

Soil nitrate test for corn in Michigan

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Why test soil for nitrates

Nitrate testing of soil is an excellent and inexpensive way of evaluating the available nitrogen (N) status of your soil. Michigan State University research and demonstration studies have shown that many farmers could reduce their N fertilizer application rate on corn without risk of reducing yields if they used the nitrate soil test. Nitrate testing provides credit for available nitrogen already in the soil and therefore helps to prevent over-use of N fertilizers. Excess N fertilizer use adds cost and may increase nitrate contamination of groundwater.

What does the test measure

A soil nitrate test measures the nitrate N content of the soil at the time the sample is taken. It does not measure ammonium N or organic N. The nitrate content of the soil is rather dynamic, changing over time as the result of microbial activity and crop uptake. For samples taken in late May or in June, much of the ammonium and some of the organic N will have been converted to nitrate and will show up in the test.

When to take soil samples

Soil samples may be taken anytime, however, the soil nitrate content increases with time as the soil warms up in the spring of the year. The greatest amount of available soil nitrate usually occurs in the soil three to four weeks after corn emergence (V6 to V8 stage). At this stage of growth, corn begins to take up nitrogen quite rapidly and is when sidedress nitrogen is appropriately applied. Depending on the year, this may occur from mid-May to early June. At this time the test measures both residual nitrate N from the previous year and recently mineralized N from ammonium and organic matter (also plant residues and manure).

Soil samples taken in early spring (April or early May) measure primarily residual nitrate, therefore the amount of N credit will be smaller. Testing in early spring may still be well worth the effort. Testing for ammonium in early spring where manure has been applied will provide a preliminary indication of available nitrogen release.

Samples taken just prior to sidedress time can be used to the greatest advantage to determine the appropriate rate of sidedress N. The soil nitrate test provides the best information about the available soil N status when only small amounts of nitrogen (less than 40 lb N/A) have been broadcast preplant. When large amounts of nitrogen fertilizers have been knifed in or broadcasted and incorporated prior to planting it is difficult to get a good indication of the available N status in the soil system.

Samples taken in the fall may be used to evaluate how much N is left at the end of the season. Soil test levels in excess of 15 ppm at harvest indicate excess soil N was present. Growers who have excess soil N in June or at harvest time, should consider reducing next years fertilizer rate or use the presidedress soil nitrate test (PSNT) to determine the appropriate N rate.

What fields should be sampled

Sample all fields where corn is to be or is planted. Manured fields and legume fields sampled in June will likely contain the most nitrate. Sampling these fields early, however, will not result in the maximum N credit that should be taken because ammonium N and easily decomposed organic N will not be measured by the test. See Extension Bulletin E-2344 and E-2567 for determining the appropriate N credit from manure and legumes if samples are taken in early spring.

Other fields that show the most nitrate N are fields with fine textured soils (i.e. loam, clay-loam and clay) that were heavily fertilized with N the previous year. Sandy soils even though heavily fertilized the previous year may not show much N carryover.

Where to get soil sample boxes

Soil sample boxes for nitrate testing and information on taking soil samples for the soil nitrate test are available from your county Extension office or the **MSU Soil and Plant Nutrient Laboratory**, East Lansing, MI 48824-1325. ph. 517-355-0218.

How to take soil samples

Each sample should be a composite of 15-20 soil cores taken from a uniform field area no larger than 20 acres. Use a soil sampling probe. **Take each core to a depth of 12 inches.** Place the 15-20 cores in a clean pail and mix thoroughly. Save one quart of the soil sample for drying.

How to handle soil samples

Air dry the sample immediately in a warm room. Placing the sample near a hot air vent, space heater or fan will speed up the drying process. **Do not hold wet samples in a plastic bag for any length of time.** Microbial action in wet samples can significantly change the nitrate test results and the sidedress N recommendation.

Where to get samples analyzed

Contact your MSU county Extension office. Dry soil samples may be mailed to the **MSU Soil and Plant Nutrient Laboratory**. If the samples are still moist, do not put them in the mail. Moist samples should be transported directly to the county MSUE office or to the MSU laboratory for drying. Some county extension offices have made arrangements for taking samples directly to the Soil and Plant Nutrient Lab on certain days of the week.

Interpretation of test results

Interpretation of the MSU soil nitrate test for corn has been changed this year. The change is necessary with the "Maximum Return To Nitrogen" (MRTN) or "economic optimum N rate" approach now being used by MSU for recommending nitrogen for corn production in Michigan. (Refer to **CSS Information Sheet #3**). The MRTN approach accounts for some of the N mineralization potential of soils. More productive soils tend to mineralize (release) more N. As a result the N recommendations are now lower than when calculated based on yield goal. Taking a direct N credit, as previously done, results in too much of a credit and is not appropriate. When the corn nitrogen recommendation is based on MRTN the soil nitrate test results need to be interpreted differently than previously when corn N recommendations were based solely on crop yield. Interpretation guidelines for the soil nitrate test results are now indexed and are presented in the table below.

SOIL NITROGEN CREDIT FOR CORN IN MICHIGAN. (Use when N recommendation is based on MRTN)		
Soil Nitrate Test Value	Interpretation	Soil N Credit ¹
ppm		lbs N/acre
≤ 10	Low <i>Use Full Recommended N</i>	0
11 – 15	Medium - Low <i>Reduce N Rate Slightly</i>	30
16 – 20	Medium <i>Reduce N Rate</i>	60
21 – 25	Medium - High <i>Reduce N Rate</i>	90
≥ 26	High + <i>No Additional N Needed</i>	**

¹ These credits apply only for corn and MRTN nitrogen rates.
****** Soil contains adequate available nitrogen for growing the corn crop. No additional nitrogen is needed.

Economics of nitrate testing

The cost of a soil nitrate analysis by the MSU and Plant Nutrient Lab is \$10 per sample (\$13 for nitrate and ammonium). Each sample should represent no more than 20 acres. Assuming it costs \$7 to take the sample, the total cost is \$17 to \$20 per 20 acres or **75 to 90 cents per acre** (less than one-half bushel corn). At 50 cents per pound of N, each 10 lbs per acre of N credit is worth \$5. A 60 lbs N/A credit is worth \$30 /A. This is a good return on investment. Using the correct amount of nitrogen has value in terms of good water quality as well as monetarily. **Results from research and on-farm demonstration studies indicate that nitrogen adjustments based on the soil nitrate test would return at least \$5 per acre in either cost savings or improved yield.**