Corn Product Response to Nitrogen Strategy

Trial Overview

- Nitrogen is an expensive input. The cost of nitrogen can vary widely between years causing the cost of this input to fluctuate significantly. In a 2017 trial, corn products responded differently to how nitrogen was applied. Some corn products had similar yields to an all-upfront nitrogen application compared to fertigating nitrogen throughout the growing season, while other corn products yielded more with the fertigation treatment.
- This study was conducted to evaluate if nitrogen application strategy impacted corn products differently in terms of grain yield.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Soybean	Strip-till	04/28/18	10/18/18	270	34K

- A standard formula was used to determine nitrogen (N) application rates:
  - N need = (yield goal * 1.1) – soil N – legume credit
  - 188 lb/acre = (270 * 1.1) – 69 lb soil N in 2 ft – 40 lb/acre
- N treatments were as follows:
  - All N upfront – 30 lb/acre of N was strip-tilled prior to planting followed by 160 lb/acre of N applied with 360 Y-DROP® four days after planting (DAP).
  - Fertigation – 30 lb/acre of N was strip-tilled prior to planting followed by 40 lb/acre of N applied with 360 Y-DROP® four DAP. An additional five applications of 15 lb/acre of N were applied through the subsurface drip irrigation (SDI) system over the growing season.
- All treatments had a base level 109 lb/acre of N from residual N in the soil and N credit from the previous soybean crop as detailed in Table 1.

Table 1. Nitrogen application rates and timing along with residual soil nitrogen and legume credits

	N application rates (lb/acre)	
	All N Upfront	**Fertigation**
Residual N	69	69
Strip-till N	30	30
Legume N credit	40	40
At planting N	160	40
Fertigation N	0	75
Total N	**299**	**254**

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- The study was a split-plot with nitrogen strategy as the whole plot with four replications.
- Corn products were grown under full irrigation which was met using the SDI system. Total irrigation applied was 3.4 inches over the growing season. Timely rainfall events occurred from June through mid-August that limited the need for supplemental irrigation.
- Twenty-four corn products were evaluated.
- All weeds were controlled as needed. No fungicide or insecticide were used in crop.

Understanding the Results

- Corn yield was similar between the all-upfront and the fertigation treatments with both treatments yielding 269 bu/acre when averaged across all corn products. However, the fertigation treatment had 45 lb/acre less nitrogen, which caused the fertigated corn products to use less nitrogen to produce a bushel of corn as detailed in Figure 1.

