Submitting the sample

Use permanent ink or pencil to complete a current *Plant Sample Information* form, which is available online at www.ncagr.gov/agronomi/forms.htm. Forms and sample envelopes are also available from local Cooperative Extension offices, agribusinesses, regional agronomists and the Agronomic Division laboratory. Fees are listed on the sample form and online at www.ncagr.gov/agronomi/fees.htm.

Pay attention to detail when filling out the information form. Be especially sure to provide all information requested in the shaded areas. Record planting date, and note any conditions—drought, disease, injury, pesticide or foliar nutrient applications—that might be relevant.

When identifying the plants that you sampled, give the exact name (common and scientific): e.g., flue-cured or burley tobacco. Give each sample a unique identifier that will help you remember the plants or area it corresponds to—such as HOUSE1, 15B, GOOD or BAD. You can use up to six letters and/or numbers. Put the identifier on both the sample information form and the sample envelope.

Diagnostic interpretations require more details than predictive. When sending matching soil, solution or waste samples, record matching sample IDs in the designated areas on the sample information form. Be sure grower name and address are exactly the same on all matching information forms. Ship all matching samples as a single package addressed to the NCDA&CS Agronomic Division Plant/Waste/Solution Section.

Place each tissue sample in a paper envelope, paper lunch bag or cardboard box so it can begin drying during transport. Do not use plastic bags because heat and moisture will cause decomposition, which can alter test results.

Interpreting the report

The lab analyzes samples and generates a report within two working days of their arrival. The prompt turnaround makes it possible for growers to take any corrective action needed to improve nutrient status and optimize yield. The report is immediately posted on the Agronomic Division's Web site and a copy mailed to the grower. A cover sheet that explains the technical terms and index values accompanies the report. Cover sheets and other information about plant analysis are also available on the Agronomic Division's Web site.

North Carolina Department of Agriculture and Consumer Services

Steve Troxler, Commissioner of Agriculture

Agronomic Division
Colleen M. Hudak-Wise, Ph.D., Director

www.ncagr.gov/agronomi/

(919) 733-2655

Mailing Address
1040 Mail Service Center
Raleigh NC 27699-1040

Physical Address [DHL, FedEx, UPS]
4300 Reedy Creek Road
Raleigh NC 27607-6465

Agronomic Sampling
Folder No. 5

prepared by
Brenda Cleveland, Michelle McGinnis
and Catherine Stokes

revised November 2008

Sampling for Plant Analysis

pictorial key to tissue sampling:
www.ncagr.gov/agronomi/pictorial.htm

The Agronomic Division analyzes plant tissue for nutrient content. It measures 11 of the essential nutrients required for plant growth. The plant analysis report

- indicates plant nutrient concentrations,
- identifies deficiencies and toxicities and
- provides recommendations for optimizing yield, quality and nutrient-use efficiency.

Tissue tests assess plant nutrient uptake while soil tests predict nutrient availability. The two tests are complementary as crop management tools, but each has limitations. For example, plant analysis cannot predict the need for lime; soil samples should be taken for this purpose. Soil testing is not the best indicator of nutrients that leach easily, such as nitrogen and sulfur. Tissue tests measure the micronutrients boron, iron and molybdenum, whereas soil tests do not.

Deciding when to sample

To monitor plant nutrient status most effectively, sample during the growth stages recommended for your specific crop (Table 1). Take predictive samples weekly or biweekly during critical periods, depending on management intensity and crop value. Any time you suspect a nutrient-related problem, however, submit diagnostic tissue samples to identify the problem.

Although exact timing is not critical, the best time to collect samples is between mid-morning and mid-afternoon. Nitrate nitrogen levels are especially subject to variation, depending on time of day and environmental conditions (drought, cloud cover). Keep samples free of soil and other contaminants that can affect results.

Taking a representative sample

Proper sampling is the key to reliable plant analysis results. When problem solving, take samples from both "good" and "bad" areas. Comparison between the two samples helps pinpoint the limiting element. Comparative sampling also helps factor out the influence of stress due to drought, disease or injury. Always take matching soil samples from the root zones of both "good" and "bad" plants for the most complete evaluation.

When monitoring the status of healthy plants, take samples from a uniform area. If the entire field is uniform, one sample can represent a number of acres. If there are variations in soil type, topography or crop history, take multiple samples so that each unique area is represented by its own sample. All tissue within a sample should be from the same cultivar or variety.

