Bench Marking For Local Nitrogen Application Recommendations – Soil Nitrate 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.

For each year, 3 benchmark positions were selected in the field along a straight line and positioned to represent distinct soil typic or topographical zones within the field. Benchmark positions were marked with telephone near surface markers so that the exact location of the centre point could be found at any time. Eight soil cores 2 x 30cms were extracted at each sampling event and the cores composited to make a 250 gram sample that was bagged, labeled and moved to frozen storage as soon as possible.

Samples were collected from each benchmark on a 7-10 days schedule from early spring until early July, then at physiological maturity of the crop and fall freeze up.

In the years following the establishment of a set of benchmarks, the sites were sampled ~5 times (thaw, early May, Mid June, physiological maturity of the crop grown, and fall freeze up) to evaluate if the mineralization pattern varied considerably between crops.

Soils were analyzed for NO3 and NH4 by the Land Resource Science Dept. of the University of Guelph. Results were tabulated and graphed.

Results:

Summary statistics for ammonium and nitrate nitrogen concentrations in the soil samples collected for this project are shown in the following tables.

Table 1: Summary Statistics for Ammonium N in Benchmark Soil Samples

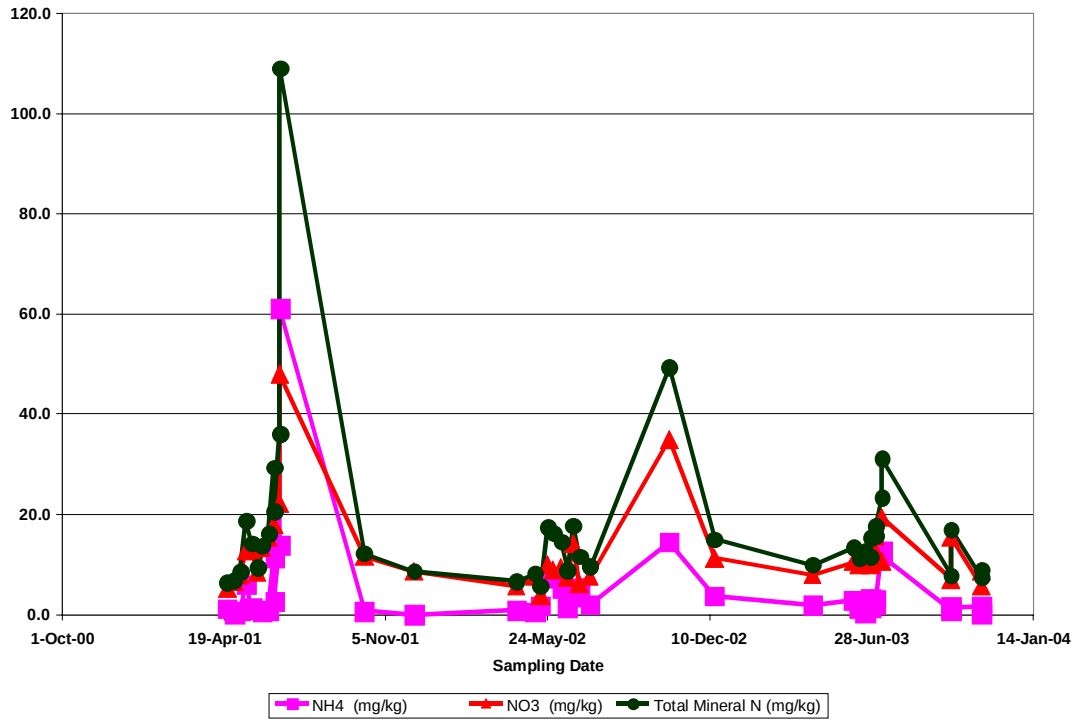
NH4-N (mg/kg)	2001	2002	2003	2001-03
Mean	2.9	3.3	1.2	2.3
Standard Deviation	13.2	8.3	4.3	8.9
Median	1.1	1.2	0.0	0.7
Minimum	0.0	0.0	0.0	0.0
Maximum	346.7	71.5	88.4	346.7
# of Samples	1425	1738	2031	5194

Table 2: Summary Statistics for Nitrate N in Benchmark Soil Samples

NO3-N (mg/kg)	2001	2002	2003	2001-03
Mean	17.2	15.7	18.2	17.1
Standard Deviation	11.6	10.8	12.2	11.6
Median	13.5	12.9	14.9	13.8
Minimum	1.7	1.3	0.0	0.0
Maximum	87.3	103.3	106.1	106.1
# of Samples	1425	1737	2031	5194

The data for both ammonium and nitrate are highly skewed, so the median is a better indicator of the central tendency of the data than the mean. Ammonium N levels were, as expected, generally low, except where manure or anhydrous ammonia had been applied shortly before sampling.

Figure 1: Example of Mineral N Contents of Field Soils Over Three Growing Seasons



Mineral N levels in general followed a pattern of accumulation through spring and then a decline towards harvest and freeze up. On initial observation there was not a significant impact of topographical benchmark position on the levels of N found.

Summary:

The seasonal pattern of nitrate N accumulation was generally a gradual increase from early spring through the early part of the growing season, peaking in early July. Other studies have shown a decline in soil nitrate concentrations when the phase of rapid corn growth commenced, but this did not appear in many fields in this study, presumably because the sampling period ended before this decline was evident. There was a significant decline in soil nitrate concentration between the end of spring sampling, and corn maturity. Roughly 25% of the sites showed either no change in nitrate N concentration over the season(10%), or a decline (15%). Possible mechanisms for this decline include denitrification or leaching, but further analysis of the data will be required to make any conclusions.

Next Steps:

The results of this study are being further analyzed with more sophisticated statistics to filter through the massive data set that exists. This analysis will take into account the type and timing of various management practices on the cooperating farms including manure application and amounts, tillage system, cropping sequence etc. The data summarized thus far is being extended through meetings and written reports to the farm community.

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 OMAF 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 OMAF.

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.