

Using the Pre-Sidedressing Soil Nitrate 'Quick Test' to Guide N Fertilizer Management

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November 2015

In California vegetable fields, nitrate-form nitrogen ($\text{NO}_3\text{-N}$) can build up to levels high enough to supply crop nitrogen demand for an extended period. Sampling the root zone soil for $\text{NO}_3\text{-N}$ concentration before sidedressing can identify fields in which N application can be delayed or reduced without affecting crop productivity. Collection of a composite soil sample representative of the entire field is necessary to make an accurate determination of soil nitrate status. Eight to 12 soil cores from throughout the field is usually adequate. Sample depth should cover the active root zone, which for most vegetable crops is the top foot of soil. Collect the soil cores starting in a plant row and angling the core toward the bed center. Be sure not to sample the zone where a fertilizer band has been recently applied. Thoroughly blend the soil cores together.

Laboratory analysis is the most accurate method of soil nitrate determination, but a semi-quantitative estimate of soil nitrate concentration can be made using the following on-farm 'quick test' procedure. The advantages of this procedure are a) results can be obtained in less than an hour for most soils, and b) no weighing or drying of soil is required, although you do need to estimate the soil texture and moisture content.

Procedure

- 1) Make the extracting solution by dissolving approximately 6 grams of calcium chloride (about one teaspoon) in a gallon of distilled water. The concentration of this solution is approximately 0.01 molar.
- 2) Fill a volumetrically marked tube or cylinder to the 30 ml level with the extracting solution. Any volumetrically marked tube or cylinder will work, but 50 ml plastic centrifuge tubes with screw caps are convenient and reusable.
- 3) Add the soil to the tube until the level of the solution rises to 40 ml; cap tightly and shake vigorously until all soil clods are thoroughly dispersed. It is critical that the soil you test is representative of the sample; for moist clay soils that are difficult to blend, pinch off several small pieces of each soil core. Testing duplicate samples will minimize variability.
- 4) Let the sample sit until the soil particles settle out and a clear zone of solution forms at the top of the tube. This may take only a few minutes for sandy soils, but as much as an hour or more for clay soils.
- 5) Dip a EM Quant® nitrate test strip into the clear zone of solution, shake off excess solution, and wait 60 seconds. Compare the color that has developed on the strip with the color chart provided. When the strip color is between two color samples on the chart, interpolate the nitrate concentration of the strip as closely as possible. The strip color will continue to darken with time, so make the determination between 60 and 70 seconds after dipping the strip.

Interpretation of results

The nitrate test strips are calibrated in parts per million (PPM) NO_3^- . Conversion to PPM $\text{NO}_3\text{-N}$ in dry soil requires dividing the strip reading by a correction factor based on soil texture and moisture content:

$$\text{strip reading} \div \text{correction factor} = \text{PPM } \text{NO}_3\text{-N in dry soil}$$

Soil texture	Correction factor	
	Moist soil	Dry soil
sand	2.3	2.6
loam	2.0	2.4
clay	1.7	2.2

Soil less than 10 PPM $\text{NO}_3\text{-N}$ on a dry soil basis has limited N supply, and fertilization is usually justified. Soils between 10-20 PPM $\text{NO}_3\text{-N}$ have enough N to meet immediate plant needs but a modest amount of sidedress N may be appropriate. In soil with $\text{NO}_3\text{-N}$ greater than 20 PPM, additional N application should be postponed until retesting shows that residual soil $\text{NO}_3\text{-N}$ has declined.

Obtaining the required materials

Centrifuge tubes (50 ml volume) can be purchased from many vendors, in packs of as few as 10 tubes; an internet search will identify a choice of vendors. Calcium chloride, which is also used in food processing, can be purchased in small quantities from suppliers of home canning supplies such as Bulk Foods (<http://bulkfoods.com>). EM Quant nitrate test strips are available from a number of vendors, including Ben Meadows Company (<http://coleparmer.com>).