

## **Corn Response to Starter Fertilizer and AVAIL on Soils with High Soil Test Phosphorus**

AVAIL is a new product that can be added to phosphorus (P) fertilizer that is designed to reduce P fixation of the fertilizer by the soil. Nutrisphere-N is a new product that can be added to N fertilizer (i.e., UAN or Urea) that is designed to prevent urea volatilization and slow down the rate of nitrification. Both products are marketed by Specialty Fertilizer Products. Corn growers and crop consultants are asking if these products would provide value to Delaware growers. Currently, these products have not been tested in Delaware. Information is needed to determine if these products could provide value to Delaware corn growers.

### **OBJECTIVES:**

- 1) Evaluate corn yield response of corn to starter fertilizer on soils high in soil test P
- 2) Evaluate corn yield response to AVAIL added to starter fertilizer
- 3) Evaluate corn yield response to AVAIL & Nutrisphere-N when added to starter fertilizer

### **EXPERIMENTAL DESIGN:**

This study involved two separate experiments during the 2007 growing season. The first study was repeated at two different locations (Site 1 and Site 2) and involved either 10 or 12 treatments depending on the location. The 12 treatments were the following:

- 1) No starter fertilizer
- 2) N ONLY starter that was applied at 25 lb N/acre
- 3) 25 lb N/acre PLUS 5 lb P<sub>2</sub>O<sub>5</sub>/acre and NO AVAIL
- 4) 25 lb N/acre PLUS 10 lb P<sub>2</sub>O<sub>5</sub>/acre and NO AVAIL
- 5) 25 lb N/acre PLUS 20 lb P<sub>2</sub>O<sub>5</sub>/acre and NO AVAIL
- 6) 25 lb N/acre PLUS 30 lb P<sub>2</sub>O<sub>5</sub>/acre and NO AVAIL
- 7) 25 lb N/acre PLUS 5 lb P<sub>2</sub>O<sub>5</sub>/acre and AVAIL added
- 8) 25 lb N/acre PLUS 10 lb P<sub>2</sub>O<sub>5</sub>/acre and AVAIL added
- 9) 25 lb N/acre PLUS 20 lb P<sub>2</sub>O<sub>5</sub>/acre and AVAIL added

- 10) 25 lb N/acre PLUS 30 lb P<sub>2</sub>O<sub>5</sub>/acre and AVAIL added
- 11) 25 lb N/acre applied in a broadcast spray, nothing applied with planter
- 12) 25 lb N/acre PLUS 4 lb S/acre and NO AVAIL

Treatments 11 and 12 were not applied at Site 2 because the plot area was only large enough to include the first ten treatments. All treatments except 1 and 11 were applied with the planter in a 2-inch by 2-inch band beside and below the corn seed. Treatment 11 was applied immediately after planting. The fertilizer treatments were mixed by using 32-0-0, 11-37-0, 8-0-0-9 and/or water, and treatments 3, 4, 5, 7, 8, 9, and 12 were all applied at a rate of 10.5 gal/acre; however, treatment 2 and 11 were applied as straight 32-0-0 at a rate to supply 25 lb N/acre and treatments 6 and 10 were applied at a rate of 13.8 gal/acre. Sidedress N was applied to Treatments 2 thru 12 at a rate of 135 lb N/acre as 32-0-0 dribbled on the soil surface between the corn rows, while Treatment 1 received 160 lb N/acre as sidedressing. The corn was sidedressed when it was about 12 inches tall.

