

Verifying a Pre-Sidedress Soil Nitrate Threshold Test for Evaluating Nitrogen Top-Up Requirements (Oxford SCIA Major Grant)

Purpose:

The Pre-sidedress soil nitrate test (PSNT) provides a means of estimating soil nitrogen supply, and can aid in fine-tuning nitrogen application rates for corn. One drawback of current soil nitrate tests is that they are only calibrated for situations where all of the nitrogen being measured has come from soil mineralization, such that cores need to be taken in soil that has not received any nitrogen fertilizer. When soil nitrate samples are pulled, a 30cm (12") deep core is used to extrapolate the total N supply in the rooting profile based on past research which suggests that the soil nitrate in the top 12" of soil, under most conditions, represents approximately 60% of the total N in the rooting profile.

As a result of this extrapolation, soil nitrogen supply will be overstated under circumstances where additional nitrate has been added through fertilization (i.e. broadcast pre-plant N applications), and as a result nitrogen recommendations will be underestimated. So currently, no soil nitrate test is available which can aid in evaluating the relative soil nitrogen supply for the large portion of Ontario's corn acreage that receives pre-plant nitrogen.

Recent nitrogen research in Ontario has identified a pre-sidedress soil nitrate threshold of 36 ppm which has been relatively effective at identifying whether additional nitrogen is likely to provide an economic yield response when a modest (i.e. 100 lbsN/ac) amount of nitrogen has been applied pre-plant. Soil tests less than 36 ppm usually benefit from an additional application of nitrogen, while those over 36 ppm typically do not. This tool could allow a grower to apply pre-plant nitrogen, and identify at side-dress time if there is a requirement to top-up the initial pre-plant rate. The purpose of this research is to verify the validity of this threshold concept.

Methods:

Two locations were secured in Oxford County for the 2014 growing season to test the 36 ppm nitrate threshold concept. Both locations received 90-100 lbsN/ac of pre-plant nitrogen, and received three sidedress top up rates providing 45, 90 and 135 lbsN/ac in replicated field length strips to provide a means of estimating nitrogen response at these fields. A 0 lbsN/ac control plots was also left to verify an economic yield response to nitrogen above the 90-100 lbsN/ac pre-plant rate. Soil nitrates were sampled just prior to sidedressing. Final plot yields and harvest moistures were collected by a weigh wagon.

Results:

Pre-sidedress soil nitrate values were below the 36 ppm threshold at both locations (Table 1), which based on the threshold concept would recommend that more nitrogen should be applied (Table 3). At location 1, a positive economic response (refer to Table 2 for economic assumptions) was observed for additional nitrogen above the pre-plant rate, for which the 45 lb-N/ac rate provided the greatest economic return. At location 2, a 0 lbsN/ac side-dress rate was not included at the second location, but the positive economic response between the 45 lbsN/ac rate and 90 lbsN/ac rate suggests that a

positive response would also have been apparent for the 45 lb-N/ac rate above the 0 lbsN/ac sidedress rate. Based on these results, the 36 ppm threshold successfully identified yield response potential above an initial 100 lbsN/ac pre-plant application rate at these locations.

Table 1. Pre-sidedress soil nitrate tests and final corn yields across 4 sidedress application rates at 2 locations in Oxford County, 2014.

Location	Pre-plant N Rate (lbsN/ac)	PSNT (ppm)	Sidedress N Rate (lb-N/ac)			
			0	45	90	135
			----- corn yield (bu/ac) -----			
1	90	30	161	181	185	185
2	100	23	-	155	170	175

Table 2. Assumptions made in evaluating economic responses to additional side-dressed nitrogen

----- price of inputs, corn -----	
Price of nitrogen	0.65 \$/lb-N
Cost of side-dress application	10.00 \$/ac
Price of corn	4.50 \$/bu
----- breakeven bushels of corn for input costs -----	
Side-dress application	2.2 bu/ac
Each 45 lb-N/ac increment	6.5 bu/ac

Table 3. Decision process to follow when using the 36 ppm PSNT threshold in deciding whether to apply additional nitrogen following a 100 lb-N/ac pre-plant application.

Location	Pre-plant N Rate (lb-N/ac)	PSNT (ppm)	PSNT Over 36 PPM?	Additional Nitrogen Recommended?	Economic Response to Additional N?
1	90	30	No	Yes	Yes
2	100	23	No	Yes	Yes

Summary:

Two trials were conducted in Oxford County in 2014 to verify the use of a 36 ppm PSNT threshold as a tool to aid in predicting whether nitrogen top-ups at side-dress time are likely to provide positive economic responses under modest pre-plant nitrogen application practices where standard PSNT tests are invalid. PSNT values were below 36 ppm at both locations, and both locations experienced economic responses to applying additional nitrogen above the initial 90-100 lb-N/ac pre-plant rates.

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More research may be required to identify what an appropriate top-up rate is for a given PSNT value following a pre-plant application of nitrogen, particularly for fields that have received pre-plant nitrogen but test much lower than a 36 ppm, such as location 2 above.

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