

Benchmarking For Localized N Recommendations – Yield Response Studies

Purpose:

To determine if the Pre Side Dress Nitrogen Test (PSNT) can be better calibrated for use under Ontario conditions through monitoring the release of organic N from the soil pool during the period from early spring through until early July.

Methods:

Thirty farm cooperators were selected from across the province to represent a broad cross section of field crop production scenarios. Sites were selected based on a range of geographies, soil types, tillage practices and cropping systems. At each site fields were selected that were going into corn in each of the 3 years of the study (2001,2002, 2003). In some cases the same field was used while in others a different field was used each year.

At each field site, strips with four rates of supplemental N were applied, replicated twice, to allow the determination of the Maximum Economic Rate of N (MERN) for each field. Each field had starter N applied to the entire field, at rates up to 40 kg/ha of N. Supplemental rates were targeted at zero, 50%, 100% and 150% of the farmer's normal rate of nitrogen. Yields were measured from each rate strip using either a combine yield monitor or commercial weigh wagon, and the results were fit to a quadratic equation. This was then used to calculate the MERN for the field. Yield measurements were not available for all fields, due to mechanical problems or poor planting or harvest conditions, but on average, 22 yield measurements were available each year.

Results:

Table 1. Summary of Maximum Economic Rates of N (MERN), 2001-03

| Cooperator | MERN (kg/ha) | | | |
|------------|--------------|------|------|---------|
| | 2001 | 2002 | 2003 | Average |
| SF1-01-001 | 66 | 255 | 125 | 149 |
| SF1-01-002 | 100 | | | 100 |
| SF1-01-003 | 0 | | 127 | 64 |
| SF1-01-004 | | 128 | 111 | 120 |
| SF1-01-005 | 140 | 102 | 139 | 127 |
| SF1-01-006 | 190 | 108 | 151 | 150 |
| SF1-01-007 | 65 | 105 | 90 | 87 |
| SF1-01-008 | 0 | 0 | 0 | 0 |
| SF1-01-009 | 44 | 69 | | 57 |
| SF1-01-010 | 158 | 142 | | 150 |
| SF1-01-011 | 97 | | 92 | 94 |
| SF1-01-012 | 0 | 0 | 85 | 28 |
| SF1-01-013 | 150 | | | 150 |
| SF1-01-014 | 80 | 0 | | 40 |
| SF1-01-015 | 171 | 112 | 229 | 171 |

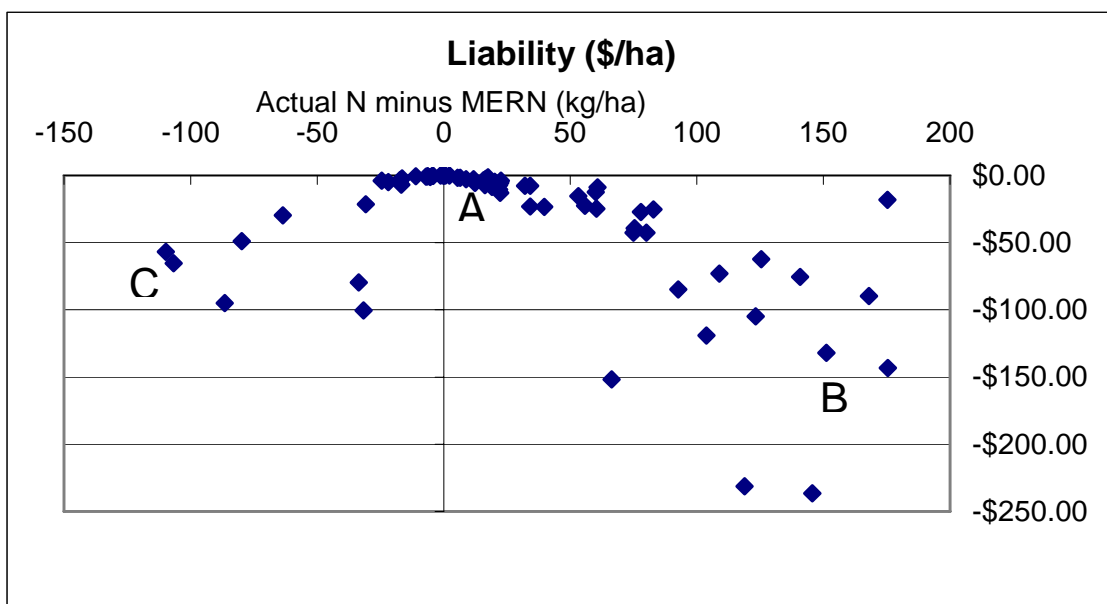
(continued)