The second study was conducted at only one site (Site 3). This study involved six treatments that were applied with the planter in a 2-inch by 2-inch band below and beside the corn seed. The six treatments were the following:

- 1) No starter fertilizer
- 2) 25 lb N/acre and 0 lb P<sub>2</sub>O<sub>5</sub>/acre without AVAIL or Nutrisphere-N
- 3) 25 lb N/acre and 0 lb P<sub>2</sub>O<sub>5</sub>/acre without AVAIL and with Nutrisphere-N
- 4) 25 lb N/acre and 23 lb P<sub>2</sub>O<sub>5</sub>/acre without AVAIL and without Nutrisphere-N
- 5) 25 lb N/acre and 23 lb P<sub>2</sub>O<sub>5</sub>/acre with AVAIL and without Nutrisphere-N
- 6) 25 lb N/acre and 23 lb P<sub>2</sub>O<sub>5</sub>/acre with AVAIL and with Nutrisphere-N

Sidedress N was applied to Treatments 2 thru 6 at a rate of 150 lb N/acre as 32-0-0 dribbled on the soil surface between the corn rows, while Treatment 1 received 175 lb N/acre as sidedressing. The corn was sidedressed when it was about 12 inches tall.

Site and cropping information for all three sites is provided in Table 1. Individual treatments (i.e., plots) were four rows (30-inch rows) wide and 150 feet long. Each treatment was replicated four times and arranged in randomized-complete blocks. Early growth samples were taken when the corn was about 10 inches tall by cutting 16 plants at the soil surface. These plants were taken from the two outside rows (8 per row) and placed in a paper bag. The samples were dried for four days at 60 degrees Celsius and then weighed for dry weight determination. The results were adjusted and presented as a percentage of the average of the four control treatments within each location.

Corn yields were determined by harvesting the center two rows of each plot and weighing the grain in a certified weigh wagon. All statistical analyses were done by using the SAS system.

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**Table 1. Soil and cropping information for each site for the 2007 season.**

Description	Site 1	Site 2 <sup>2</sup>	Site 3 <sup>2</sup>
M3-K, ppm K	120	73	49
M3-P, ppm P	259	181	274
OM, %	2.0	1.4	0.9
Soil Series	Rumford	Woodstown	Rumford
Soil Texture	Loamy Sand	Loamy Sand	Loamy Sand
Irrigated	Yes	Yes	Yes
Crop in 2006	Corn	Corn	Corn
Hybrid/Variety	DK63-39	P33B51	P33B51
Planting Date	May 14	May 1	May 14
Previous Crop	Corn	Corn	Sweet Corn
Tillage <sup>1</sup>	NT	CT	CT

<sup>1</sup>Tillage: CT = conventionally tilled; NT = No-till

<sup>2</sup>Received broadcast applications of 200 lb/ac of 0-0-62 before planting

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## **RESULTS and DISCUSSION:**

