicated field studies and limited greenhouse environments. Earlier green house studies utilized various ratios of finely ground Zinc oxides and Sulfates which indicated that 35% of the zinc source should be in the soluble form. A more recent greenhouse study using a zinc sulfate with two sources of homogenous zinc oxysulfate products also suggest that water solubility of zinc can be a factor in correcting a zinc deficiency in high pH soils. Other researchers have conducted replicated field trials in Nebraska on high pH soils. The study was conducted as a broadcast application at several locations with mixed fertilizers. The study indicated that the source of zinc has little effect on plant uptake or yield. Very few studies have been conducted with zinc containing fertilizers on soils classified as not zinc deficient and its relationship to yield.

Study Description

This study examines an application of zinc on corn as a treatment for producing higher corn yields versus no treatment. Two zinc formulations were evaluated over a five year period, in replicated plots from 1994 to 1998 at Arise Research & Discovery, Inc. in Martinsville, Illinois. This test was designed to study a one hundred percent water soluble form of zinc versus a homogenous zinc oxysulfate source. The plots were replicated using a randomized complete block with a latin square configuration. The objective of this experiment is to examine the availability of zinc oxysulfate versus sulfate products.

Study Results

Data collected to date indicates that the application of zinc has produced significant yield increases over untreated plots. The untreated plots averaged 146.43 bushel per acre, the zinc sulfate plots averaged 156.91 bushel per acre and the zinc oxysulfate plots averaged 167.07 bushel per acre.

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Zinc Sources
Continued

Soil Plant Nutrient Interactions

The soil, plant interaction with plant nutrients is complicated. Soils consist of solid, liquid and gaseous states. The chemical and physical composition of soils and plant nutrients is diverse and in a constant state of dynamic change due to biological, chemical and gravitational influences. Micronutrients are very diverse and active due to the metallic state of each element. The positive charged micronutrients are taken up by the plant in only the elemental state. Zinc is taken up as the Zn++ form and generally only 10% of Zinc is found in the soluble or extractable form at any one time. The soil environment will always move towards equilibrium with elements constantly moving from unavailable to available form. Studies on the uptake of zinc in corn has shown that the plant takes up the zinc in very small quantities but needs to be in an extractable form throughout the growin g season. California studies have indicated that zinc cations do not move in the soil profile. The plant's newly formed root hairs must directly intercept with the zinc source regardless of the form found in the soil.

Discussion

The application of zinc, regardless of the chemical form, produced consistent increases in yield over untreated plots. The application of the zinc oxysulfate consistently outyielded the zinc sulfate application by an average of ten bushel per acre. Tissue analysis indicated that either form of zinc produced no significant difference in zinc levels at the four leaf stage. At both the six and ten leaf stage, a higher level of zinc was found in the oxysulfate treatment. Economic analysis gives significant advantages to the oxysulfate formulation.

Conclusions

Data is indicating the reason for the increase in yield of the zinc oxysulfate treated crops over the zinc sulfate application is a combination of hybrid interaction to the extended availability of the zinc. Zinc oxysulfate provides sufficient availability of zinc for immediate plant uptake with extended zinc availability throughout the growing season. Zinc applications, in either form, offer an economical and viable return on investments.

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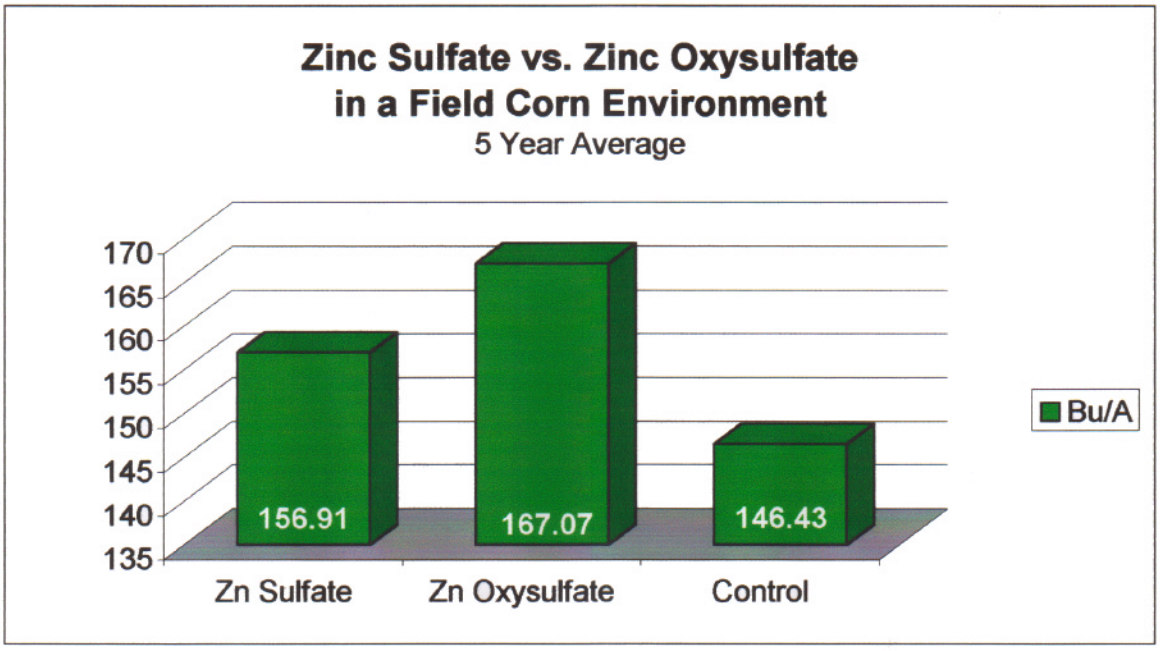
Corn Study Plot Data

Treatment	Form	Rate	Unit	Plot	1994	1995	1996	1997	1998*	Average
Zn Sulfate	31	30	LB/A	101	158	144.5	154.7	176.3	139.6	154.62
Phosphorus	1152	150	LB/A	201	155.5	145.5	154.9	186	154.3	159.24
Potassium	60	200	LB/A	301	160.5	150.5	149.8	193.2	143.5	159.5
Urea	4600	250	LB/A	401	156	159	147.8			154.27
				Average	157.5	149.9	151.8	185.2	145.8	156.91
Zn Oxysulfate	31	30	LB/A	102	178.5	156.5	160.3	197.3	148.3	168.18
Phosphorus	1152	150	LB/A	202	177	152	160.5	184.5	150.2	164.84
Potassium	60	200	LB/A	302	174.5	167	158	190.2	144.1	166.76
Nitrogen	4600	250	LB/A	402	179.5	166.5	159.5			168.5
				Average	177.4	160.5	159.6	190.7	147.53	167.07
Control				103	146	152	146.5	184.1	139	153.52
Phosphorus	1152	150	LB/A	203	142	148	145.3	184	142.4	152.34
Potassium	60	200	LB/A	303	149	151	147	184.9	137.3	133.84
Nitrogen	4600	200	LB/A	403	142	147	149			146
				Average	144.8	149.5	146.95	184.3	139.57	146.43

*In 1998 One replication was eliminated due to water damage.



Source: Arise Research & Discovery