Innovative Nitrogen Management Strategies For Winter Wheat

Purpose:

To determine if new nitrogen level detection equipment such as “Green Seeker” Technology along with innovative application windows for supplement nitrogen fertilization could achieve consistent minimum protein levels in newer varieties of hard red winter wheat as required to meet market demands with Ontario millers.

Methods:

A series of small plot and farm scale research trials are being established in various locations across Ontario. In small scale plots the goal is to determine varietal response to nitrogen rate/timing systems. This work is being conducted at the Elora Research Station of the University of Guelph. Mid size plots have also been established by project partners C&M Seeds of Palmerston and Hyland Seeds of Blenheim Ontario in which nitrogen rate/timing systems will be applied to existing and new materials being developed separately by each partner.

Field scale trials will be located in the Ridgetown area of Ontario and coordinated by Ridgetown College. In these cases, a full size self propelled sprayer has been outfitted to apply 28% UAN (urea ammonium nitrate) at various rates and timings. Fields planted to hard red winter wheat varieties in the fall of 2006 are being monitored to determine suitable sites for installation of the trials in early spring 2007. Additional sites are being scouted in the Golden Horseshoe Soil and Crop Region to complement these more intensive Ridgetown sites.

The main project was to commence in the fall of 2006 for two growing seasons (2007 and 2008); however, pilot work was performed in the 2006 crop on a small scale as a step toward more extensive plans for the fall of 2006 and in preparation for 2007.

Two handheld Green Seeker Units (http://www.ntechindustries.com/) have been purchased for the project. These are being calibrated and will be used to optically monitor nitrogen relationships in the soil from early spring until post anthesis on a by variety basis. The goal is to determine if such technology has a useable place in eastern Canadian wheat production to assist in judging nitrogen application volume requirements and potentially more importantly, optimal timing of nitrogen application to target minimum wheat protein levels of 12%.

The nitrogen rate and timing components of the project are based on work done internationally that indicates post anthesis nitrogen applications being more consistent in achieving milling quality protein levels then has been experienced with North American single nitrogen application or split early and pre anthesis application timing methods.

Due to the nature of the fall 2006 wheat planting season, the limited number of trials that were able to be seeded will be monitored carefully through early spring to determine their suitability for the study. There is concern that yield potential has been compromised on these sites because of the late date and difficulty of planting coupled with continued

poor conditions through the Nov 2006 to Jan 2007 period. Although the fall 2006 sites will likely be followed through in 2007 the partners have discussed the issue of predisposition of results due to poor yield potential and are prepared to conduct the trials for an additional year. The small plot trials at Elora were unable to be seeded. These will be planted in the fall of 2007 and 2008 instead of the previously planned 2006 and 2007 windows.

Results:

Two fields were acquired during 2006 where N rates and their timing were investigated on wheat yield and protein concentrations. N was applied at various rates during March or April for the early application; more N was applied in a second application around flowering. There was an economical response to an early N application up to approximately 90 kg N ha^{-1}. Protein concentrations did not respond to late application of N in the one field, while samples still need to be analyzed for protein the second field. We expected little protein response from the first field because of extremely high yields and the relatively low rate of N in the second application at flowering, but we expect higher protein concentrations in the second field because of lower yields compared to the other field. One of the objectives of this project in the future is to determine or fine-tune N rates for the late timing that would account for yield potential. Currently, no recommendations exist in Ontario.

We participated in a workshop in Oklahoma for using optical sensing technology for fine-tuning N applications. This research has been conducted around the world with promising results, but little research has been conducted in Ontario on our wheat's and in our climate. Therefore, field-length N rates were established in 2006 on several wheat fields with varying yield potentials across varying topography and soil types. With the assistance of A&L Laboratories, we optically-sensed field-length strips of wheat on-the-go in late April using an ATV-mounted Greenseeker sensor equipped with a GPS data logger. Field maps were generated, whereby wheat yield potentials will be subsequently determined (see Figure 1). These potentials will be compared with actual yield data from the combine. Small plots were also established on these fields to determine the response to N fertilizer (see Figure 2). Both of these are needed to test and calibrate optical sensing technology for Ontario. All data have yet to be analyzed, but early results and comparisons indicate promise for using the tool to fine-tune N requirements for hard red winter wheat and for attaining higher and more consistent protein concentrations at harvest.

