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Measuring the nitrogen status -- 2007

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Abstract
Tools are available that can aid decisions about applying supplemental nitrogen (N) if losses from applied fertilizer or manure are suspected. These can provide more site-specific information than estimating losses and can also provide N rate application guidance.

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Measuring the nitrogen status -- 2007

by John Sawyer, Department of Agronomy

Tools are available that can aid decisions about applying supplemental nitrogen (N) if losses from applied fertilizer or manure are suspected. These can provide more site-specific information than estimating losses and can also provide N rate application guidance.

Late Spring Soil Nitrate Test

Details about this test can be found in the Iowa State University Extension publication PM 1714, Nitrogen Fertilizer Recommendations for Corn in Iowa, available for download through the Iowa State University Extension online store. Soil samples are collected when corn is 6 to 12 inches tall, often in early June. Soil conditions should allow the collection of good samples from the entire one-foot depth. Test interpretations are adjusted when spring rainfall is well above normal. In fields where less than full rates of N were applied preplant, lower the critical concentration from 25 ppm to 20-22 ppm when rainfall from April 1 to time of sampling is more than 20 percent above normal. With full rates of N applied preplant (fall or early spring) or with manured soils, the suggested critical concentration is 15 ppm if May rainfall exceeds 5 inches. In these fields, if tests are between 16 and 20 ppm, consider a small N application. In situations where manure or full rates of N were applied, a suggestion is to limit additional N application to 60-90 lb N per acre, even if the test result is 10 ppm or less.

Corn Plant N Status

A method to determine the N status of corn plants is explained in Iowa State University Extension publication PM 2026, Sensing Nitrogen Stress in Corn, available through the Iowa State University Extension online store. The corn plant expresses N stress through reduced leaf greenness, which can be seen as you look at corn plants and measured with sensors such as a chlorophyll meter. Measurements need to be compared with adequately fertilized (non-N limiting) reference areas in order to reduce bias due to different growing conditions, soils, hybrids, or factors affecting color other than N deficiency (like plant yellowing in response to wet soils).

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A chlorophyll meter is used to collect readings in corn. (John Sawyer)

If you are concerned about N loss, then apply two or three supplemental N strips (a rate that is non-N limiting) across fields or in targeted field areas and watch the corn. These will be the reference areas that are compared with the rest of the field. When corn gets some size to it, around the V8-V10 growth stages, and you see differences in the color between the strips and the rest of the field, then additional N should be applied to the field or field areas showing differences.

A method to quantify the N deficiency stress and amount of N to apply is to monitor the crop with a chlorophyll meter, other sensing instrument, or aerial image. Relative chlorophyll meter values (readings from the field area of interest divided by readings from the reference area) give an indication of the severity of deficiency; that is, the lower the relative value the greater the N deficiency and the larger the N application rate needed.

Chlorophyll readings can aid in confirming suspected N-loss situations and need for supplemental N. This is especially helpful when corn has recovered from wet conditions, resumed good growth, and is putting pressure on the available N supply. The later into the growing season these readings are taken, the more they can indicate deficiencies and the better they relate to total crop N fertilization need. Small plants usually do not reflect potential N shortages because the amount of N taken up is small. Therefore, corn plant sensing is more reliable with larger plants. Measurements from approximately V10 to VT stages should provide similar results. Table 1 gives suggested N rates to apply at various relative chlorophyll meter values. Readings are taken from the uppermost leaf with the collar visible until the VT stage (tassel emergence), and then from the ear leaf. Average 15-30 representative readings per field location or reference strip location.

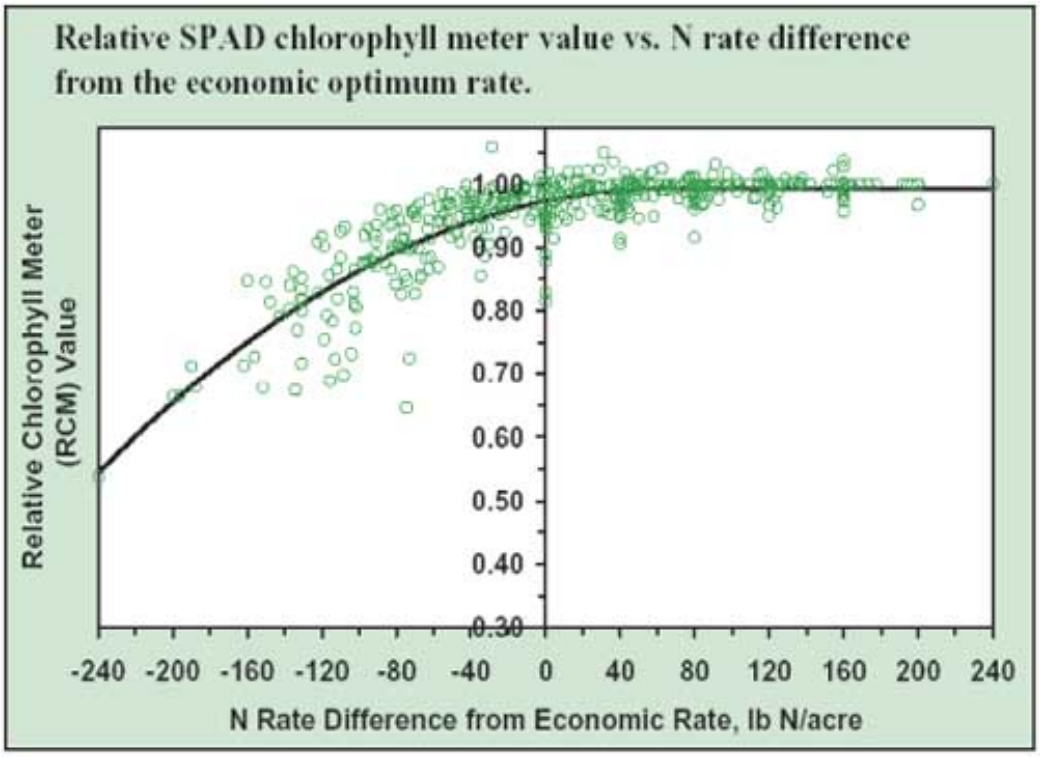
An advantage of plant N stress sensing or visual observation, and comparison with reference areas, is the ability to monitor the crop multiple times as the season progresses to see if the N supply is adequate, remains adequate, or N stress develops.

Table 1. Relative Minolta SPAD 502® chlorophyll meter value and N rate to apply.

Relative SPAD Value*	N Rate to Apply**
	lb N/acre
< 0.88	100
0.88-0.92	80
0.92-0.95	60
0.95-0.97	30
> 0.97	0

* Relative values calculated by dividing readings from the area of interest by readings from the well-fertilized reference strip. Readings taken from approximately the V10 to VT corn growth stage.

** Suggested supplemental N rates limited to a maximum of 100 lb N per acre.



Relationship between relative chlorophyll meter values and the N-rate deviation from the economic optimum N rate.

A field of N-deficient corn and well-fertilized, non-N limiting strips. (John Lundvall)

John Sawyer is an associate professor with research and extension responsibilities in soil fertility and nutrient management.

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