

## Nitrogen Application to Corn Following Cover Crops

**Study ID:** 731061201701

**County:** Franklin

**Soil Type:** Kenesaw silt loam 0-1% slope; Kenesaw silt loam 1-3% slope

**Planting Date:** 5/10/17

**Harvest Date:** 10/19/17

**Population:** 30,000

**Row Spacing (in):** 30

**Hybrid:** Cropland

**Reps:** 4

**Previous Crop:** Soybean

**Tillage:** No-Till

**Herbicides:** *Pre:* Roundup® and a pre-plant residual

**Foliar Insecticides:** None

**Foliar Fungicides:** None

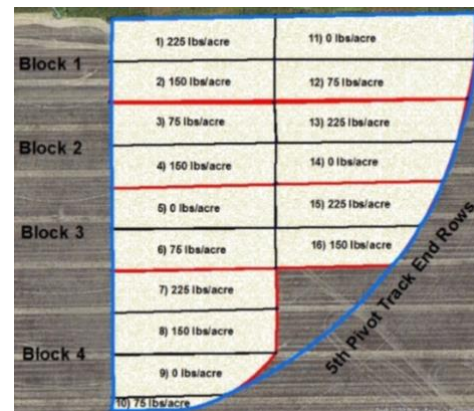
**Note:** Hail and wind in October 2017; 25-30 bushels on the ground; marked off 17.5 ft of row and counted ears.

**Irrigation:** Pivot, Total: 4"

**Rainfall (in):**



**Introduction:** The purpose of this study was to better understand N management of corn following cover crops. The cover crop mix included cereal rye, winter wheat, and winter pea. They were established by drilling in the fall following harvest and were grazed in the spring. They were terminated at the end of April, prior to planting. Nitrogen was applied as dry N spread on May 15, 2017 at four rates: 0, 75, 150, and 225 lb N/acre. The plot layout is shown in *Figure 1*. Plot sizes ranged from 0.11 acres to 0.76 acres. Soil tests were taken for each plot in April 2017 prior to application of N (*Table 1*).



**Figure 1.** Plot layout.

**Table 1.** Soil samples for each plot. ID number corresponds to the plot number in *Figure 1*.

ID	Soil pH 1:1	BpH	Soluble Salts 1:1 mmho/cm	OM LOI %	Nitrate - N ppm N	Nitrate lb N/A	Mehlich P-III ppm P	Sulfate-S ppm	DPTA (ppm)				Ammonium Acetate (ppm)				CEC me/100g	% Base Saturation				
									Zn	Fe	Mn	Cu	K	Ca	Mg	Na		H	K	Ca	Mg	Na
1	5.8	6.6	0.18	3.5	2.5	6	109	18	2.7	85.6	26.8	1.15	429	1606	254	32	15.5	26	7	52	14	1
2	6.1	6.8	0.14	2.4	4.3	10	19	17	1.9	45.5	23.1	0.68	271	1372	197	36	11.5	18	6	60	14	1
3	6.6		0.15	2.6	4.9	12	21	17	2.5	36.6	13.0	1.51	259	1320	180	32	8.9	0	7	74	17	2
4	6.7		0.19	3.2	3.2	8	30	17	2.9	49.7	14.1	1.52	386	1669	248	41	11.6	0	9	71	18	2
5	6.6		0.13	2.0	2.7	6	19	15	3.5	30.0	15.9	0.65	301	1362	193	31	9.3	0	8	73	17	1
6	6.4	6.9	0.12	2.4	1.9	5	17	16	2.1	38.6	17.0	0.75	271	1463	212	62	11.1	10	6	66	16	2
7	6.2	6.9	0.12	2.3	1.8	4	26	15	2.2	36.2	17.5	0.70	246	1343	209	29	10.2	10	6	66	17	1
8	6.5	6.9	0.11	1.8	4.4	11	14	14	2.4	33.0	16.0	0.59	253	1232	181	35	9.2	8	7	67	16	2
9	5.8	6.7	0.11	2.2	2.8	7	48	18	1.9	77.1	20.9	0.94	361	1734	284	40	15.2	20	6	57	16	1
10	6.3	6.9	0.12	2.3	2.2	5	18	20	2.5	40.9	17.4	0.81	314	1664	247	39	12.7	10	6	66	16	1
11	6.3	6.8	0.15	3.0	4.6	11	168	18	3.4	134.3	10.7	1.47	428	1916	324	47	15.8	14	7	61	17	1
12	6.3	6.8	0.14	2.9	3.1	7	115	19	2.9	101.0	12.3	1.14	425	1764	265	38	14.5	15	8	61	15	1
13	5.9	6.8	0.10	2.4	2.5	6	36	17	2.2	66.1	21.4	0.81	281	1407	209	39	12.1	20	6	58	14	1
14	6.3	6.9	0.13	2.4	2.5	6	31	17	2.1	52.8	19.4	0.90	369	1727	270	43	13.3	10	7	65	17	1
15	6.7		0.15	3.0	4.3	10	24	18	2.7	36.5	13.9	0.70	409	1591	240	36	11.2	0	9	71	18	1
16	6.4	6.9	0.19	3.2	3.0	7	30	16	4.0	48.0	16.9	0.83	438	1758	254	37	13.3	8	8	66	16	1

