

## Using the Late Spring Soil Nitrate Test In 2022

Antonio Mallarino, Professor and Nutrient Management Extension Specialist, Department of Agronomy, Iowa State University

This year corn planting was delayed due to an unseasonably cold spring, and at this time corn growth stage ranges mostly from the V2 to V6 across the state. Many producers had doubts concerning preplant nitrogen (N) application due to high N fertilizer prices, and now some are wondering about possible in-season diagnostic tools to assess a potential need for supplemental in-season N application.

Iowa research has shown that the Late Spring Soil Nitrate Test (LSNT), or Presidedress Soil Nitrate Test (PSNT) as it is called in some other states, is a useful tool to assess if post-planting supplemental sidedressed N is needed. Extension publication CROP 3140 [Use of the Late-Spring Soil Nitrate Test in Iowa Corn Production](#) provides information about the sampling, research that helped with interpretation of results, and guidelines for N application when it indicates a need for supplemental N application. Also, last year's Integrated Crop Management blog article [Collecting Late Spring Soil Nitrate Test Samples](#) further discusses soil sampling for the LSNT and includes a useful video concerning the soil sampling.

For the LSNT, soil samples are collected when the corn is 6 to 12 inches tall (from the ground to the center of the whorl), which usually occurs around the V5 to V6 growth stages. The LSNT sampling time is designed to measure nitrate-N concentration in the top foot of soil as affected by residual applied N and spring mineralized nitrate until the soil sampling time. Of particular importance for this year when much of the corn was planted later than normal, is that despite this recommended sampling time, research has shown that the sampling should not be delayed until after June 10 or 15 even if the corn is shorter than 6 inches.

The LSNT does not measure ammonium-N because research has shown that in most conditions the ammonium measurement is not useful to assess and predict N supply for corn and its consideration can underestimate supplemental N needs. Soil sampling below a one-foot depth is not recommended because of its cost and because research has shown that a deeper sampling seldom improves the one-foot sampling capacity to predict the need for supplemental N.

Publication CROP 3140 shows results of field correlations of LSNT test results with corn yield response conducted from 1987 to 1992 pooled for corn after corn and follow-up corn after soybean; separate correlations conducted from 1996 to 2004 for corn after alfalfa, corn after corn; and more recent correlations for corn after corn and corn after soybean. Of particular interest among the recent research are results for fields receiving preplant manure N because the soil nitrate spatial variability can be particularly high when manure is applied mainly in the spring. Figure 1 summarizes two figures in CROP 3140 that show the relationship between relative corn grain yield and LSNT test when injected or broadcast liquid swine manure or solid poultry manure had been applied. Results show that even in these potentially highly variable conditions, the LSNT is useful to identify conditions where supplemental N is or is not needed.

For all cropping and preplant fertilization field response trials conducted since 1987 (shown in the publication) and in Fig. 1) nitrate-N levels higher than 20 to 30 ppm (on average 25 ppm) in the top foot of soil indicate a very low probability of corn yield increases from additional sidedressed N. As Fig. 1 shows, the LSNT is not too good at predicting the precise amount of supplemental N needed to optimize or maximize corn yield. However, as a general guidance for corn after corn and corn after soybean with previous N fertilization, the research since 1987 has suggested to apply 8 pounds N/acre per ppm LSNT below the critical value of 25 ppm, as CROP 3140 indicates. The most recent research conducted by Dr. John Sawyer (now retired) indicated that 34 percent of the values from the trials were within plus or minus 2 ppm of the average value. For corn after manure being applied and corn after alfalfa, publication CROP 3140 provides a table with supplemental N application rates for four LSNT results ranges and favorable or unfavorable corn and fertilizer price ratios.

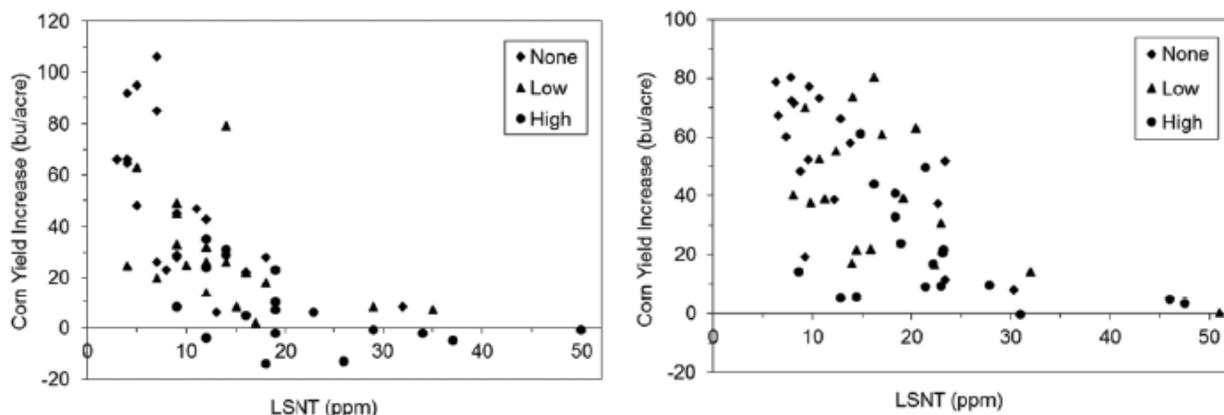


Figure 1. Relationship between the late spring soil nitrate test (LSNT) and relative corn yield increase to supplemental N fertilizer N application across trials with preplant application of liquid swine manure (left graph) or solid poultry manure (right graphs). Adapted from publication CROP 3140.

The LSNT, as any test, is not perfect but it is a useful diagnostic tool. Be careful in how you collect the soil samples and follow the procedure suggested in publication CROP 3140, especially if N fertilizer or manure were injected in the spring before corn planting. If soil cores are not pulled representatively from within and between the bands, incorrect interpretation will occur. Nitrate will not move much laterally across the topsoil, so sampling between bands will not include nitrate remaining from banded N applications.

Publication 3140 also includes valuable additional information about the LSNT and for making supplemental N applications. It discusses the critical value of 25 ppm could be reduced by 3 to 5 ppm if rainfall before sampling was about 20% higher than normal, that it can underestimate supplemental N need when nitrification inhibitors are used with fertilizer or manure applied close to the corn planting, and that excessive rainfall after the soil sampling may increase the estimated supplemental N rate.