Table 1. Best time to sample when monitoring nutritional status.

Alfalfa, clover, peanut, pea: early growth → bloom
Apple, cherry, grape, peach, pear, pecan: mid-season
Cotton: from matchhead square → 4th week of bloom
Corn, sorghum, sweet corn: early growth → lay-by and tasseling (prior to silking)
Cucumber, melon, pepper, squash, tomato: from 2 weeks before first bloom → fruiting
Flowering plants & foliage plants: early growth → bloom
Leaf and root crops: early growth to first half of growing season
Small grain: early growth → Feekes GS 5
Soybean & other bean: early growth → bloom
Strawberry: spring vegetative growth → fruiting
Tobacco: early growth → bloom for nutritional status; one week prior to harvest for flue-cured harvest readiness
Turfgrass: monthly during growing season
Woody ornamentals: current year's growth

Selecting the best indicator sample

The appropriate part of the plant to sample varies with crop, stage of growth and purpose of sampling. In general, when sampling seedlings less than 4–6 inches tall, take whole plants from 1 inch above the soil line. For larger plants, the most recent mature leaf (MRML) is the best indicator sample, except as noted in Table 2.

The MRML is the 3rd to 5th leaf below the growing point (Figure 1). It is neither dull from age nor shiny green from immaturity. For some crops, the MRML is a compound leaf. For example, the MRML on soybean and strawberry is a trifoliate compound leaf: three leaflets comprising one leaf.

Table 2. Situations in which the most recent mature leaf (MRML) is not the best indicator sample.

Alfalfa, clover: take top 6 in. or upper third of plant.
Corn: after bloom—take ear leaf.
Cotton: take petioles only *or* both MRML blade and petiole (separated in field); details at www.cotton.ncsu.edu/ccn/2008/june30.html.
Flue-cured tobacco: for harvest readiness—take samples by stalk position (upper, middle, lower).
Grape, muscadine: take blade opposite cluster.
Grape, vinifera: take petiole opposite cluster.
Pecan: take middle leaflet pair (Fig. 1) from MRML.
Small grain: seedling to full tillering—take whole plant (from 1 in. above soil); jointing to bloom—take top 6 in. of plant; bloom through maturity—take flag leaf.
Strawberry: take both MRML blade and petiole (separated in field).
Turfgrass: take clippings from mower bag.

For cotton, vinifera grape and strawberry, petioles provide a strong indication of nitrogen status. When submitting tissue samples from these crops, detach leaves from petioles in the field to stop translocation of nutrients. If analysis requires both leaf blades and petioles, put the petioles in a separate envelope inside the leaf sample container.

Choosing sample size

A good sample contains enough leaves to represent the entire area sampled. A representative sample must provide an average of nutritional status for an entire field, not just one or two plants. Therefore, the larger the area is, the larger the sample size needs to be.

Sample size also varies with crop. For crops with large leaves, like tobacco, a sample of six leaves may be adequate. For crops with small leaves, like azalea, a sample of 30–50 leaves is necessary. For most crops, 15–30 leaves are best. For crops requiring petiole analysis, collect at least 20–50 petioles.

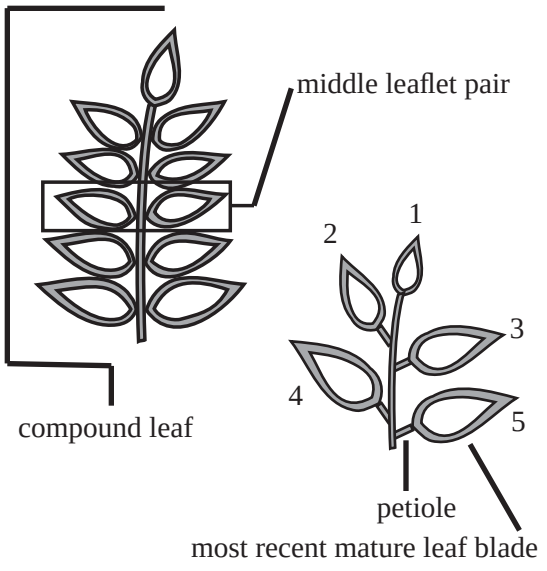

Figure 1. Some best indicator samples