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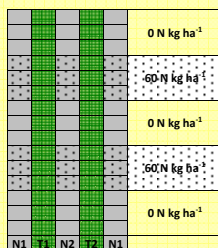
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## Introduction:

Site specific application of nitrogen to corn is motivated by increasing costs and environmental concerns associated with nitrogen. Spectral reflectance of a corn canopy has been proposed as a means to discern spatial variation in soil nitrogen supply and corn responsiveness to additions of nitrogen fertilizer. Optical sensors that measure Normalized Difference Vegetation Index ((NIR-red)/(NIR+red)) (NDVI) have been developed and are being commercially used; but their ability to improve nitrogen use efficiency on a field scale has not been thoroughly tested in Ontario. The objective of this study was assess whether corn responsiveness to nitrogen fertilizer can be determined spatially using an optical sensor to measure NDVI.

## Material and Methods:

Field scale trial (3 replicates, RCBD – (Figure 1)) conducted over 2 years - 2006 (Ariss ON), 2007 (Conestogo, ON), with locations chosen based on crop history and production background that increased probability of nitrogen responsiveness.



**Figure 1:** Field trial layout. Main plot length 150m. Subplot length 10M with 6, 75 cm rows. NDVI measured on green highlighted subplots. Yield measured on all subplots. 60 kg N ha<sup>-1</sup> strips applied pre-plant across each replicate to further enhance spatial nitrogen variability.

- Treatments:
  - T1 - 0 kg N ha<sup>-1</sup> starter
  - T2 - 30 kg N ha<sup>-1</sup> starter  
- (applied as a 5cm x 5cm side band on the planter)
- Nitrogen references:
  - N1 - 0 kg N ha<sup>-1</sup>
  - N2 - 210 kg N ha<sup>-1</sup>  
- applied at side dress as 28% (Figure 2)
- NDVI measurement of T1 and T2 subplots:
  - tractor mounted GreenSeeker RT 200<sup>®</sup> system (N-Tech Industries Inc.)
  - a two sensor system in 2006 and a four sensor system in 2007 (Figure 3)
  - 2006: 7,8,10 and 11 leaf over stage of corn
  - 2007: 6,8,10 and 12 leaf over stage of corn
- Yield and moisture measurements of N1 and N2 sub-plots:
  - R42 Gleaner<sup>®</sup> equipped with a High Capacity GrainGauge<sup>®</sup> (Juniper Systems Inc.) (Figure 4)
  - Delta yields determined for corresponding T1 and T2 subplots

## Results:

- In both years the field sites were N responsive; average yield differences between the 0 and 60 kg N ha<sup>-1</sup> strips of 2250 kg ha<sup>-1</sup> in 2006 and 1200 kg ha<sup>-1</sup> in 2007 (Figure 5).
- When starter N was applied (T2), in both years, average NDVI for subplots located in the 60 kg N ha<sup>-1</sup> strips did not differ from average NDVI for subplots in the 0 kg N ha<sup>-1</sup> strips.
- In 2006, a year characterized by favorable growing conditions and adequate rainfall, NDVI was not significantly correlated with delta yield (Figure 6).
- In 2007, a year characterized by lower precipitation, NDVI was not significantly correlated with delta yield (Figure 6).



**Figure 2** - 28% side dressing with a plant row applicator.



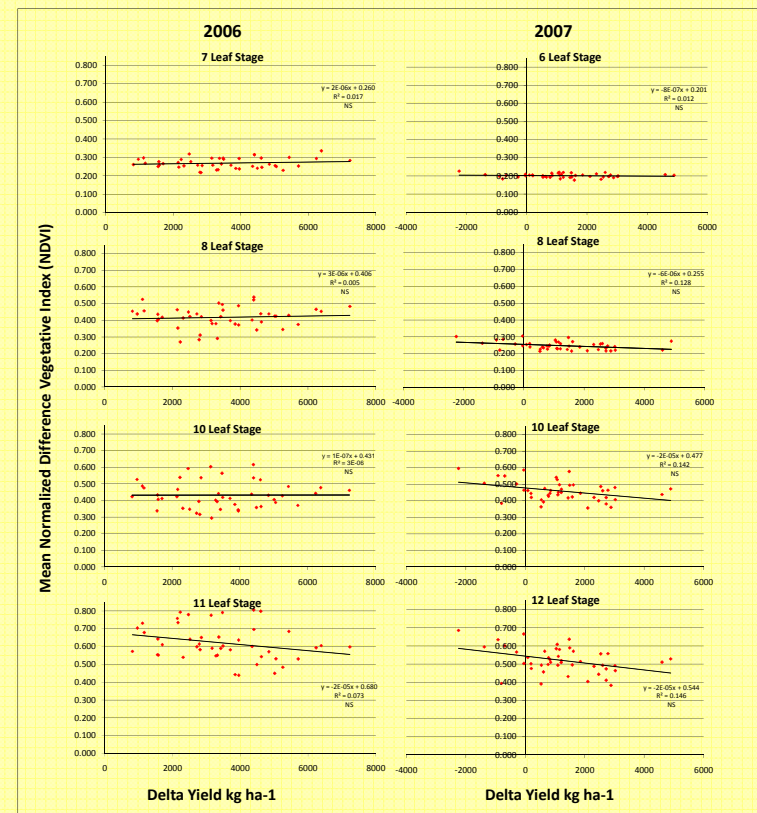
**Figure 3** - Four sensor system used in 2007, inner two sensors were used in 2006.



**Figure 4** - R42 Gleaner with a High Capacity GrainGauge<sup>®</sup> harvesting plots.



**Figure 5** - Treatment 1 showing 0 and 60 kg ha<sup>-1</sup> cross strips in 2007.



**Figure 6:** Treatment 1 NDVI vs. Delta Yield at four leaf stages over two years. In 2006 differences in NDVI were not picked up until the 11 leaf stage while they were picked up at the 8 leaf stage in 2007.

## Conclusion:

NDVI measurements did not correlate with corresponding spatial measurements of corn yield response to nitrogen. As a result, feasibility of spatial nitrogen application based on NDVI is questionable. This concern is further accentuated by the fact that, in this study, addition of starter nitrogen (30 kg N ha<sup>-1</sup>) largely eliminated spatial differences in NDVI until the 10-12 leaf stage. In Ontario, substantial yield benefits to starter nitrogen have been demonstrated in corn, and growers would be reluctant to forego starter nitrogen use.

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