**Table 2.** Soil health tests from each treatment area taken in April, prior to N application and planting.

Treatment lb N/acre	Solvita CO2 Burst, ppm C	Total Nitrogen, ppm N	Organic Nitrogen, ppm N	Total Organic Carbon, ppm C	Nitrate, ppm NO3-N	Ammonium, ppm NH4-N	Inorganic Nitrogen, ppm N	Organic C : Organic N	Nitrogen Mineralization, ppm N	Organic Nitrogen Release, ppm N	Organic Nitrogen Reserve, ppm N	Soil Health Calculation
0	113.0	20.7	16.8	203	3.3	1.5	4.8	12.0	16.3	16.8	0.0	13.09
75	128.0	20.5	17.8	225	2.0	1.6	3.7	12.7	16.7	17.8	0.0	14.14
150	102.0	18.7	15.5	186	2.7	1.3	4.0	12.0	14.8	15.5	0.0	11.89
225	123.0	19.5	16.7	228	2.3	1.5	3.9	13.6	13.5	16.7	0.0	12.98

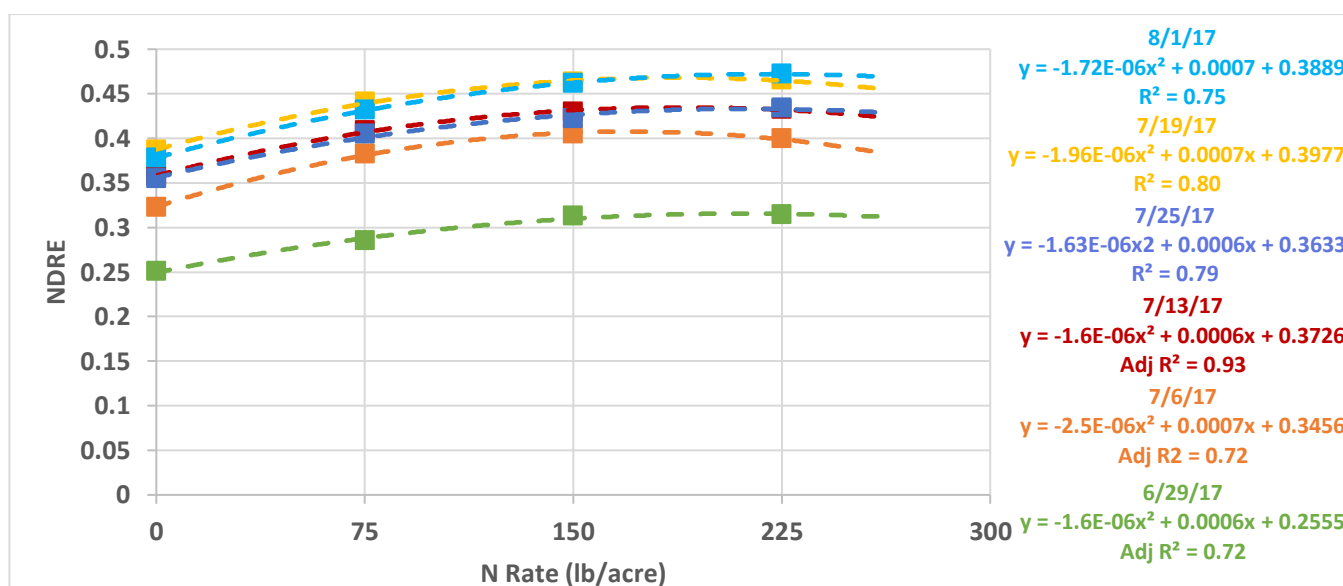
NDRE (normalized difference vegetation index) data was collected weekly with a RapidSCAN CS-45 Handheld Crop Sensor (Holland Scientific, Lincoln, NE). NDRE imagery was also obtained using a drone and multispectral sensor. Yield was collected for each plot by hand harvesting.

**Results:** Significant differences in NDRE collected with a RapidSCAN were apparent between treatments throughout the growing season (*Table 3*). At the first two data collection dates (6/29 and 7/6) there were no differences between the 75, 150, and 225 lb N/ac treatments. At the third and fourth data collection dates, the 75 lb N/ac treatment had a significantly lower NDRE than the 150 and 225 lb N/ac treatments. Throughout the season, no differences in NDRE were apparent between the 150 and 225 lb N/ac treatments. Quadratic regressions of these measurements are shown in *Figure 2*.

**Table 3.** NDRE collected with a RapidSCAN from each N treatment during the growing season from V8 (6/29) to VT/R1 (8/1).

