



Cor11-2011 - Validating Nitrogen Recommendations in Corn and Exploring New Tools: 2011 Summary

CROP ADVANCES **Field Crop Reports**

Volume 8 — February 2, 2012

Field Crops Team, Agriculture Development Branch
Ministry of Agriculture, Food and Rural Affairs
In partnership with
Ontario Soil and Crop Improvement Association
And other Agricultural Organizations and Businesses

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Validating Nitrogen Recommendations in Corn and Exploring New Tools: 2011 Summary

Purpose:

With the increase in corn yields over time, more Ontario producers are achieving yields which would not have been well represented in existing nitrogen yield response data. It is unknown how greater yield potential may impact yield response to nitrogen, and as a result the accuracy of current recommendations under these high yielding environments is unknown. In conjunction with calibrating nitrogen recommendations, development of tools which aid in tailoring side-dress nitrogen rates to deliver the maximum economical rates of nitrogen while accounting for changes in nitrogen supply have also been an ongoing effort. In Ontario, validation of these tools is limited, though some are advertised in the marketplace for this purpose. The objective of this research is to calibrate the nitrogen recommendations for corn in high yielding environments, and to evaluate the ability of current nitrogen management tools such as the SPAD meter, Greenseeker and soil nitrate tests for their ability to identify the potential for nitrogen response.

Methods:

In 2011, the nitrogen experiments were conducted at 5 sites. Nitrogen treatments were analyzed in a strip block design, randomized in 2 replicates at each site. Treatments consisted of variation in nitrogen rates and timing, and included a total of five treatments at every site; zero rate nitrogen, low rate preplant only, medium rate preplant only, high rate preplant only, high rate split application, and high rate side-dressed only. Actual nitrogen application rates varied depending on the amount of starter nitrogen used (Table 1). All nitrogen was applied as UAN, with “preplant” being applied as a top-dress after planting, and side-dress being applied at the 6-8 leaf stage. Both preplant and side-dress applications were completed with a Yetter[®] toolbar equipped with a 30’ spray boom with 3 hole streamer nozzles on 20” centres, and Agsystems coulter injection knives (Figure 1). Nitrogen management tools were evaluated for their ability to predict optimum nitrogen rates, and included a SPAD meter to measure chlorophyll content, a Greenseeker[®] to measure NDVI, and a pre-sidedress nitrate test for soil nitrate levels. Data for all tools was collected at two separate times from the beginning of June to the beginning of July. A lower stalk nitrate test was also conducted at harvest to confirm its ability to confirm nitrogen use. Plot yields were calculated from plot weights measured by combine and weigh wagon, with hand harvesting conducted to verify accuracy. Moistures were taken from samples with a moisture meter to correct all yields to 15.5% moisture.

Results:

Corn yields continued to increase with nitrogen application rates right up to the highest rates of 180-190 lb/ac at all sites, and thus no maximum yield response to nitrogen rate could be identified (Table 1). Without confirming a yield response maximum, no maximum economic rate of nitrogen could be identified for any of these sites without extrapolating beyond the data points tested, indicating that another higher rate of nitrogen would have been required. Yield response to application timing was not consistent across the sites. A large positive response to side-dressing was observed at the Ilderton and South Woodstock sites, while the response was negligible at North

Woodstock and Ancaster, while there was a negative yield response to side-dressing at Kirkton. Yield differences between split application and side-dressing were negligible across all sites except for Ancaster where the split application was the highest yielding.



Figure 1. Toolbar with hydraulic UAN pump, knife injectors for sidedressing and steamer nozzle bar for planting time applications.

Given the positive yield response with increasing rates of nitrogen, an effective nitrogen management tool would be expected to identify differences between nitrogen treatments in attempts to predict yield response potential. At side-dressing time, visual differences in plant colour were not evident in most fields. No differences in SPAD readings, even between the highest and lowest N rates, were observed between any of the different nitrogen treatments at any sites, suggesting SPAD measurements were ineffective at identifying nitrogen yield response potential at side-dressing time for these sites. The first set of Greenseeker readings did not demonstrate any consistent trends or differences between nitrogen treatments, while the second measurements demonstrated consistently lowest readings for the lowest application rate (planter N only) but little differences or consistent trends for any of the higher application rates.

Soil nitrate concentrations at side-dressing time were observed to increase with pre-plant nitrogen application rates at all sites. Due to the inability to identify a yield response plateau with the nitrogen application rates, we were unable to determine if a critical soil test nitrate value existed which would identify a reduced likelihood of yield response to nitrogen.

Table 1. Planter nitrogen rates and yields for six nitrogen treatments at five sites in Ontario, 2011

Location	Planter N (lb/ac)	Total N Rate (lb/ac)					
		Zero	Low PP	Med PP	High PP	High Split	High SD
		(0)	(70-80)	(120-130)	(180-190)	(180-190)	(180-190)
----- yield (bu/ac) -----							
Kirkton	45	164	168	180	209	210	184
Ilderton	30	73	103	135	168	164	177
Woodstock N	35	140	174	201	219	214	223
Woodstock S	5	74	122	157	181	180	194
Ancaster	25	134	153	168	168	179	170
PP=preplant broadcast, SD=sidedress							

Lower stalk nitrate tests were conducted at Kirkton and South Woodstock. For the zero, low and medium pre-plant rates, nitrate values were well within the low test level range (less than 250ppm) for most recommendations where a yield response with added nitrogen is expected, which was observed for the given treatments at these sites. The high rates ranged from adequate to excessive (over 2000ppm) at Kirkton depending on application timing, while all high rates in Woodstock were in the excessive category.

Summary:

Corn yields increased with all nitrogen rates at all fields tested in 2011, thus no maximum yield or maximum economic rate of nitrogen could be identified for any of the sites. Weather conditions (cool April and wet May) may have contributed to the increased need for N fertilizer in 2011. The average yield (highest N rates) across all 5 sites was 190 bu/acre and may also have contributed to the need for additional nitrogen.

General N recommendations produced by the Ontario Corn N Calculator were lower than the highest rate applied at each site, so in all cases this recommendation would be less than the economic optimum.

There was variability in response to the nitrogen timing treatments, with yield response to side-dressing ranging from negative to positive. The SPAD and Greenseeker measurements failed to identify differences between different nitrogen treatments at the standard 6-8 leaf side-dressing time. No critical yield-response predicting soil nitrate concentration was able to be observed during this first year.



Figure 2. Visual difference between high (left) and low (right) nitrogen treatments in 2011

Next Steps:

This was the first year of this project which will be continued for two more years. Next year will be conducted in a similar manner but will include more locations and more/higher nitrogen rates to ensure the maximum economic rate of nitrogen can be identified.

Acknowledgements:

Support for the 2011 portion of this project was supplied by the Grain Farmers of Ontario, AAC FIP program and OMAFRA. Appreciation is expressed to the farm co-operators, Green Lea Ag Center for modifications to the applicator and to K. Janovicek and B. Rosser, University of Guelph for technical expertise.

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