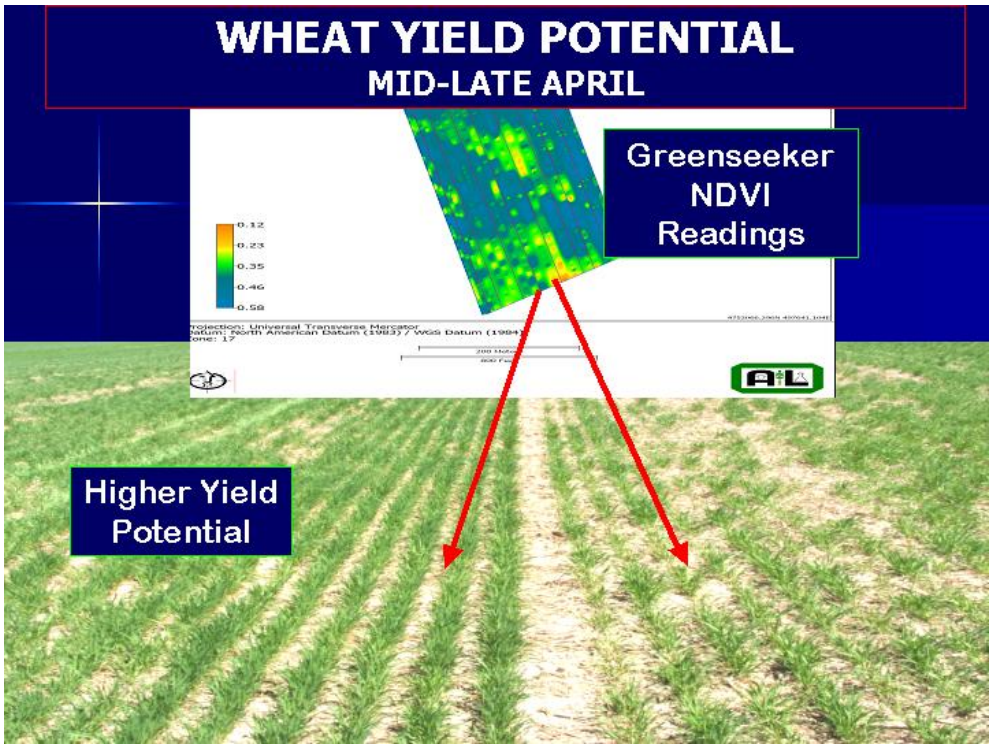

Figure 1. Wheat yield potential map generated from optical sensing tool in mid-late April.

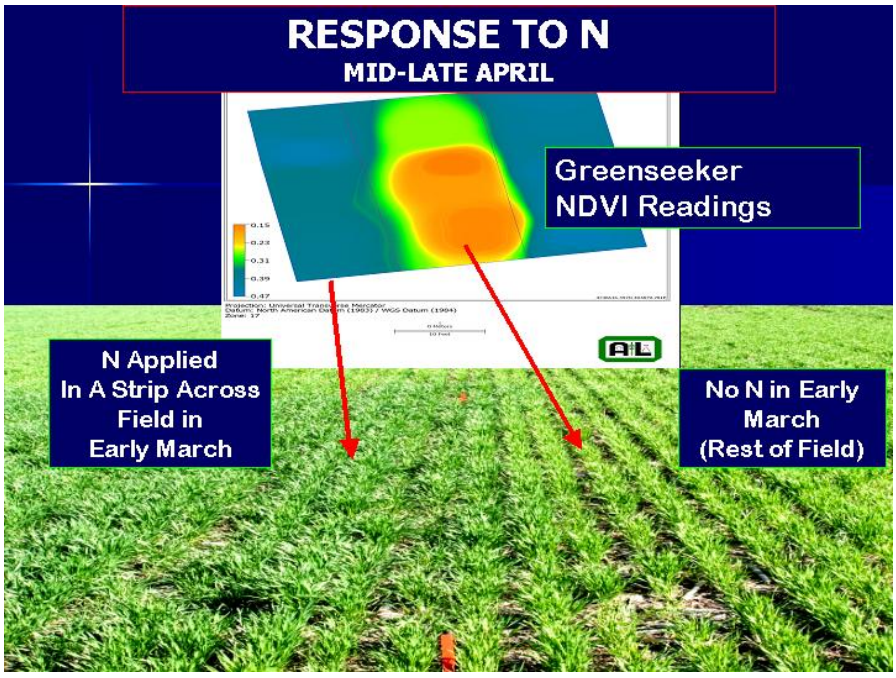

Figure 2. Response to N from an early application in March during mid-late April. The difference in the response is related to the amount of mineralized N in the soil solution, and the wheat crop is used as the indicator to determine the response to N fertilizer.

When we couple the N response with the yield potential, N rates may be fine-tuned from our current recommendations.

Summary:

NA

Next Steps:

Described in “Methods” above.

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Location of Project Final Report: