Including Zinc and Sulphur in Starter Fertilizer Blends for Corn: 2012 Summary

Purpose:

Work on micronutrient fertilizer response in corn has been neglected, despite the fact that micronutrients are expected to suffer from the same issues as P and K; decreases in soil quantities due to increasing yields over time, and in the case of sulphur, decreasing deposition. In response to these developments, this project is building on previous starter fertilizer research by evaluating corn yield response and economic returns to the application of sulphur and zinc through pre-manufactured micronutrient starter blends as well as traditionally starter fertilizer sources. It is also examining the importance of including potassium in sulphur and zinc fertilizer blends.

Methods:

Starter fertilizers were evaluated on eleven sites in 2012. Six of the sites were "farmer" starter fertilizer sites where only the core starter fertilizer blends investigating the relative importance of phosphorous, sulfur, zinc and potassium nutrition in dry starter fertilizer blends were investigated. The remaining five sites were "intensive" sites which investigated the contributions of the previously mentioned core starter fertilizer blends as well as some other dry/liquid fertilizers, and alternative placement options towards increasing corn productivity. When included in dry fertilizer blends, nutrients were applied at rates providing 12 lb-N/ac, 40 lb-P_2O_5/ac, 30 lb-K_2O/ac, 10 lb-S/ac, and 1 lb-Zn/ac, all applied in a 2"x2" band. In some trials the product MESZ (Micro Essentials Sulphur Zinc) was used to provide the combined N,P,S, and Zn fertilizer. In other treatments mono-ammonium phosphate (MAP) was used and blended with other sources of K, S, and Zn. Liquid fertilizer treatments consisted of 6-24-6 which was applied at 5 gal/ac in-furrow. During the growing season, plant tissue samples were taken from the "farmer" sites to evaluate crop nutrition and the relationship between critical concentrations and yield response potential at these sites. When interpreting results, means followed by the same letter are not significantly different at the 5% level.

Results:

Soil test results for the 2012 corn starter locations are summarized in Table 1, and ranged from highly responsive to rarely responsive for both phosphorous and potassium.

Table 1. Soil test results for eleven sulphur and zinc starter fertilizer trial locations in Ontario, 2012

Trial Type	Location	Soil pH	Organic Matter	Phosphorous Soil Test (ppm)	Potassium Soil Test (ppm)
Intensive Trials	Alma	6.9	4.6	35	115
	Elora	7.5	3.4	9	55
	Bornholm	7.4	3.8	20	90
	Lucan	6.8	3.9	9	96
	Strathroy	5.7	2.5	11	83

Farmer Trials	Wallacetown	6.1	3.1	9	83
	Drumbo	6.6	2.8	29	139
	Paris	6.3	2.6	11	82
	Highgate	6.2	3.9	8	120
	Chatham	5.7	4.9	15	176
	Ridgetown	6.4	3.3	20	141

Yield results for the "intensive" starter fertilizer trials were averaged across all five locations, and are presented in Table 2**.**

Table 2. Average corn yields and yield responses to starter fertilizer across the five "intensive" starter trials in Ontario, 2012

Treatment†	**All Sites**	**Yield Response**
	--------- bu/ac ---------	
1) Control	145 c	-
2) MAP	156 b	11
3) MAP+S	153 b	8
4) MAP+S+Zn (or MESZ)	156 b	11
5) MAP+S+Zn+K (or MESZ +K)	163 a	18
6) 6-24-6 @ 5 gal/ac	155 b	10
7) 6-24-6 @ 5 gal/ac + K	163 a	18

† In treatments 2,3,4 and 5 where included, nutrients were applied at rates providing 12 lb-N/ac, 40 lb-P_2O_5/ac, 30 lb-K_2O/ac, 10 lb-S/ac, and 1 lb-Zn/ac

When yields were averaged across all intensive sites, significant increases in corn yields were observed for all starter fertilizers. Inclusion of sulfur and zinc did not appear to produce yield responses greater than that of MAP alone. The highest yield responses appeared to be associated with starter fertilizers which included potassium (MAP + S + Zn + K, and 6-24-6 + K), which appeared to be significantly higher than the control and all other starter fertilizer treatments.

The influence of the placement of starter fertilizer blends containing S and Zn was investigated at four of the intensive sites where the MAP + S + Zn treatment was applied as the standard 2X2 band, and also as a split in-furrow and 2X2 application delivering the same overall rates as outlined previously**.** When averaged across all sites, no significant increase in yield was observed for delivering part of the fertilizer blend in-furrow. (Table 3**)**

Table 3. Corn yield response to split-application in furrow and 2x2) versus 2x2 only of MAP + S + Zn starter fertilizer across four intensive starter fertilizer sites in Ontario, 2012

Treatment	All Sites	Yield Response
	---------- *bu/ac* ----------	
MAP+S+Zn (2x2 only)	154 a	-
MAP+S+Zn Split	158 a	4

As a result of poor growing conditions, harvest data from the Drumbo "farmer" trial was highly variable and was dropped from the analysis. Yield results for the "farmer" starter fertilizer trials were averaged over all locations, and are presented in Table 4.

Table 4. Average corn yields and yield responses to starter fertilizer across the five "farmer" starter trials in Ontario, 2012

Treatment†	Yield	Yield Response
	---------- *bu/ac* ----------	
Control	165	-
MAP	173	8
MAP+S	167	2
MAP+S+Zn	164	-1
MAP+S+Zn+K	169	4

† Where included, nutrients were applied at rates providing 12 lb-N/ac, 40 lb-P_2O_5/ac, 30 lb-K_2O/ac, 10 lb-S/ac, and 1 lb-Zn/ac

When yields were averaged across all farmer sites, no significant increase in corn yields was observed for any starter fertilizer treatments. Inclusion of sulfur, zinc or potassium into starter fertilizer blends did not provide any significant benefits above MAP in 2012.

When corn tissue nutrient concentrations were averaged across all farmer sites, all nutrients appeared to range from slightly below to well above critical concentrations (Table 5), suggesting that on average yield responses to these nutrients may not be expected. Average tissue P concentrations were slightly lower than critical at the vegetative stage, while average yield response to starter P was significantly positive. Average tissue Zn concentrations at tasseling were at critical concentrations, but no yield enhancements were observed for including Zn in MAP starter blends.

Table 5. Critical Corn Tissue Nutrient Concentrations and Average Corn Tissue Nutrient Concentrations for Control and MAP + S + Zn + K Treatments Across Six "Farmer" Trial Locations (2012)

	Critical	Average Control	Average MAP + S + Zn + K
	-------- Concentrations at Vegetative Stage --------		
Tissue P (%)	0.35	0.34	0.34
Tissue Zn (ppm)	20	33	35
	-------- Concentrations at Silking Stage --------		
Tissue P (%)	0.28	0.50	0.49
Tissue K (%)	1.2	3.4	3.5
Tissue Zn (ppm)	20	20	19
Tissue S (%)	0.14	0.18	0.19

Summary:

Overall, these results appear to support the requirement for addressing proper P and K nutrition in corn, particularly at sites with low soil tests. No enhanced yield responses to including S and Zn in starter fertilizer blends was observed at these sites in 2012. Split applying the N, P, S and Zn starter blend through banding and in-furrow did not provide a significant yield response over banding alone. On average, plant tissue P at the "farmer" sites was at the critical concentration at the vegetative stage, while tissue Zn was at the critical concentration at silking. A yield response was observed to MAP starter fertilizer while no response was observed for starter including Zn.

Next Steps:

This was the first year of a two year project. Similar fertility and placement treatments will be conducted in 2013 at five intensive starter and six farmer starter locations.

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