Special Inside: Recap of the 2008 NC Conference & Show

Soil Testing Is the Foundation to Quality Turf

Limiting Canada Goose Use of Turfgrass Areas

TCNC MEMBER PROFILE:
Bill McLemore,
New TCNC President
Soil testing through the NC Department of Agriculture and Consumer Services (NCDA&CS) is a popular, free service available to all state residents. In fiscal year 2007, the laboratory analyzed more than 333,000 samples — an all-time record over its 67-year history. Of these, nearly 50,000 were from turf.

Soil testing is the quintessential best management practice (BMP). It helps ensure cost-effective fertilization and optimal turf growth, while preventing excessive application of nutrients and preserving environmental quality.

For soil-test results to be most useful, however, clients must do their part — they must collect representative samples, provide sufficient and accurate background information, interpret the report correctly and then implement recommendations in a timely manner. The soil-testing section of the NCDA&CS Agronomic Division offers guidance on all aspects of this process.

Soil testing — predictive or diagnostic?

The two main reasons for soil testing are predictive and diagnostic. These approaches affect the timing and method of sampling, as well as report results. When samples are submitted for predictive purposes, the client receives a computer-generated recommendation for lime and fertilizer based on the type of grass being grown and specific soil properties. When samples are submitted for diagnostic purposes, an agronomist reviews the description of the problem, compares the test results of all agronomic samples submitted from the site and crafts a situation-specific assessment.

The vast majority of soil samples in North Carolina are submitted for predictive purposes: that is, the client wants an accurate lime recommendation. When maintaining an optimal soil pH is a primary goal, soil testing should be repeated at one- to three-year intervals, depending on soil type. Because sandy soils lose nutrients more readily than clay soils, they should be tested more frequently, perhaps every year or two, depending on management intensity and turf use.

Soil samples taken for diagnostic purposes are commonly referred to as "problem samples." Low pH is probably the greatest fertility concern for turfgrasses such as tall fescue, bermudagrass, St. Augustinegrass and zoysiagrass. It can interfere with the availability of soil nutrients and trigger many growth problems. Historically, more than 30 percent of diagnostic samples have a soil pH of 5.4 or less (most turfgrasses grow best at levels between 6 and 7).

### Good practices for collecting soil samples

Soils are highly variable over relatively short distances, both vertically and horizontally. This is problematic since soil-test recommendations for a large area are based on data from a one-pint sample. If the area to be fertilized differs significantly from the sample, then the test results and recommendations are not meaningful.
Obtaining reliable soil-test information requires investing time in the collection of good, representative samples. A soil sample should be a mixture of cores or slices taken from 10 to 15 randomly selected locations within a relatively uniform area, such as a putting green, a fairway or a sports field. This entire area should have the same general management history and requirements. Atypical features, such as edges and depressions, should be avoided. Heavy thatch should be removed.

On golf courses, it is good practice to sample greens, tees and fairways individually, submitting one sample for each hole from each of these areas. For example, a golf course with 18 holes would submit a total of 54 samples (3 from each hole — 1 from each green, tee and fairway).

In settings such as home landscapes or the grounds of commercial buildings or real estate, identifying unique turf sampling areas is somewhat subjective. However, most landscapes do have distinct areas — for example, front and back yards. Since soil type and fertility can be very different between front and back yards, collecting separate samples from each location may be best.

If a contiguous area is relatively large (several acres in size) such as at an industrial park, a sample may represent up to several acres. However, if there is a need to manage one or more parts of an area differently (for example, if a different grass species is planted), additional samples may be justified. Management is a very important factor in determining areas to sample and, subsequently, the number of samples to acquire.

Depth of sampling is critical (Figure 1). Sampling too shallowly or deeply can affect soil acidity and phosphorus measurements, leading to incorrect lime and fertilizer recommendations. For established areas where amendments cannot be tilled into the soil, all cores/slices should be taken to a uniform depth of 4". For new plantings or recently tilled areas, sample depth should be 6". When samples are being taken to diagnose a suspected problem, such as soluble salts, it may be advisable to collect a series of samples representing different 1" or 2" increments of soil depth.

To collect samples, most professional landscapers will use a soil probe, but you can also sample adequately with a garden spade or trowel. Small coring devices are available for use on golf greens where minimal disturbance is needed. In any case, pay attention to depth, and never

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**Table 1. Some management parameters associated with NCDA&CS soil-test crop codes.**

<table>
<thead>
<tr>
<th>CROP</th>
<th>CROP CODE</th>
<th>TARGET pH</th>
<th>RECOMMENDATION UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centipedegrass</td>
<td>022</td>
<td>5.5</td>
<td>lb./1,000 ft²</td>
</tr>
<tr>
<td>Lawn¹</td>
<td>026</td>
<td>6.0</td>
<td>lb./1,000 ft²</td>
</tr>
<tr>
<td>Roadside grass, establishment²</td>
<td>062</td>
<td>5.8</td>
<td>ton/acre (lime)</td>
</tr>
<tr>
<td>Roadside grass, maintenance²</td>
<td>063</td>
<td>5.8</td>
<td>lb./acre (nutrients)</td>
</tr>
<tr>
<td>Golf fairway/athletic turf</td>
<td>150</td>
<td>6.2</td>
<td>ton/acre (lime)</td>
</tr>
<tr>
<td>Golf tee</td>
<td>151</td>
<td>6.2</td>
<td>lb./1,000 ft²</td>
</tr>
<tr>
<td>Golf greens</td>
<td>152</td>
<td>6.2</td>
<td>lb./1,000 ft²</td>
</tr>
</tbody>
</table>

¹ All grasses except centipedegrass.
² Relates to intermediate fertility best suited for centipede/fescue/bahiagrass mixed stands.

