UNDERSTANDING SOIL TEST REPORTS AND RECOMMENDATIONS

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WHY SOIL TEST?

We soil test because it estimates the nutrient supplying power of the soil. Although tissue tests are valuable in detecting nutrient stress in growing turf, it is the soil test that determines the nutrient status of the soil, *before* the turfgrass plant needs fertilization. Recommendations for many of our fertilizer nutrients are based on the results of a soil test.

HOW A SOIL TEST WORKS

Let's assume you have already collected your soil sample and mailed it to the soil-test laboratory of your choice. Here's what happens once the sample reaches the lab:

In most cases the soil sample is dried, and then the sample is ground so that a uniform sample size passes through a screen. A small subsample of the soil (usually around 5-20 gram) is weighed into a container, and a soil-test extractant is added. Many different soil-test extractants are used, and it will vary with the soil type, region of the country and nutrient to be extracted. An appropriate extractant will remove a plant nutrient in an amount relative to the needs of the turf.

For example, a common Midwestern soil extractant for soil phosphorus is the Bray extractant. It is a strong acid which removes P from the soil solution, and from reacted forms such as calcium phosphates, iron phosphates, or aluminum phosphates. The idea is that the Bray extract removes that amount of P that would become available to the turfgrass throughout a typical growing year – we say that the extract has been *calibrated* to the crop needs. If we used a stronger extract (perhaps a stronger acid), it would remove more phosphorus than would become available to the turf, and our soil-test P reading would not be calibrated to our soil type or growing conditions. This is the reason why you should check that a selected soil-test laboratory uses the extractants that are common to your region. Sending your samples to a local (or at least regional) lab will generally ensure this. Remember, you cannot use analytical values generated from one extractant for recommendations based on another extractant.

The lab adds the selected extractant, shakes the sample, filters it, and analyzes the soil extract for nutrient content. The amount of nutrient found in the sample is provided on the soil-test report that is mailed to you. The nutrient amount may be reported in parts-per-million (ppm) or pounds per acre. An easy conversion between the two is that parts-per-million multiplied by two is pounds per acre.

INTERPRETING THE RESULTS

Soil-test laboratories don't just provide a soil-test result, with the amount of a certain nutrient extracted listed in pounds per acre, they also provide a soil-test *rating*, which places the soil-test result into a group which describes the likelihood that you will see a response if that nutrient is applied to the turf. Typical soil-test ratings are:

Very Low (VL): A crop response is highly likely. The fertilizer recommendation is to supply enough nutrient for crop needs, plus a substantial amount to build up levels in the soil.

Low (L): A crop response is probable. The fertilizer recommendation is enough to supply crop needs, plus some for soil buildup.

Medium (M): A crop response is possible. The fertilizer recommendation is enough to supply crop needs, plus a small soil buildup.

High (H): It is unlikely that the crop will respond. A small amount of fertilizer may be recommended for maintenance only.

Very High (VH): No crop response will occur. No fertilizer is recommended.

Some laboratories will report the exact soil-test result, and the rating group will be placed next to the result. Other labs may show the result on a bar scale, with the rating group marked along the scale. Fertilizer recommendations are usually made either at the bottom of the soil-test report, or in some separate box on the report page.

OTHER ITEMS THAT MAY BE ON A SOIL TEST REPORT

Cation Exchange Capacity (CEC): A measure of the soils' ability to hold cations. A typical CEC for a USGA-type putting green is around 2 $cmol_c$/kg soil.

Base Saturation: We consider the cations K^+, Ca^{++}, Mg^{++} and Na^+ to be basic cations. The cations Al^{+++} and H^+ are acid cations. The CEC is the sum total of the acid and basic cations. So, the amount of basic cations divided by the CEC is the base saturation. We like the percentage of basic cations in the CEC to be high, around 70%. Some soil tests will give individual cation saturations, such as the hydrogen ion saturation, which is the amount of H^+ ions divided by the CEC.

pH: The acidity or basicity of the soil. Specifically, the pH is the activity of H^+ ions in the soil solution. If you have a lot of H^+ ions in the soil solution, the pH will be low. If the pH is low, there will almost always be a lime recommendation.

Buffer pH: A number used to help determine how much lime is needed to be applied to acid soils. If the lime recommendation is provided, you really do not need the buffer pH itself.

It is a useless number unless you are calculating lime requirements, which is the situation with some precision ag applications. Be careful, buffer pH generated with one buffer solution will not be the same as that generated from another, and are not interchangeable in lime requirement formulas.

WHAT WILL BE MISSING FROM A SOIL TEST REPORT

Soil Nitrogen Test: Except in the arid western U.S., we do not have well-calibrated, reliable soil tests for nitrogen. We cannot take a soil N test and use it to predict how much fertilizer N we should add to get a turf response. Thus, fertilizer N recommendations are based on years of crop response testing. This is also largely true for iron and sulfur recommendations.

Soil nitrogen tests can take several forms. First, there could be an analysis of the inorganic forms of N (nitrate and ammonium). These are the plant-available forms of N, but again there are no reliable calibration equations to include them in fertilizer recommendations. Second, an analysis for organic N could be performed. This analysis would provide a much larger number than a nitrate + ammonium analysis, as organic N comprises 80% of the total N in the soil. Again, however, because we have no reliable way to predict how much of that organic N will become available to the turfgrass we do not use this number in making N fertilizer recommendations.

There will be a N fertilizer recommendation on the report. Except for some arid regions, this recommendation is based on calibration test and result and not soil test data. This N fertilizer recommendation is valid and useful – it just isn't based on a soil test.

Organic Matter: Soil tests for organic matter content can be performed, but these are usually an expensive and special test. If you were interested in the organic matter content of your soil, you could request this analysis from your soil testing laboratory.

Micronutrients: There are soil-tests for many of the micronutrients, but we often do not perform them as a regular diagnostic test. Such tests might be requested if there was a concern about micronutrient toxicity, especially if a waste product such as sludge has been applied for many years. The need for micronutrient fertilizers is most often the result of something other than low soil test levels such as a specific plant, soil, pH, etc. Because of overriding factors, the specific level of a micronutrient in the soil is not generally of much value.