Fine-Tuning Nitrogen Use on Corn

Adaptive Management Process

Corn producers now have access to new nitrogen (N) assessment tools that allow for evaluation and improvement of manure and N fertilizer use by field or management zone. Best results are achieved using an iterative process where measurements are taken and changes are made based on an evaluation of the data (adaptive management). Adaptive management requires the use of assessment tools that measure performance indicators and allow for learning over time (data-driven decision making). In this factsheet we apply the idea of adaptive management to N management of corn and introduce concepts that can be used to implement the process at the farm.

Record the Baseline

The starting point for an adaptive management plan for N is the set of current practices applied to any given field or management zone. For example, producers can start with their current target N rate or use the Cornell N equation for corn to generate a baseline N guideline for a field. See Agronomy Factsheet #35 (N Guidelines for Corn) for more details.

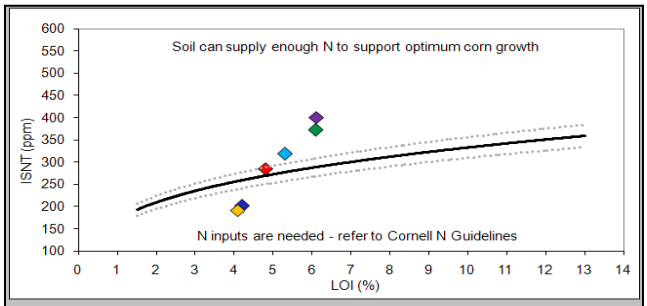
Decide on a Comparison Plan

An adaptive management plan should test questions and adjust decisions as new information comes to light. An on-farm strip trial with two or more treatments repeated four times (replications) within the same field is the most ideal way to compare different management strategies. A farmer can also compare different practices on groups of fields (where each field is a replication of two or more treatments). A third method is to evaluate practices on the same field over multiple years. Although fully replicated strip trials are the quickest way to get answers, approaches two and three are valid as well since all three options generate data to help fine-tune N management over time. Yield monitors (especially as more farms purchase forage harvesters with monitors) can make the evaluation process much more efficient.

Use the Assessment Tools

Illinois Soil Nitrogen Test (ISNT)

Corn gets a large portion of its N from mineralization of organic matter by soil microbes. The ISNT is a measure of soil N supplying capacity. Soils testing above the ISNT critical value curve (Figure 1) will supply enough N throughout the growing season to support optimum corn growth. These soils can quickly mobilize N into a plant available form. The ISNT can also confirm fields that should receive additional N (fields that fall below the line). See Agronomy Factsheet #36 (Illinois Soil Nitrogen Test) for more details. Regularly manured fields are prime candidates for this test to determine whether starter or additional fertilizer N may be eliminated without risking reduced yield.



Field Name	LOI (%)	ISNT (ppm)	Critical ISNT	Interpretation
Field 1	4.2	202	263	N inputs needed
Field 2	6.1	373	302	Soil can supply enough N
Field 3	5.3	319	288	Soil can supply enough N
Field 4	4.8	285	277	Marginal
Field 5	6.1	400	302	Soil can supply enough N
Field 6	4.1	192	261	N inputs needed

Figure 1: Illinois soil nitrogen test (ISNT) illustrates which soils have the capacity to supply N without additional fertilizer inputs.

Corn Stalk Nitrate Test (CSNT)

The CSNT is a measure of nitrate accumulation in the lower portion of the corn stalk and helps illustrate where N management was optimal, above, or below plant requirements (Figure 2). This is an end-of-season "report card" on field N management. When the CSNT is 2000 ppm or greater, corn had access to more N than it needed; less than 750 ppm, the corn had difficulty accessing N and might have suffered depressed yields (for details, see Agronomy Factsheet #31: Corn Stalk Nitrate Test).