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**Figure 1. Appropriate soil sampling depths.**

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use galvanized tools, which can contaminate the sample and make the soil test give a false high reading for zinc.

All cores/slices representing a unique area should be placed in a plastic bucket and mixed thoroughly, breaking up all cores (intact cores within a sample are a sign of poor technique). Fill a standard Agronomic Division soil-sample box with the mixture, and label it with an identifier indicative of the area it represents. If cores are wet and do not crumble easily when hand-mixed, site conditions are too wet for sampling.

Sample boxes and the appropriate information sheets/forms (AD-1 and AD-2, described below) are available at all NC Cooperative Extension offices. Information on collecting or submitting soil samples is also available online at the NCDA&CS Agronomic Division website at www.ncagr.com/agronomi/. For additional help, call the division office at 919-733-2655, or contact the NCDA&CS regional agronomist assigned to your county. Visit www.ncagr.com/agronomi/rahome.htm for a list of regional agronomists and their service areas.

Providing background information about the sample
When submitting routine soil samples to the NCDA&CS lab, clients must fill out form AD-1, Soil Sample Information. Providing complete and accurate details is the key to obtaining reliable soil-test recommendations. Since turfgrasses differ in their nutrient requirements, choosing the correct crop code for each sample from the list on the back of form AD-1 is crucial. Table 1 indicates just a few of the management parameters affected by crop code. For example, recommendations for centipedegrass, which has a lower target soil pH and lower fertility needs, would be inappropriate for most other grasses.

On form AD-1, clients must also record the date and rate of recent lime applications. Since lime is not readily water soluble and contains particles of different size that affect reactivity, it may take several months to change soil pH, especially when applications are surface-applied. Lime applied several weeks prior to sampling may still be having an effect on soil pH. The NCDA&CS Soil Testing Section can use this information to adjust the lime recommendation accordingly.

Special approaches associated with problem diagnosis
Soil testing is a valuable tool when troubleshooting a plant nutrient problem, but it is not sufficient in itself —
diagnosing a nutrient problem requires additional information. For best results, clients should submit two sets of soil and plant-tissue samples: one from an area exhibiting the worst symptoms and another set from a nearby area that looks reasonably well. Clients should name the samples appropriately so that it is obvious which are from the respective “good” and “bad” areas.

Problem samples must be submitted with form AD-2, Diagnostic Soil Sample Information. The form provides space for pertinent details about plant and site conditions, fertilizer management and other relevant information. In addition to the routine soil-sample parameters, analysis of problem samples includes measurement of soluble salts, which are often a cause of plant concerns. Since time is of the essence with such concerns, problem samples are given priority when they arrive at the lab. Results are most often available within three days.

**Reading the soil-test report**
The soil-test report has two distinct sections: results and recommendations. The results section can list measurements for 22 possible factors. The first seven generally describe the soil’s properties and degree of acidity. These include humic matter (HM%), weight per volume (W/V), cation exchange capacity (CEC), base saturation (BS%), exchangeable acidity (Ac) and pH. The remaining 15 factors are measurements of various nutrients, including plant-available phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), manganese (Mn), copper (Cu) and zinc (Zn).

Although better management decisions can be made by using all report results, full understanding of soil-test data is difficult and challenging without extensive training or knowledge in soil fertility. To make soil-test data easier to understand, NCDA&CS reports convert measurements of nutrients into index values that readily indicate sufficiency (Figure 2).

Nutrient designations ending in “-I” refer to index values: for example, P-I means phosphorus index. In general, for nutrients that plants use in large amounts (like P and K), index values greater than 50 indicate sufficiency. As index values increase above 50, it is less...
likely that application of that particular nutrient will be beneficial. For nutrients needed in very small amounts, such as the micronutrients Mn, Zn and Cu, index values above 25 indicate sufficiency.

Although soil analytical results are very informative, most clients should focus on the recommendations section of the report. Lime needs are best met by use of dolomitic lime since it supplies calcium and magnesium, as compared to calcitic lime that supplies only calcium; both will neutralize acidity and raise pH. Pelleted lime is easier to handle than ground lime, especially when spreading with small equipment. Whenever establishing new turf or renovating an existing area, incorporate lime before seeding for maximum effectiveness.

The NCDA&CS soil lab does not test for nitrogen (N) because it is very unstable in our soils. Turfgrass should typically receive 1 lb. of N per 1,000 ft² at various times throughout the growing season, depending on variety (Table 2). Centipedegrass, however, requires only 0.5 lb. per 1,000 ft² per season.

Blended, bagged fertilizers with grades that match specific soil-test recommendations for N, P and K can be difficult to obtain at chain retail stores. It is acceptable to choose a fertilizer with a similar ratio of N, P and K, and apply it at a proportional rate. For large areas, fertilizers can be bulk-blended to meet fertility requirements and custom applied.

Soil testing is a superlative turf-management tool. It can be used to optimize plant growth in an environmentally sound, economically appropriate manner. Its implementation is relatively easy, but it requires conscientious attention to detail during sampling. Quality turf begins with soil testing!

![Figure 2. Soil-test nutrient-index interpretation.](image-url)