EXAMINATION of PHOSPHORUS STARTER FERTILIZERS, RATES and ADDITIVES

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Introduction

Low rates of phosphorus (P) fertilizers applied with the seed has been shown to be as effective in achieving maximum yields in sugarbeet production in the Red River Valley of Minnesota and North Dakota (Sims and Smith, 2002; 2003). Although the original studies were conducted using ammonium polyphosphate (10-34-0), and host of other products and additives that claim enhanced P availability have emerged into that market. The objective of this experiment was to examine starter P sources and additives to determine if additional benefits could be gained from their general use.

Materials and Methods

A field experiment was established on a Glyndon very fine sandy loam soil on the Rhizomania Research Site southeast of Glyndon, MN. The experimental design was a randomized complete block design with eighteen treatments and four replications. Individual plots measured 11 feet wide and 30 feet long.

Following soil sampling and analysis, urea was applied to the entire plot area to achieve a total available N level of between 120-130 lb N/acre as residual soil N and supplemental urea. Potassium fertilizer was also applied to the plot area at a rate of 100 lb/acre 0-0-60 using a 6-foot drop spreader.

The sugarbeet variety Seedex Alpine, (rhizomania resistant variety) was planted on May 08, 2006 with a John Deere MaxEmerge 2. Sugarbeet seed was placed 1.25 inches deep with 5-inch in-row spacing. Row spacing was 22-inches. Counter 15G was surface-band applied at 11.9 lbs/a, and incorporated with a drag chain at planting. Four
postemergence micro-rate herbicides, two cultivations and hand labor was used as needed for weed control. Three fungicide applications, Eminent, Supertin and Headline were applied for Cercospora leafspot control.

The treatments are as follows- all treatments were applied in furrow at seeding unless otherwise indicated-

Check- no supplemental P, broadcast or banded.
10-34-0 at 1 gal/acre
10-34-0 at 2 gal/acre
10-34-0 at 3 gal/acre
10-34-0 at 3 gal/acre + ACA Plus @ 32 oz/acre
10-34-0 at 3 gal/acre (in-furrow) + Awaken post-applied
10-34-0 at 3 gal/acre (in-furrow) + Radiate@2oz/acre post-applied
10-34-0 at 3 gal/acre (in-furrow) + 60 lbs P_2O_5 as 0-46-0
10-34-0 at 1 gal/acre + Avail 1.5% v/v
10-34-0 at 2 gal/acre + Avail 1.5% v/v

10-34-0 at 3 gal/acre + Avail 1.5% v/v
Riser R 7-17-3 at 2.5 gal/acre
Awaken at 2 qt/acre
6-22.5-0 + Humate
6-22.5-0 + Humate + ACA Plus
Nutra Flow 6-26-6 at 3 gal/acre
Nutra Flow 6-26-6 at 5 gal/acre
Broadcast P at 60 lbs P_2O_5 as 0-46-0

Harvest was conducted September 27, 2006. The middle two rows of each 6 row plot were harvested. Yield determinations were made and quality analysis performed at American Crystal Sugar Quality Tare Lab, East Grand Forks, MN.

Results and Discussion

The Nutra Flow @ 5 gpa, 10-34-0 @ 2 gpa, and 6-22.5-0 + humate treatments had the lowest early stand counts as well as the fewest beets per 100 ft. of row at harvest (Table 1). Nutra Flow @ 5 gpa may have caused some reduced emergence of sugarbeet plants due to higher than recommended rate of N in the treatment. We have no explanation why stand in the 2 gpa 10-34-0 treatment also had lower emergence, while the 3 gpa treatment did not. The 6-22.5-0 with the added humate treatments also had lower stand, but this was most likely caused by the interference of the product in the flow of the starter. The humate material tended to clump into diffuse masses of brown organic materials. Within about 10 feet, starter nozzles began to plug, necessitating stopping in the middle of the plot and cleaning the nozzles out. It is likely that some rows either received no starter in places, or too much in others as a result. Based on our experiences, due to the physical difficulties in using this material as a row starter, we would not recommend that growers use it for that purpose.