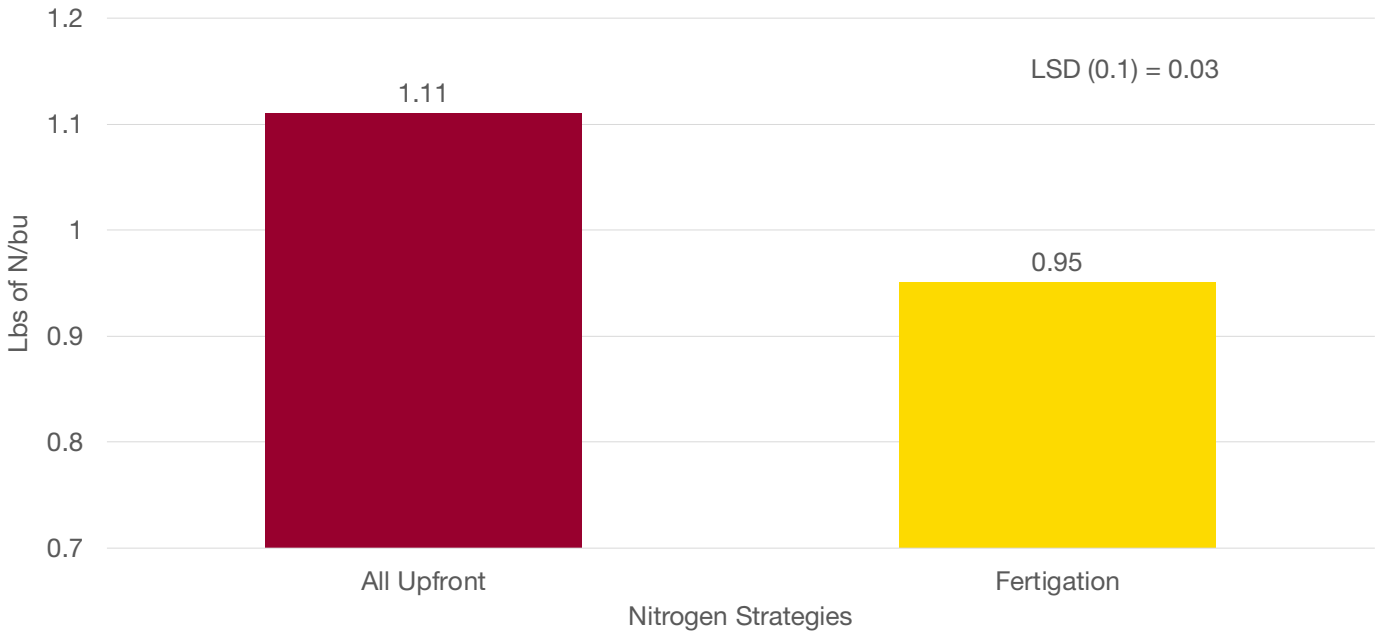

Figure 1. Corn products fertigated with the SDI system had a greater nitrogen use efficiency than corn products with the all-upfront treatment.

- Corn product yield did not respond differently to nitrogen strategy. This contrasts with the 2017 trial where corn products did respond differently. The inconsistency in the results between years could be attributed to a couple of factors.
  - First, 45 lb/acre less nitrogen was applied in the fertigation treatment. This occurred because of some mechanical problems and the timely rainfall in 2018. Because of the rainfall, only 3.4 inches of water were applied, which limited the opportunities for nitrogen to be applied through the SDI system.
  - Second, because of the moist soil conditions, the root system likely remained active throughout the growing season instead of going dormant in the top six inches of soil, which allowed for better nutrient extraction.

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Table 2. Average yield and nitrogen efficiency for all corn products.

	Average Yield (bu/acre)		N efficiency (lb of N/bu)	
	All Upfront	Fertigation	All Upfront	Fertigation
101RM	253	262	1.19	0.97
105RM-A	257	260	1.16	0.98
106RM-A	273	265	1.10	0.96
108RM-A	267	269	1.12	0.94
110RM-A	261	266	1.15	0.95
110RM-B	268	272	1.12	0.94
111RM-A	265	260	1.13	0.98
113RM-A	277	287	1.08	0.89
114RM	280	278	1.07	0.91
107RM	269	261	1.11	0.97
109RM	266	267	1.13	0.95
110RM-C	266	260	1.13	0.98
112RM-A	269	269	1.11	0.94
113RM-B	273	275	1.10	0.92
115RM-A	274	269	1.09	0.94
116RM	282	278	1.06	0.91
106RM-B	277	267	1.08	0.95
108RM-B	267	264	1.13	0.97
111RM-B	256	267	1.17	0.95
112RM-B	276	287	1.08	0.89
115RM-B	273	270	1.10	0.94
115RM-C	266	265	1.12	0.96
105RM-B	271	259	1.11	0.98
115RM-D	277	276	1.08	0.92
LSD (0.1)	----------NS----------		----------NS----------	

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- Nitrogen efficiency was greatest for the corn products fertigated over the growing season compared to an all-upfront nitrogen strategy.
- Corn products had similar yields in the all-upfront nitrogen strategy compared to fertigation, which had 45 lb/acre less nitrogen applied. This is important because at $265.00/ton of 32-0-0 it represents a 6.5 cents/bushel or $18.63/acre savings in nitrogen cost.

Figure 2. Representative cobs from the all-upfront treatment (left) and the fertigation treatment (right) for the 105RM-B product.

Legal Statements