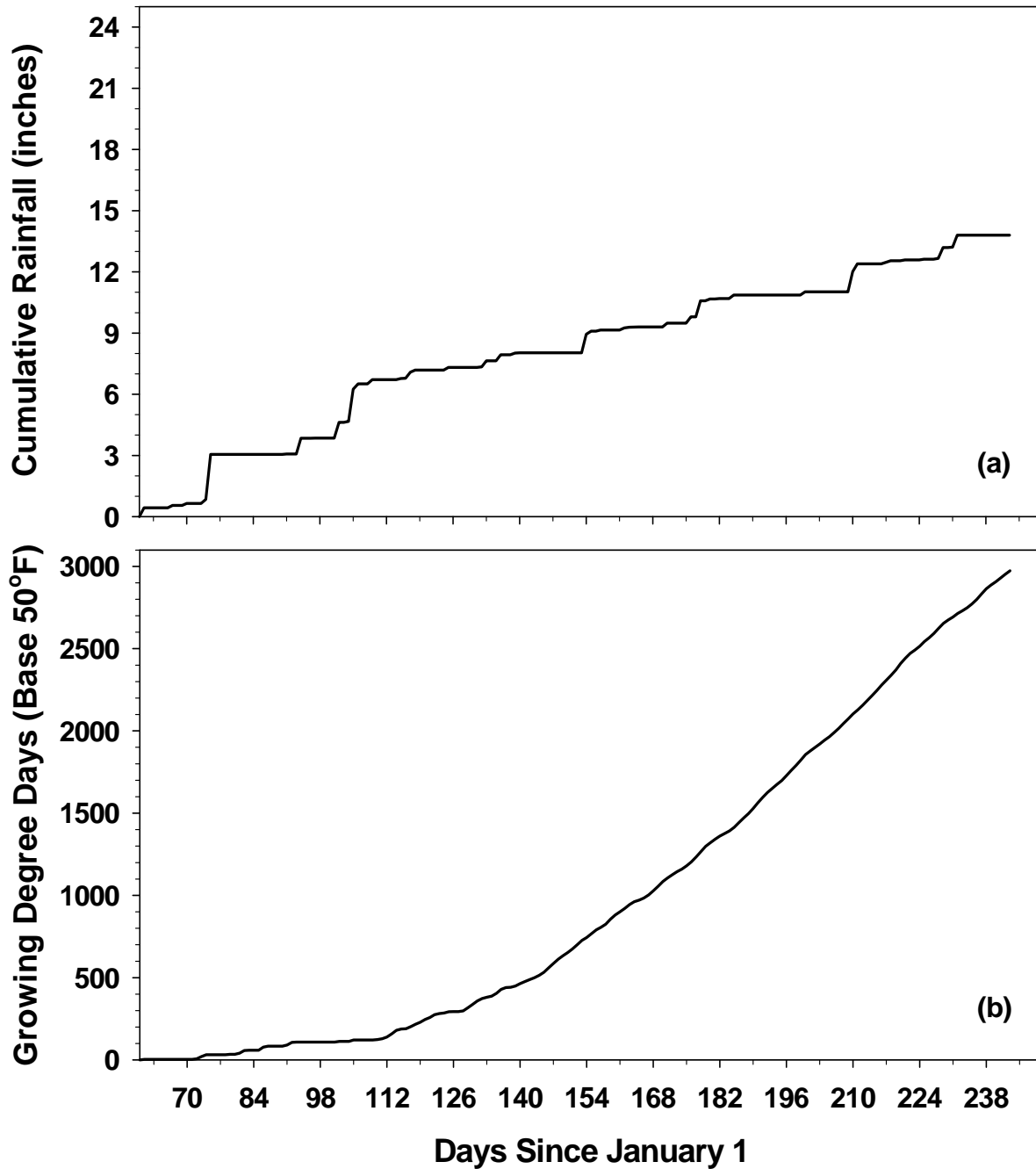
The 2007 growing season was unusually dry during June and July and temperatures were hot (Figure 1). Fortunately, all three sites were irrigated, so water was not a limiting factor and grain yields were good at all three sites (Tables 2 and 3). At Site 1, early growth rates were significantly increased by applying starter fertilizer, but this increase was caused by the N in the starter fertilizer (Table 3). At Site 2, there was also an early growth response to N fertilizer but there was an additional response by adding P to the starter fertilizer (Table 2). Adding AVAIL to the starter fertilizer had no significant effect on the early growth responses at either Site 1 or Site 2. At Site 3, the early growth responses were significantly greater for all five fertilizer treatments when compared to the control; however, with the exception of Treatment 6, most of the early growth response appeared to be due to the N in the starter (Table 3). Although Treatment 6 appeared to have the highest early growth response at Site 3, this treatment was not significantly different from Treatments 3 and 5. Figure 2 is a photo of the corn at Site 3 comparing Treatment 1 and Treatment 6; this photo shows that the control treatment is not as green as Treatment 6 (i.e., N+P + AVAIL and Nutrisphere-N).

Grain yields did not follow the same trends as the early growth responses, which is common with starter fertilizer responses. There was no significant effect of starter fertilizer on grain yields at any of the three sites. In fact at Site 3, the highest yield observed in this study was the control (i.e., no starter fertilizer) treatment (Table 3). There was also no effect of AVAIL on grain yields at Site 1 or Site 2. The average of the four starter P treatments at Site 1 with no AVAIL was 199 bu/ac, while the same four P rates with AVAIL averaged 194 bu/ac. At Site 2, the averages of the four starter P treatments with and without AVAIL were both 235 bu/ac (Table 2).