There was a large decrease in harvested beets (approximately 22% stand loss) from when the early emergence counts were taken. Rhizoctonia root rot disease and sand syndrome effect moved into the plots late summer (especially replications 2 and 4) and may have had an impact on stand.

The application of starter fertilizer resulted in a significant increase in sugar production with several of the treatments over the untreated check (Table 2). The 10-34-0 @ 2 gpa treatment plus Avail was the best treatment for yield, recoverable sugar per acre, gross $ return per acre and near the top in most of the other yield parameters. The untreated check and 10-34-0 + Radiate post-applied treatment were at or near the bottom in yield, recoverable sugar per acre, and gross $ return per acre. Although most treatments were not significant from one another, up to 3 tons yield, 1277 lbs. recoverable sugar per acre, and 181 gross, dollar return per acre was realized with the use of some treatments. Use of traditional 10-34-0 and Nutra Flow treatments @ 3gpa alone or in combination with other amendments, seem to provide higher yields, recoverable sugar per acre, and gross $ return per acre.

Table1. Effect of starter fertilizer and additives on sugarbeet emergence and harvest. Glyndon, MN, 2006.

TREATMENT	EMERGENCE BEETS /100 FT	HARVEST BEETS /100 FT	Vigor Ratings June 8
Check	184 a	145 b	2.5 a
10-34-0 @ 3 g/a	174 ab	136 ab	3.0 ab
RiserR 7-17-3 @ 2.5 g/a	190 a	149 b	3.8 b
10-34-0 @ 3 g/a +ACA Plus @ 32 oz	189 a	144 b	3.7 b
Awaken @ 2 qt/a	189 a	143 b	3.6 b
6-22.5-0 + Humate	164 b	127 a	3.2 ab
6-22.5-0 + Humate + Aca Plus	166 b	135 ab	3.8 b
10-34-0 + Awaken @ Post Applied	174 ab	133 ab	2.5 a
10-34-0 + Radiate Post Applied	170 ab	123 a	2.9 ab
10-34-0 @ 1 g/a	176 ab	130 ab	3.5 b
10-34-0 @ 2 g/a	164 b	125 b	3.0 ab
10-34-0 1 g/a + Avail	174 ab	136 ab	3.5 b
10-34-0 @ 2 g/a + Avail	171 ab	137 ab	3.3 ab
10-34-0 @ 3 g/a + Avail	176 ab	139 b	3.8 b
Nutra Flow @ 3 g/a	172 ab	136 ab	3.4 ab
Nutra Flow @ 5 g/a	165 b	124 a	3.5 b
10-34-0 @ 3 g/a + Brdcst P @ 60 lb/a	172 ab	132 ab	3.0 ab
Broadcast P @ 60 lb/a	186 a	150 b	3.4 ab
LSD (.05)	18	14	1.0
Mean	175	136	3.5

Table2. Effect of starter fertilizer and additives on sugarbeet root yield, sucrose percentage, recoverable sugar production, harvest population and gross $ return. Glyndon, MN. 2006.

Treatment	Root Yield Tons/A	Net Sucrose Percent	Rec Sugar Lbs/Acre	Rec Sugar Lbs/T	Harvest Beets /100 FT	Gross Return $/A	Gross Return $/T
Check	25.6 a	14.6 a	7556 a	292 c	145 b	962.28	37.59
10-34-0 @ 3 g/a	29.1 b	14.5 a	8363bc	290bc	136 ab	031.85	35.46
RiserR 7-17-3 @ 2.5 g/a	31.1 bc	14.8 a	9041 d	296 d	149 b	1111.89	35.75
10-34-0 @ 3 g/a +ACA	28.5 ab	14.8 a	8434bc	296 d	144 b	1143.11	40.11

