

Starter Fertilizer Nutrient Component Effects on Corn Yield on High Testing P and K Soils in a High Yield Environment

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Background & Justification

- What is the value of starter fertilizer on high testing soils?
 - High fertilizer & corn prices create more risk
 - Not uncommon to see low K, but high P testing soils
- Past Wisconsin research with starters has been complete starter (N-P₂O₅-K₂O)
- Corn yield potential has increased
- Atmospheric S deposition has decreased

Objectives

1. Understand the effects of nutrient components in 2 x 2 placed starter fertilizer in a high yield environment with high soil test P and K levels
2. Understand the effects of nutrient components in pop-up placed starter fertilizer on soils with high P and K levels
3. Evaluate the efficacy of pop-up fertilizer containing lower rates of nutrients to increase yield and decrease grain moisture compared to 2 x 2 starter fertilizer
4. Evaluate the effect of cultural practices to “bump” yield levels
5. Collect new data on plant nutrient concentrations at various growth stages to improve our plant analysis interpretation database to more adequately reflect current high yield corn hybrids

Study information

Site Characteristics

Parameter	Arlington ARS	Lancaster ARS
Soil	Plano silt loam	Fayette silt loam
pH	6.6	7.1
OM, %	3.7	2.0
P, ppm	101 (EH)	45 (EH)
K, ppm	186 (EH)	150 (H)
Cropping history	Cg-Cg-Cg-Cg-C	Cg-C
Tillage	Fall chisel, sp soil finisher, Sp cultimulcher	Fall chisel, sp soil finisher
Planting, 30" rows	May 18	May 21
Hybrid	Pioneer P36V53 (105-day RM, HX1, LL, RR2)	
Sidedress 28% UAN	June 19	June 20
Foliar fungicide @ R1	August 2	July 31
Whole plant biomass at PM	September 24	September 25
Grain harvest	October 31	November 5 and 8

Weather

Month	Precipitation		Average air temperature	
	Arlington	Lancaster	Arlington	Lancaster
	inches		°F	
April	3.07 (-0.17) †	3.07 (-0.27)	43.5 (-1.9)	49.3 (3.4)
May	2.94 (-0.49)	3.91 (0.19)	59.0 (1.9)	64.5 (6.8)
June	0.26 (-3.78)	1.48 (-3.25)	67.7 (1.1)	70.7 (3.8)
July	2.20 (-1.66)	2.26 (-1.83)	75.8 (5.3)	79.0 (7.9)
August ‡	2.89 (-1.35)	1.52 (-3.07)	66.9 (-1.6)	71.1 (2.2)
September	1.01 (-2.63)	3.22 (0.03)	57.7 (-2.8)	61.4 (0.9)
October	3.97 (1.54)	3.79 (1.38)	44.4 (-5.0)	48.6 (-0.3)

† Numbers in parentheses are the departure from the 30-year average (NOAA).

‡ Values for August to October are preliminary.

Treatments



Trt	Place	N	P ₂ O ₅	K ₂ O	S	micros	N Rate	Fungi	Pop.
		lb/a							x1000
1	2x2	20	20	20	10	+	185	+	41
2	2x2	5	20	20	10	+	185	+	41
3	2x2	20		20	10	+	185	+	41
4	2x2	20	20		10	+	185	+	41
5	2x2	20	20	20		+	185	+	41
6	2x2	20	20	20	10		185	+	41
7	2x2	20			10	+	185	+	41
8	2x2	20	20	20			185	+	41
9	2x2	20					185	+	41
10	2x2						185	+	41
11	2x2	20	20	20	10	+	150	+	41
12	2x2	20	20	20	10	+	185		41
13	2x2	20	20	20	10	+	185	+	35
14	Pop	7	25				185	+	35
15	Pop	5	11	5			185	+	35
16	Pop	6	20	4	3		185	+	35

Micros

- 0.5 lb/a Zn EDTA +
- 0.5 lb Mn EDTA +
- 0.3 lb Cu/a EDTA

Sidedress N

- 28 % UAN

Fungicide

- 5 fl. oz/a Stratego YLD

10-34-0 (6.3 gpa)

9-18-9 (5.3 gpa)

8-27-5-4S (6.3 gpa)

Measurements

- Plant stand counted at V3-4
- Total N and total mineral concentration and uptake in corn
 - V5-6
 - V12
 - R6 (physiological maturity)
- Corn ear leaf nutrient concentration at R1
- Canopy reflectance measurements with Crop Circle
 - V5-6
 - V12
 - R1
- Grain harvested
 - Total N and total mineral concentration measured and used to calculate crop removal
 - Moisture & test weight determined

What did we learn in 2013?

Effect of 2x2 starter composition on V3-4 population and V12 biomass at Arlington & Lancaster

Trt	Place	N	P ₂ O ₅	K ₂ O	S	micros	N Rate	Fungi	Pop.	Pop. A	Pop. L	Biomass A	Biomass L
		lb/a							x1000	x1000	x1000	lb/a	lb/a
1	2x2	20	20	20	10	+	185	+	41	42.9	39.2	3349	4548
2	2x2	5	20	20	10	+	185	+	41	42.0	39.9	3530	4527
3	2x2	20		20	10	+	185	+	41	42.5	40.5	3989	3748
4	2x2	20	20		10	+	185	+	41	42.6	40.0	3394	3812
5	2x2	20	20	20		+	185	+	41	43.0	41.7	3784	4231
6	2x2	20	20	20	10		185	+	41	41.4	40.1	3311	3882
7	2x2	20			10	+	185	+	41	43.1	40.3	3473	4129
8	2x2	20	20	20			185	+	41	42.7	41.0	3750	3691
9	2x2	20					185	+	41	41.8	40.7	3390	4630
10	2x2						185	+	41	42.8	41.2	3450	3979

Treatments 2-10 were individually contrasted with treatment 1 and treatments 2-9 were individually contrasted with treatment 10. Numbers in red are significantly ($P \leq 0.10$) different than treatment 1.

Effect of 2x2 starter composition on silage & grain yield at Arlington & Lancaster

Trt	Place	N	P ₂ O ₅	K ₂ O	S	micros	N Rate	Fungi	Pop.	Silage Yield A	Silage Yield L	Grain Yield A	Grain Yield L
		lb/a							x1000	T/a DM		bu/a	
1	2x2	20	20	20	10	+	185	+	41	6.53	8.30	148	109
2	2x2	5	20	20	10	+	185	+	41	6.92	7.71	141	98
3	2x2	20		20	10	+	185	+	41	7.15	8.46	159	127 *
4	2x2	20	20		10	+	185	+	41	7.51	8.07	151	118
5	2x2	20	20	20		+	185	+	41	8.71*	8.29 *	152	108
6	2x2	20	20	20	10		185	+	41	7.11	8.07	148	115
7	2x2	20			10	+	185	+	41	6.74	8.44	144	126 *
8	2x2	20	20	20			185	+	41	7.97	8.89 *	144	115
9	2x2	20					185	+	41	7.35	8.35	139 *	105
10	2x2						185	+	41	6.89	7.69	147	107

Treatments 2-10 were individually contrasted with treatment 1 and treatments 2-9 were individually contrasted with treatment 10. Numbers in red are significantly ($P \leq 0.10$) different than treatment 1. Numbers with an * are significantly different than treatment 10.

Effect of 2x2 starter composition on grain moisture & test weight at Arlington & Lancaster

Trt	Place	N	P ₂ O ₅	K ₂ O	S	micros	N Rate	Fungi	Pop.	Grain Moist. A	Grain Moist. L	Test wt. A	Test wt. L
		lb/a							x1000	%		lb/bu	
1	2x2	20	20	20	10	+	185	+	41	16.9	18.1	55.6	54.8
2	2x2	5	20	20	10	+	185	+	41	16.9	18.5	55.6	54.4
3	2x2	20		20	10	+	185	+	41	17.1	17.3	55.7	54.8
4	2x2	20	20		10	+	185	+	41	16.9	18.2	55.7	55.1
5	2x2	20	20	20		+	185	+	41	16.9	17.6	55.8	55.0
6	2x2	20	20	20	10		185	+	41	17.1	18.0	55.6	54.9
7	2x2	20			10	+	185	+	41	16.9	17.6	55.3	54.6
8	2x2	20	20	20			185	+	41	16.7	18.1	55.4	54.9
9	2x2	20					185	+	41	16.5	17.4	54.9 *	54.4
10	2x2						185	+	41	17.1	17.6	55.5	54.4

Treatments 2-10 were individually contrasted with treatment 1 and treatments 2-9 were individually contrasted with treatment 10. Numbers in red are significantly ($P \leq 0.10$) different than treatment 1. Numbers with an * are significantly different than treatment 10.

Effect of starter placement and composition on V3-4 population and V12 biomass at Arlington & Lancaster

Trt	Place	N	P ₂ O ₅	K ₂ O	S	micros	N Rate	Fungi	Pop	Pop. A	Pop. L	Biomass A	Biomass L
		lb/a							x1000	x1000		lb/a	
13	2x2	20	20	20	10	+	185	+	35	36.8	34.7	3413	4036
14	Pop	7	25				185	+	35	35.7	33.8	2907	3944
15	Pop	5	11	5			185	+	35	35.5	34.7	3049	4442
16	Pop	6	20	4	3		185	+	35	35.8	35.3	2617	3571

Treatments 14-16 were individually contrasted with treatment 13. Numbers in red are significantly ($P \leq 0.10$) different than treatment 13.