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**Figure 1.** Cumulative rainfall amounts (a) and cumulative growing degree days (b) for the 2007 growing seasons. Growing degree days calculated using a base of 50 degrees F.

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**Table 2.** Starter fertilizer study from two irrigated sites in Sussex County.

Trt #	Treatment <sup>a</sup>	Avail	Grain Yield		Early Growth	
			Site 1	Site 2	Site 1	Site 2
			---- bu/ac ----		-- % of Control --	
1	Control	no	232.1	198.4	100	100
2	25-0-0-0	no	232.6	202.5	142	120
3	25-5-0-0	no	234.2	193.5	137	140
4	25-10-0-0	no	235.1	198.7	122	148
5	25-20-0-0	no	235.3	194.2	138	153
6	25-30-0-0	no	234.0	208.9	149	151
7	25-5-0-0	yes	235.0	195.4	144	144
8	25-10-0-0	yes	236.2	195.1	134	158
9	25-20-0-0	yes	232.3	191.5	143	170
10	25-30-0-0	yes	235.2	193.1	137	152
11	25-0-0-0 <sup>b</sup>	no	231.7	NA	107	NA
12	25-0-0-4	no	231.7	NA	141	NA
	CV(%)		2.8	4.3	13.1	10.5
	LSD <sub>(0.05)</sub>		7.5	10.7	20.1	20.0
<b>CONTRASTS:</b>			----- P > F -----			
	AVAIL vs. NO AVAIL		0.9964	0.0710	0.5418	0.1266
	Trt 1 vs. Trt 2		0.8938	0.1601	0.0001	0.0473
	Trt 2 vs. Trt 5, 6, 9, & 10		0.5853	0.1926	0.9877	0.0002

**NOTES:**

<sup>a</sup>pounds/acre of N - P<sub>2</sub>O<sub>5</sub> - K<sub>2</sub>O - S; control received no starter fertilizer

<sup>b</sup>This treatment was broadcast immediately after planting

All treatments applied in 2x2-inch band with planter except for Trt 1 & 11

Trts 2 thru 12 received 135 lb N/ac at sidedress

Trt 1 received 160 lb N/ac at sidedress

Trt 11 & 12 were not applied at Site 2 due to field size limitations

Site 1 received 80 lb N/ac via fertigation

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**Table 3.** Starter fertilizer trial at Site 3 (UD's R&E Center).

Treatment <sup>a</sup>	NSN <sup>b</sup>	Avail	Grain Yield	Early Growth <sup>c</sup>
			-- bu/ac --	-- % --
Control	no	no	192	100
25-0-0	no	no	179	127
25-0-0	yes	no	185	135
25-23-0	no	no	191	126
25-23-0	no	yes	189	135
25-23-0	yes	yes	184	160
CV(%)			3.1	13.3
LSD <sub>(0.05)</sub>			9.4	27.9

<sup>a</sup>pounds/acre of N - P<sub>2</sub>O<sub>5</sub> - K<sub>2</sub>O

<sup>b</sup>NSN = Nutrisphere-N

<sup>c</sup>Early growth expressed as a percentage of control

All treatments applied in 2x2-inch band with planter

Control received no fertilizer at planting

Control received 175 lb N/ac as sidedressing

All except control received 150 lb N/ac as sidedressing

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**Figure 2.** Site 3 on June 5. The four rows to the left of the black line are Treatment 6 (i.e., N + P starter with AVAIL and Nutrisphere-N), while the four rows to the right of the black line are Treatment 1 (no starter fertilizer; i.e., control). The four rows in Treatment 6 have a darker green color than the four rows in Treatment 1.

**SUMMARY:**

These studies showed no yield benefit from using starter fertilizer with or without AVAIL added to the fertilizer. Starter fertilizer did result in significant early growth responses, but adding AVAIL did not result in increased early growth. These studies should be repeated for another year before making final conclusions and recommendations.

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