Plus @ 32 oz							
Awaken @ 2 qt/a	29.6 b	14.6 a	8609cd	283 a	143 b	1030.06	34.80
6-22.5-0 + Humate	31.8 bc	14.2 a	8969 d	292 c	127 a	1038.46	32.66
6-22.5-0 + Humate + ACA Plus	31.6 bc	14.6 a	9092 d	291bc	135 ab	1060.02	33.54
10-34-0 + Awaken @ Post Applied	29.9 b	14.4 a	8515 cd	288 b	133 ab	1061.41	35.50
10-34-0 + Radiate Post Applied	26.5 ab	14.6 a	7820 ab	292 c	132 a	882.32	33.30
10-34-0 @ 1 g/a	29.6 b	14.5 a	8614 cd	291 b	130 ab	1041.27	35.18
10-34-0 @ 2 g/a	29.9 b	14.7 a	8884 d	293 c	125 b	1039.38	34.76
10-34-0 1 g/a + Avail	29.1 b	14.5 a	8454 c	291 b	135 ab	1045.66	35.93
10-34-0 @ 2 g/a + Avail	33.5 c	14.9 a	9982 e	297 d	137 ab	1250.70	37.33
10-34-0 @ 3 g/a + Avail	29.4 b	14.1 a	8265 bc	282 a	139 b	1006.13	34.22
Nutra Flow @ 3 g/a	30.3 bc	14.4 a	8649 cd	289 bc	136 ab	1112.80	36.72
Nutra Flow @ 5 g/a	29.5 b	14.6 a	8668 cd	293 c	124 a	1081.85	36.67
10-34-0 @ 3 g/a + Brdcst P @ 60 lb/a	27.4 ab	15.0 a	8171 bc	300 e	132 ab	1063.42	38.81
Broadcast P @ 60 lb/a	27.1 ab	14.8 a	8017 b	295 cd	150 b	1037.38	38.28
LSD (.05)	3.4	0.6	420	3	17	186.76	2.85

All treatments except for the 10-34-0 @3 g/a, 10-34-0 + Radiate post-applied, 10-34-0 + broadcast P and the broadcast P had greater root yield than the check. The rest of the treatments were not different from each other in root yield except for the 10-34-0 @ 2 g/a + Avail, which was higher in yield than all other treatments except for the RiserR 7-17-3 @2.5 g/a, the 6-22.5-0 + humate treatments and the Nutra Flow @ 3g/a treatment. It is unlikely had we not stopped in each plot and unclogged orifices, that the humate treatments would have faired as well as they did. The other two Avail treatments were no higher than most of the other non-check treatments.

Although there were differences in net sucrose between treatments, there were no differences between any treatment and the check.

All treatments improved recoverable sugar per acre. The 10-34-0@ 2 g/a + Avail was the treatment with the greatest recoverable sugar per acre. The other two Avail treatments were no different from the 10-34-0 at their respective rates without Avail.

Awaken and the 10-34-0 @3 g/a + Avail treatments were lowest in recoverable sugar per ton, while the 10-34-0 @ 3 g/a + broadcast P was highest.

Gross $ return per ton and per acre followed the differences of recoverable sugar per ton and per acre,

with highest gross return per ton coming from the 10-34-0 @3 g/a + broadcast P, and the highest gross per acre
return from the 10-34-0 @ 2g/a + Avail treatments.

This study emphasizes again the value of a starter fertilizer treatment on sugarbeet production and profitability. It also shows, in the case of a higher rate of Nutra Flow, how stand can be affected with higher than recommended rates of row-starter. There is also a caution for the growers within this study to be certain that the products used in a low-rate starter flow well through the delivery system and contain no materials that have the potential to plug the small orifices required for such an application. Use of clear solutions is essential. It is especially important to avoid suspended materials.

Although the one Avail treatment resulted in higher root yield, and subsequently higher recoverable sugar per acre than other treatments, it is troubling that the other two Avail treatments did not achieve the same level of performance. This inconsistency in results may need to be further studied before clear recommendations are developed.

References-

Sims, A., and L. Smith, 2002. Use of starter fertilizer to reduce broadcast applications of phosphorus. p. 94-99 *In* 2002 Sugarbeet Research and Extension Reports.

Sims, A., and L. Smith, 2003. Use of banded in-furrow phosphorus to reduce broadcast applications in sugarbeet production. p. 129-138 *In* 2003 Sugarbeet Research and Extension Reports.