Effect of starter placement and composition on silage & grain yield at Arlington & Lancaster

Trt	Place	N	P ₂ O ₅	K ₂ O	S	micros	N Rate	Fungi	Pop	Silage Yield A	Silage Yield L	Grain Yield A	Grain Yield L
		lb/a							x1000	T/a DM		lb/a	
13	2x2	20	20	20	10	+	185	+	35	6.21	7.70	142	123
14	Pop	7	25				185	+	35	6.97	7.69	140	140
15	Pop	5	11	5			185	+	35	6.44	7.93	144	131
16	Pop	6	20	4	3		185	+	35	6.65	7.02	147	116

Treatments 14-16 were individually contrasted with treatment 13. Numbers in red are significantly ($P \leq 0.10$) different than treatment 13.

Effect of starter placement and composition on grain moisture & test weight at Arlington & Lancaster

Trt	Place	N	P ₂ O ₅	K ₂ O	S	micros	N Rate	Fungi	Pop	Moisture A	Moisture L	Test Wt A	Test Wt L
		lb/a							x1000	%		lb/bu	
13	2x2	20	20	20	10	+	185	+	35	17.5	17.9	55.4	55.0
14	Pop	7	25				185	+	35	17.1	18.2	55.5	55.8
15	Pop	5	11	5			185	+	35	17.1	18.2	55.1	54.9
16	Pop	6	20	4	3		185	+	35	17.4	18.5	55.6	54.6

Treatments 14-16 were individually contrasted with treatment 13. Numbers in red are significantly ($P \leq 0.10$) different than treatment 13.

Effect of high yield management on V3-4 population and V12 biomass at Arlington & Lancaster

Trt	Place	N	P ₂ O ₅	K ₂ O	S	micros	N Rate	Fungi	Pop	Pop. A	Pop. L	Biomass A	Biomass L
		lb/a							x1000	x1000		lb/a	
1	2x2	20	20	20	10	+	185	+	41	42.9	39.2	3349	4548
11	2x2	20	20	20	10	+	150	+	41	41.6	39.8	3832	4448
12	2x2	20	20	20	10	+	185		41	41.7	40.0	3377	4385
13	2x2	20	20	20	10	+	185	+	35	36.8	34.7	3413	4036

Treatments 11-13 were individually contrasted with treatment 1. Numbers in red are significantly ($P \leq 0.10$) different than treatment 1.

Effect of high yield management on silage & grain yield at Arlington & Lancaster

Trt	Place	N	P ₂ O ₅	K ₂ O	S	micros	N Rate	Fungi	Pop	Silage Yield A	Silage Yield L	Grain Yield A	Grain Yield L
		lb/a							x1000	T/a DM		bu/a	
1	2x2	20	20	20	10	+	185	+	41	6.53	8.30	148	109
11	2x2	20	20	20	10	+	150	+	41	7.29	7.32	151	124
12	2x2	20	20	20	10	+	185		41	8.30	8.33	152	123
13	2x2	20	20	20	10	+	185	+	35	6.21	7.70	142	123

Treatments 11-13 were individually contrasted with treatment 1. Numbers in red are significantly ($P \leq 0.10$) different than treatment 1.

Effect of high yield management on grain moisture & test weight at Arlington & Lancaster

Trt	Place	N	P ₂ O ₅	K ₂ O	S	micros	N Rate	Fungi	Pop	Moisture A	Moisture L	Test Wt A	Test Wt L
		lb/a							x1000	%		lb/bu	
1	2x2	20	20	20	10	+	185	+	41	16.9	18.1	55.6	54.8
11	2x2	20	20	20	10	+	150	+	41	16.9	17.1	55.8	55.2
12	2x2	20	20	20	10	+	185		41	16.9	17.5	55.7	54.8
13	2x2	20	20	20	10	+	185	+	35	17.5	17.9	55.4	55.0

Treatments 11-13 were individually contrasted with treatment 1. Numbers in red are significantly ($P \leq 0.10$) different than treatment 1.

Tissue and grain nutrient composition

- Data not available

Summary of 2nd year

- Results varied between locations
- Results were impacted by drought
- At Arlington, starter with all nutrients except P had significantly greater V12 biomass & grain yield compared to complete 2x2 starter
- At Lancaster, starter with all nutrient except S or N only starter had significantly greater V3-4 population and significantly lower grain moisture compared to complete 2x2 starter

Summary of 2nd year continued

- At Arlington, pop-up treatments with lower V3-4 population or lower V12 biomass did not result in yield differences compared to 2x2 complete starter
- Fungicide application did not affect grain yield at either site, but did significantly decrease silage yield at Arlington
- Lower sidedress N rate resulted in lower silage yield and lower grain moisture at Lancaster

Questions?

Thanks to:

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