Crop Advances: Field Crop Reports

| Cooperator | MERN (kg/ha) | | | |
|------------|--------------|------|------|---------|
| | 2001 | 2002 | 2003 | Average |
| SF1-01-016 | 169 | 167 | 191 | 176 |
| SF1-01-017 | 49 | 138 | 137 | 108 |
| SF1-01-018 | | 78 | 42 | 60 |
| SF1-01-019 | 101 | 142 | 151 | 131 |
| SF1-01-020 | 0 | 212 | 123 | 112 |
| SF1-01-021 | 129 | 79 | 0 | 69 |
| SF1-01-021 | | 106 | | 106 |
| SF1-01-022 | 224 | 0 | 116 | 114 |
| SF1-01-023 | 125 | 82 | | 104 |
| SF1-01-024 | 33 | 100 | | 67 |
| SF1-01-025 | 183 | | 98 | 141 |
| SF1-01-026 | | | 101 | 101 |
| SF1-01-027 | | 114 | | 114 |
| SF1-01-028 | | 79 | 119 | 99 |
| SF1-01-029 | | 167 | 139 | 153 |
| SF1-01-030 | 202 | 90 | 0 | 97 |
| Average | 103 | 103 | 108 | 104 |

Maximum Economic Rates of N ranged from zero to 255 kg/ha, with an average of all plots of 104 kg/ha. Interestingly, the average values for each year did not vary from this figure by more than 4 kg/ha. Averages across years for each co-operator should be treated with caution, and are provided for information only. Benchmark sites were often moved to different fields, and occasionally to different farms, so there could be significant differences in soil type, previous crop, or management between years. These influences will be considered in further evaluation of the data.

Figure 1: Comparison of Financial Liability for applications above or below the MERN with the variation of actual N rates from the MERN.



It is clear from Figure 1 that many farmers are applying rates close enough to the MERN (A) that their economic losses are small (<\$5/acre). There are more farmers in this group who are losing money from over-application of N (B), than from under-application (C), and they are losing larger amounts of money because of it.

Summary:

Using on farm nitrogen strip trials with multiple rates of N is a cost effective method of determining field MERNs on a field to field or farm to farm basis. This method allows farmers to understand the N contribution from the overall management of the operation in terms of tillage, crop rotation, soil type and addition of organic nutrients. The “zero” check strips determine this contribution. The other rates tested then allow the determination of the field MERN which suggests that rate of N that should be the target for greatest profitability in light of input costs and crop prices.

In general the vast majority of farmers in the project were targeting the N rates close to MERN levels as suggested by Figure 1. However, there were still a significant number of farms where the rate of N used was above profitable levels and was resulting in significant financial losses. It was also interesting to note that there were a number of farms where the N rate applied was too low and was resulting in economic losses since the crop was unable to attain its economic yield potential.

Next Steps:

The MERNs for this study will be recalculated using quadratic-plateau equations, which have been shown to provide a more accurate estimate of MERN. This data will need to be correlated to soil type, previous crop, and manure history, and compared with the predicted N recommendations from the corn N database. This will provide an independent check of the accuracy of this model.

Acknowledgements:

OMAF Field Crop Technology would like to acknowledge the farm cooperators who made land and other resources available for conducting these projects. Various members of Ag Industry across the province provided application equipment, nitrogen and access to weigh wagons at harvest. This contribution was greatly appreciated and essential to the success of the project

The project was done in partnership with Dr. Ivan O'Halloran of RCAT, University of Guelph. Other members of the University and OMAFRA communities were involved in the study. University of Guelph Laboratory Services and Agri-Food Laboratories conducted various components of the soil analysis. Funding was supplied by the Stewardship Fund administered by OSCIA and OMAFRA.

Project Contacts:

Ian McDonald , OMAFRA, ian.mcdonald@ontario.ca
Keith Reid, OMAFRA, keith.reid@ontario.ca

Location of Project Final Report:

See Project Contacts above.