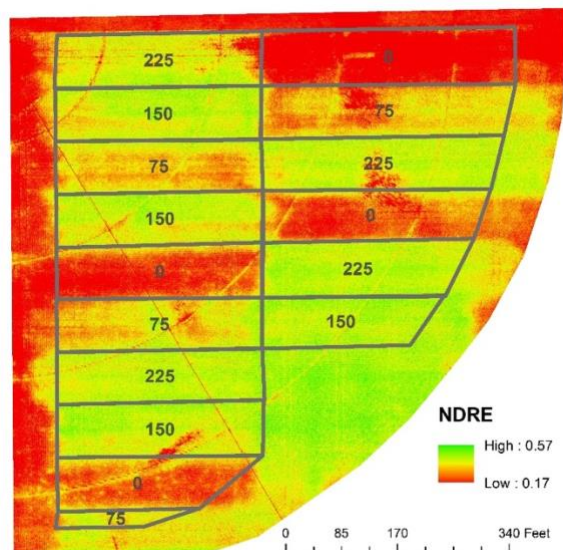
	NDRE (6/29)	NDRE (7/6)	NDRE (7/13)	NDRE (7/19)	NDRE (7/25)	NDRE (8/1)
0 lb N/ac	0.254 B*	0.338 B	0.372 C	0.393 C	0.357 B	0.385 C
75 lb N/ac	0.291 A	0.391 A	0.413 B	0.440 B	0.408 A	0.435 B
150 lb N/ac	0.313 A	0.405 A	0.429 A	0.463 A	0.422 A	0.462 AB
225 lb N/ac	0.314 A	0.399 A	0.433 A	0.465 A	0.434 A	0.472 A
P-Value	0.004	0.0002	<0.0001	0.0001	0.001	0.0003

\*Values with the same letter are not significantly different at a 90% confidence level.



**Figure 2.** Quadratic regression and equations for NDRE data collected with the RapidSCAN.

NDRE of the plot area was also obtained using a drone and sensor (Figure 3) in August. While imagery was not quantitatively analyzed, differences are apparent between the treatments.



**Figure 3.** NDRE (normalized difference red edge) index imagery of the plot area on August 1, 2017. Difference in NDRE values for the various N treatments are apparent.

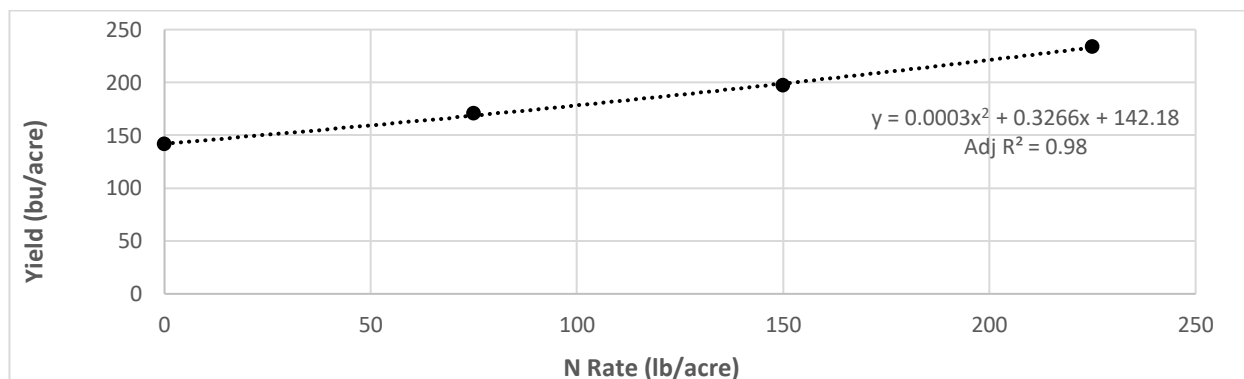
Yield was collected via hand harvesting. Significant differences in yield and marginal net return are apparent. The highest yield and net return was obtained in the 225 lb N/ac treatment.

**Table 4.** Yield and net return for the four nitrogen rates measured.

	Yield (bu/acre) †	Marginal Net Return‡ (\$/ac)
0 lb N/ac	142 D	445.86 D
75 lb N/ac	171 C	500.29 C
150 lb N/ac	197 B	552.88 B
225 lb N/ac	234 A	637.89 A
P-Value	<0.0001	<0.0001

†Yield values are from cleaned yield monitor data. Bushels per acre corrected to 15% moisture.

‡Marginal net return based on \$3.15/bu corn, \$0.41/lb N fertilizer, and \$6.17/ac application cost.



**Summary:** A maximum N rate of 225 lb N/ac was selected with a goal of providing an excess of N so that the plateau of yield response to N could be identified. However, results indicated that the highest N rate resulted in the highest yield; it is unknown if higher N applications would have resulted in greater yields.

The producer was interested in evaluating how other N recommendation methods would have compared. Fertilizer recommendations based on a standard soil test with a yield goal of 220 bu/ac ranged from 165 to 175 lb N/ac. A Haney soil health analysis resulted in recommendations of 177 to 181 lb N/ac with a yield goal of 220 bu/ac. Based on the findings of this study, N recommendations from a standard soil test and Haney soil test were not high enough to maximize yield.

The producer plans to continue this study, adding in a no cover crop treatment. Additional analysis is planned to determine N recommendations from the RapidSCAN sensor during the growing season.

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