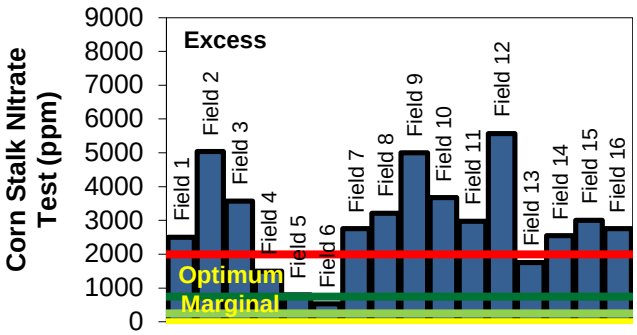


Figure 2: Corn stalk nitrate test (CSNT) results can quickly illustrate where (which fields) opportunities are for future N reductions and where more N is needed.

Evaluate the Data and Make Changes

The results of the lab tests and comparative field testing, as well as crop records and field history information help build a stronger understanding of the impact of N management decisions on crop growth and N utilization. Improved analyses and decision making can be realized by including farm advisors and peers in evaluation and discussion of the data and what to do next. An example of improved decision-making opportunities by using relevant crop management records, Cornell N guidelines, and ISNT and CSNT results, is shown in Table 1. In this example, the highest CSNT results (>7000 ppm) were obtained from fields F-19 and D9. Both fields had a high ISNT ("Soil can supply enough N") yet received fertilizer N in addition to manure. For these fields, fertilizer use can be omitted. Further, fields D8 and F17 had excessive CSNTs as well. While the ISNT result indicated these fields needed extra N, the CSNT suggests the combination of manure and fertilizer actually used could have been reduced. This also indicates there are more opportunities to reduce fertilizer use, especially where manure is involved. Implementing multiple years of testing and side-by-side comparisons on these fields is recommended.

Such experimentation and continued sampling can help to gain further confidence in decisions over time. This is the true essence of adaptive management.

Conclusion

Data-driven decision making can result in true impact at the farm level. The adaptive management concepts presented in this factsheet using crop and field records, as well as the ISNT and CSNT can help identify opportunities for improvement in N fertilizer management and aid in implementation of practices that reduce the cost of production, increase yields, and protect the environment from excess N.

Additional Resources

- Corn Nitrogen Management Evaluation Tool http://nmsp.cals.cornell.edu/software/calculators.html
- Agronomy Fact Sheets#21: Nitrogen Needs of 1st Year Corn; #30: Soybean Credits for Corn; #31: Corn Stalk Nitrate Test; #35: Nitrogen Guidelines for Corn; #36: Illinois Soil Nitrogen Test for Corn http://nmsp.cals.cornell.edu/guidelines/factsheets.html

Disclaimer

This fact sheet reflects the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of particular discharge levels from agricultural land.

For more information

Cornell University Cooperative Extension

Nutrient Management Spear Program
http://nmsp.cals.cornell.edu

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Table 1: Combining the ISNT and CSNT with crop records provides feedback on nitrogen management decisions.

Field	Acres	Rot.	Cornell N Guidelines (lbs N/acre or ISNT)	Fall Applied Manure	Spring Applied Manure	Pre Plant Fertilizer N	Starter Fertilizer N	Sidedress Fertilizer N	Total Fertilizer N	CSNT
F-2	30	COS 2	75	10000 Incorporated		0	57		57	197
F-9	20	COS 4	109			42	57		99	887
F-15	13	COS 4	58	10000 Incorporated		0	57		57	1473
D-5	15	COS 3	14	-	5200 Incorporated		3	50	53	2117
F-17	21	COS 4	78	10000 Incorporated		0	67		67	4474
D-8	32	COS 2	79	20 T Surface	5200 Incorporated		3	50	53	6230
F-19	15	COS 2	Soil can supply enough N	10000 Incorporated		0	67		67	7149
D-9	20	COS 4+	Soil can supply enough N		5200 Incorporated		3	50	53	7646