IMPROVING NITROGEN MANAGEMENT IN CORN TO REDUCE GHG EMISSIONS

GHG Taking Charge Team Fact Sheet

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WHY DO WE NEED A GOOD NITROGEN MANAGEMENT?

Optimal nitrogen (N) fertilization is essential for achieving a successful, high yielding corn crop. Inadequate N inputs result in loss of silage or grain yield. Excessive N inputs can delay maturity for grain corn. Excess N inputs can also increase environmental losses of N as nitrate leaching to groundwater or in increased emissions of nitrous oxide, a greenhouse gas. Therefore, optimal nitrogen fertilization makes good economic and environmental sense. Improved N management represents an effective and practical means for producers to reduce GHG emissions.

OPTIMIZING CROP N MANAGEMENT

Our goal in optimizing crop N management is to match the N supply to the crop N demand. This N supply includes manure and fertilizer N inputs, as well as mineralization, the release of plant available nitrogen from soil organic matter and crop residues as a result of soil microbial activity. The optimal amount of N inputs for a crop varies from field-to-field and from year-to-year due to variation in both crop N demand and soil N supply. In Atlantic Canada, we currently have only general fertilizer nitrogen recommendations, which do not take soil N supply or crop N demand into account.

We are developing soil and plant N tests to improve our ability to predict optimal fertilizer N rates. The soil N tests are aimed at providing a measure of soil N supply. The plant N tests are used to measure crop N sufficiency. N sufficiency is a measure of the extent to which crop N supply meets crop N demand.

CORN PLANT AT 6-LEAF STAGE FOR PSNT SOIL TEST

We are currently working on four soil tests for corn, a pre-plant soil nitrate test (PPNT), a pre-sidedress soil nitrate test (PSNT), a post-harvest soil nitrate test (PHNT) and a soil N mineralization test. We are also evaluating the use

Greenhouse Gas Mitigation Program for Canadian Agriculture
Programme d'atténuation des gaz à effet de serre pour l'agriculture canadienne

of leaf chlorophyll index to measure corn N sufficiency

PRE-PLANT SOIL NITRATE TEST (PPNT)

This PPNT is taken in early spring to measure the carry-over of plant available N from the previous growing season. The test will measure the amount of plant available N already in the soil at planting. This test, used in combination with a N credit based on the preceding crop, can be used to reduce pre-plant fertilizer nitrogen application.

PRE-SIDEDRESS SOIL NITRATE TEST (PSNT)

This PSNT is taken at approximately the corn six-leaf stage. This test measures soil N mineralization early in the growing season in addition to carry-over of plant available N from the previous growing season. The PSNT can be used to determine if a yield response can be expected to sidedress N application, and to predict an appropriate sidedress fertilizer N rate.

POST-HARVEST SOIL NITRATE TEST (PHNT)

This PHNT is taken at harvest to measure residual soil nitrate at the end of the growing season. The PHNT can be used as a "report card" for N management that year. If the PHNT is high, it suggests that lower fertilizer N inputs would have been possible with no loss in yield.

SOIL N MINERALIZATION TEST

Soil N mineralization is the primary source of soil N supply, even when carry-over of soil nitrate from the previous growing season is high. However, soil N mineralization is difficult to predict. A Canada-wide research program was started in 2004 to determine if a soil N mineralization test can be developed. If successful, such a test should be applicable to most field crops. This test would estimate the amount of soil N mineralization expected to occur in a year with average climatic conditions.

LEAF CHLOROPHYLL INDEX TEST

Leaf chlorophyll index is a measure of the "greenness" of the crop, and is a good measure of crop N sufficiency. Leaf chlorophyll index can be measured rapidly in the field using a hand-held Minolta

SPAD-502 meter. This test is done at the corn six-leaf stage. Comparison of leaf chlorophyll index measured in the crop against leaf chlorophyll measured in a high fertility reference plot will determine if N inputs were adequate to meet crop N demand.

THE FUTURE

The GHG mitigation program was very well received in New Brunswick. The resources attached to the program were used strategically to encourage the Agriculture Industry to focus attention on the development of best management practices (BMP's) with the objective of reducing GHG emissions. A number of successful projects were undertaken to demonstrate the potential to use BMP's to reduce GHG emissions. The findings from the first GHG mitigation program were excellent however they also identified areas which need additional work. Gaps exist in fundamental agronomy, in areas such as predictive confidence of BMP's and in the impact (ecological and economic) of the actual emission reduction on-farm and to the surrounding environment.

In conclusion there is a need to focus additional resources in areas of basic agronomy to build a solid foundation with the predictive confidence and economic consequences clearly defined. Looking forward producers, industry and the public need to start looking at adaptation technology to ensure continued reduction of emissions well into the future.

CONTACTS:

For further information on how the Pre-Plant Nitrate Test can be used to improved nitrogen management, contact your local Crop Development Officer or Nutrient Management Specialist with the New Brunswick Department of Agriculture, Fisheries, and Aquaculture at 1-888-NBAGRIC (1-888-622-4742)