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# In-season N Fertilization Strategies using Active Sensors

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# In-season N Fertilization Strategies using Active Sensors

## **Abstract**

The objectives of this project were to measure corn yield response to nitrogen (N) fertilizer when applied during the V10 corn growth stage, and compare yield and N use efficiency between pre-plant N (PP-N), pre-plant + sensor N (PP+S-N), split N strategy (SNS), and rescue N strategy (RNS). The study was conducted using two crop rotations (corn-soybean and continuous corn) at multiple research farms. In-season applied N was urea treated with Agrotain®.

## **Keywords**

Agronomy

## **Disciplines**

Agricultural Science | Agriculture | Agronomy and Crop Sciences

# In-season N Fertilization Strategies using Active Sensors

## RFR-A1258

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### Introduction

The objectives of this project were to measure corn yield response to nitrogen (N) fertilizer when applied during the V10 corn growth stage, and compare yield and N use efficiency between pre-plant N (PP-N), pre-plant + sensor N (PP+S-N), split N strategy (SNS), and rescue N strategy (RNS).

The study was conducted using two crop rotations (corn-soybean and continuous corn) at multiple research farms. In-season applied N was urea treated with Agrotain<sup>®</sup>.

### Materials and Methods

The first year of this study at the Southeast Research Farm was 2012. The soil at this location is Taintor silty clay loam. The study area was soybean in 2011. Tillage was spring disk/field cultivation before planting. The farm superintendent chose the corn hybrid (Pioneer 0528AM1 planted at 35,600 plants/acre). Pest control practices are those typical for the region and rotation. Soil was sampled for routine soil tests, 0-6 in. depth (STP = 16 ppm, STK = 217 ppm, pH = 6.3, and organic matter = 3.9%).

The active sensor used was the Holland Scientific, Crop Circle ACS-210. In-season N application was conducted during the V10 corn stage. The PP-N application was 32 percent urea ammonium nitrate solution injected between the rows every 60 in. shortly after corn planting (0 to 250 lb N/acre in 50 lb increments). The PP+S-N application was the PP-N rates (0 to 250 lb N/acre in 50 lb increments) plus broadcast urea at the V10 growth stage (in-season N rates determined by

the sensor). The SNS was the 75 lb N/acre PP-N rate plus broadcast urea at the V10 growth stage with in-season N rates determined by the sensor (75 lb N/acre rate minimum). The RNS was the 150 lb N/acre PP-N rate plus broadcast urea at the V10 growth stage with in-season N rates determined by the sensor.

Corn was harvested with a plot combine and yields corrected to 15.5 percent moisture content.

### Results and Discussion

The canopy sensor directed more un-needed N fertilizer (Table 1) when using the RNS (207 lb N/acre) vs. SNS (155 lb N/acre). Typically, active sensors can better direct in-season fertilizer N rates when less PP-N is applied.

Comparison of the three N application strategies (PP-N, RNS, and SNS) shows that the RNS produced the highest overall yield (171 bushels/acre). However, N use efficiency measured as the partial factor productivity (PFP) was significantly reduced using the RNS vs. SNS. No significant differences were found between N use efficiency measured as the agronomic efficiency (AE).

The agronomic optimum PP-N rate was 148 lb N/acre, producing a yield of 161 bushels/acre (Figure 1). The PP-N agronomic optimum N rate was near the high end of typical agronomic rates for a corn-soybean rotation. The PP+S-N agronomic optimum rate was much higher than the PP-N. An additional 82 lb N/acre was applied in-season with the PP+S-N, producing a yield increase of 7 bushels/acre (230 lb N/acre with 168 bushels/acre). This study will continue in 2013.

### Acknowledgements

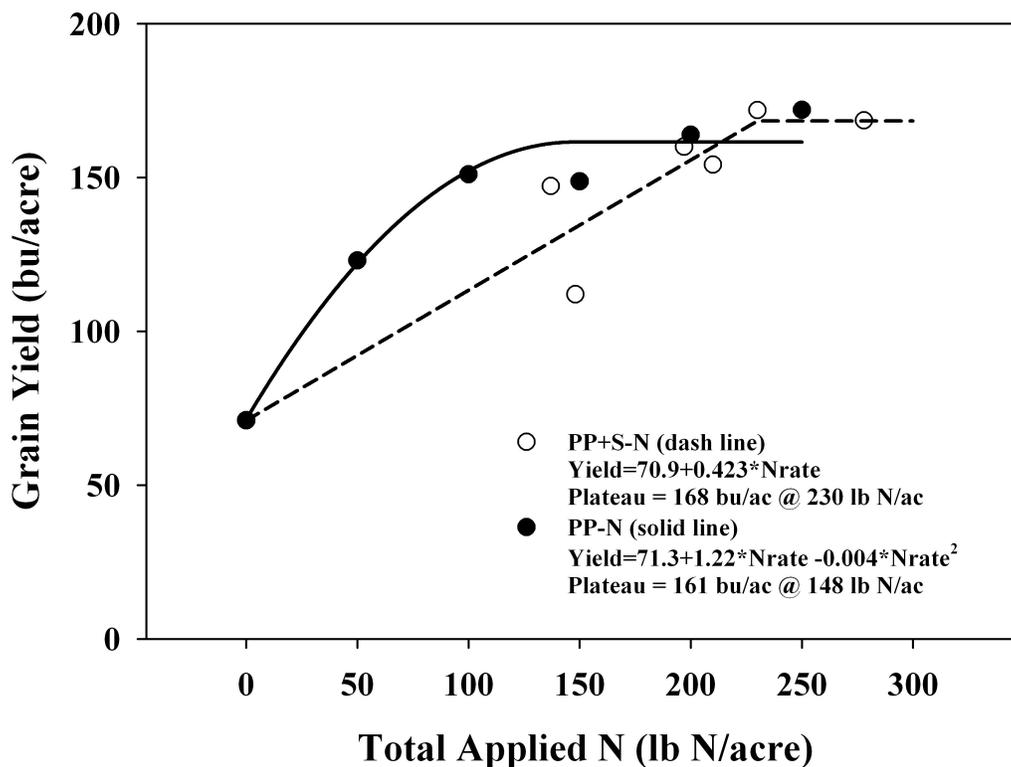
Appreciation is extended to Myron Rees and the research farm staff for their assistance.

**Table 1. Grain yield and N use efficiency comparison of pre-plant N (PP-N), rescue N (RNS), and split N (SNS) strategies, 2012.**

N Strategy	Pre-plant N rate lb N/acre	Sensor N rate	Grain yield bushels/acre	N use efficiency	
				PFP†	AE‡
PP-N	150	-	149	0.99	0.52
RNS	150	57	171	0.84	0.49
SNS	75	80	160	1.04	0.58
<u>Contrasts</u>			<u>Statistics</u>		
				----- p > F -----	
PP-N vs. RNS	-	-	0.04	NS	NS
PP-N vs. SNS	-	-	NS	NS	NS
RNS vs. SNS	-	-	NS	0.03	NS

†Partial factor productivity (PFP) calculated as (yield with N applied ÷ by amount of N applied).

‡Agronomic efficiency (AE) calculated as [(yield with N applied – yield with no N applied) ÷ by amount of N applied]. Yield with no N applied was 71 bushels/acre.



**Figure 1. Nitrogen fertilizer response of pre-plant N (PP-N) and pre-plant plus sensor N (PP+S-N). The plateau N rates are reported as agronomic optimum N. The relationship between total applied N and grain yield is described by a quadratic plateau regression model (PP-N) and linear plateau regression model (PP+S-N).**