Using the Pre-Sidedressing Soil Nitrate ‘Quick Test’
to Guide Vegetable Crop N Fertilizer Management

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Laboratory analysis is the most accurate method of determining soil nitrate concentration. If analytical results can be returned to the grower in a timely manner, lab analysis is the preferred method for measuring residual soil NO₃-N. However, a semi-quantitative estimate of soil nitrate concentration can be made using the following on-farm ‘nitrate quick test’ procedure. The main advantage of this procedure is that results can be obtained in as little as an hour after sampling. This quick test has been effectively used on a wide diversity of mineral soils (below 5 percent organic matter). The test has not been calibrated for peat soils.

The materials required for the quick test are volumetrically marked plastic centrifuge tubes (50-ml volume), which can be purchased in packs of as few as 10 tubes; these tubes can be reused indefinitely. The soil extraction solution requires calcium chloride, a chemical that is also used in home canning and brewing. Lastly, nitrate-sensitive test strips are required to estimate the nitrate concentration; these strips are sold in packages containing from 25 to 100 strips. Several brands of test strips are available; any brand should be adequate to the task, provided the strips can read concentrations up to approximately 50 ppm NO₃-N, or 200 ppm NO₃. All these items can be purchased on-line; vendors can be identified through an internet search.

Quick test procedure:

1) Prepare a composite soil sample that is representative of the field by collecting and thoroughly blending at least 15 soil cores from around the field.

2) Make the extracting solution by dissolving approximately 6 grams of calcium chloride (about one level teaspoon) in a gallon of deionized or distilled water. Precise proportions of calcium chloride and water are not important; the calcium merely acts to flocculate soil particles.

3) Fill a centrifuge tube to the 30 milliliter level with the extracting solution.

4) Slowly add blended soil to the tube until the level of the solution rises to 40 milliliter level. It is critical that the soil you test is representative of the sample; for moist clay soils that are difficult to blend, pinch off small pieces from each soil core and add to the tube. Testing duplicate samples will minimize variability. Cap tubes tightly and shake vigorously until all soil clods are thoroughly dispersed.

5) Let the sample sit until the soil particles settle out and a zone of clear solution forms at the top of the tube. This may take only a few minutes for sandy soils, but an hour or more for clay soils.

6) Dip a nitrate test strip into the clear solution, shake off excess solution, and wait the length of time specified (usually 60 seconds) before reading the strip. Compare the color that develops on the strip with the color chart provided with the strips. The strip color will continue to darken with additional time, so make the determination quickly.
Interpretation of results

Conversion of the strip reading to an estimate of ppm NO₃-N in dry soil requires the use of a correction factor that accounts for the dilution of the sample with the extracting solution. Since the amount of moisture in the soil sample affects the dilution one needs to adjust based on the soil texture and moisture content. Also, take care to determine whether the nitrate test strips are calibrated in ppm NO₃-N, or ppm NO₃.

The equation to adjust the strip color reading to ppm NO₃-N on a dry soil basis is:

\[
\text{strip reading ÷ correction factor (from the table below) = ppm NO₃-N in dry soil}
\]

<table>
<thead>
<tr>
<th>Soil texture</th>
<th>NO₃</th>
<th>NO₃-N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>moist soil</td>
<td>dry soil</td>
</tr>
<tr>
<td>sand</td>
<td>2.3</td>
<td>2.6</td>
</tr>
<tr>
<td>loam</td>
<td>2.0</td>
<td>2.4</td>
</tr>
<tr>
<td>clay</td>
<td>1.7</td>
<td>2.2</td>
</tr>
</tbody>
</table>

In choosing the correct correction factor, ‘moist soil’ would be close to field capacity, while ‘dry soil’ would be closer to permanent wilting point. Therefore, the calculation for a loam soil near field capacity moisture content registering a test strip color of 60 ppm NO₃ would be:

\[
60 ÷ 2.0 = 30 \text{ ppm dry soil NO₃-N}
\]

A dry clay soil registering a test strip color of 20 ppm NO₃-N would be:

\[
20 ÷ 0.5 = 40 \text{ ppm dry soil NO₃-N}
\]

As a general rule soil less than 10 ppm NO₃-N on a dry soil basis has limited N supply, and fertilization is usually justified. Soils between 10-20 ppm NO₃-N have enough N to meet immediate plant needs but a modest amount of sidedress or fertigated N may be appropriate. In soil with NO₃-N greater than 20 ppm, additional N application can be postponed until retesting shows that residual soil NO₃-N has declined.