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DEVELOPING A SOUND NUTRIENT PROGRAM

By Gary Grigg

When developing a nutrient program, turf professionals should test their soils on a regular basis, perhaps several times

per year. Tissue testing may also be helpful and even required in some situations.

The goal is to build a program that supplies the required nutrients in balance. The program should consist of necessary soilapplied fertilizers and foliar applications on a frequent and regular basis, as needed. These two types of fertilizer applications supplement each other. The results from soil and tissue testing will provide the application guidelines.

While building a program, remember the "Agronomic Law of the Minimum", which

states there are 13 essential elements other than carbon, hydrogen and oxygen. Each one has an optimum level required for encouraging maximum plant growth and development.

In other words, overall plant health will attain the level of the lowest optimum nutrient level present. This is the limiting factor. An analogy might be a chain with each nutrient representing a link. The chain is only as

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strong as its weakest link. This law says no element may substitute for another. For example, using excess iron will not make up for a zinc deficiency.

Keep in mind that roots, at certain times and under certain conditions, are limited in their ability to take up nutrients. Among these are poor or excessive drainage conditions, soil temperature extremes, and/ or chemical imbalances.

There are two types of soil-test data: exchangeable (traditional soil analysis) and extractable (soluble nutrient soil analysis):

Exchangeable analysis

Turfgrass managers traditionally use an exchangeable soil analysis

- Magnesium, greater than 20%;
- Potassium, greater than 50%;
- · Sodium, greater than 75%; and
- Sulfate, greater than 85%.

As for recommended extractable or soluble-base saturation, they are:

- Calcium, 55 to 60%;
- Magnesium 23 to 25%;
- · Potassium, 14 to 15%; and
- Sodium, less than 10%.



as a guide to determine total soil content and base saturation cation balance, pH, OM percentage, etc. Based on the test results, agronomists make recommendations for soil-applied fertilizers and/or amendments to promote optimum nutrient content and availability. Results depend on the "expert" source referenced and vary depending on soil type and plant varieties.

Grigg Brothers' recommended soil targets for base saturation are:

- Calcium, 65 to 75%, always higher than magnesium;
- Magnesium, 10 to 15%, always less than calcium but more than potassium;
- · Potassium, 3 to 7%, always less than
- magnesium but more than sodium;
- · Sodium, 0 to 2%, always less than potassium;
- Hydrogen, 0 to 10%; and

• Other nutrients include phosphorus (15 to 40 parts per million), sulfur (10 to 68 ppm), iron (15 to 90 ppm), manganese (5 to 30 ppm), zinc (1.5 to 10 ppm), copper (0.5 to 5 ppm) and boron (1 to 3 ppm).

Extractable analysis

Another agronomic principle is that nutrients must be in solution in order to be available to the plant. Consequently, they enter plant roots primarily via mass flows of soil water. An extractable nutrient

test addresses what nutrients are "water soluble" and consequently available to the plant from mass flow. But remember: Only a tissue test will confirm actual levels of absorbed nutrients.

An extractable soil analysis will disclose how well the soil is functioning. The results reveal microbial activity, nutrient solubility levels and potential detriments in the soil solution. Keep in mind that an extractable soil analysis does not ensure the proper nutrient ratio in the plant for photosynthesis and other metabolic functions. Ratios are important. Again, the extractable targets and ratios will vary depending on the plant variety and "expert" reference used.

Our extractable nutrient targets for turfgrass are:

• Calcium, greater than 10%;

- And finally, soluble nutrient target ratios should be:
- Calcium/Sodium, 2.5 to 1;
- Calcium/Magnesium, 4 to 1;
- Calcium/Potassium, 2 to 1;
- Potassium/Sodium, 1.25-2 to 1;
- Potassium/Magnesium, 2 to 1;
- · Potassium/Nitrogen, 1-2 to 1; and
- Nitrate/Ammonia, 1.5-5 to 1

Irrigation water quality

The impact of irrigation water quality should be carefully considered when determining which fertilizers and amendments will best

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achieve desired results.

Water testing will determine the nutrient load, if any, from the irrigation source. Many turf managers are obliged work with highsalinity water issues. The major water/soil quality issues related to salinity include: alkalinity (high pH); total salinity (electrical conductivity/ TDS); sodium hazard (SAR); and bicarbonate hazard (adjusted SAR).

Tissue testing as a nutrient-management tool has increased in popularity. It addresses the plant as a separate, yet complementary, program from the soil.

Tissue testing verifies both the amount and the ratios of nutrients present in a plant's leaf. Tissue testing will help identify nutrient restrictions and site-specific issues. In addition, it will help determine any need for an increase or decrease of certain nutrients at critical times of the year to support optimum plant health.

Most errors in tissue testing occur during sampling. Therefore, for best and most consistent results, sample at the same time of day and as close to the same environmental conditions (i.e. sunlight, soil moisture, temperature) as possible.

[Sampling is extremely important. Unfortunately, most errors occur during sampling. Strategies vary for soil collection including the number and depth of samples. Tissue testing problems include potential contaminants, sampling times, consistency, and delivery methods. We will likely present an in-depth article at a later date on the entire subject of tissue and soil sampling.]

Soil vs. tissue testing

Soil testing generally precedes tissue testing for routine fertilizer and amendment recommendations. An extractable/soluble soil analysis indicates the relative availability of nutrients in the soil. Tissue analysis indicates which nutrients have been taken up and used by the turf.

Tissue testing in combination with soil testing is an excellent way to develop a strong fertility program. When building a nutrient program remember to use sound agronomic principles. Maintain the correct ratios of soil water and air.

Overuse of nitrogen, phosphorous and potassium (N-P-K) is usually the most common mistake. Secondary macronutrients and micronutrients are also essential. A solid fertility program should consist of both soil- and foliar-applied fertilizer(s) based on soil and tissue test recommendations plus personal observations of plant health including growth, color, and response to fertilizer applications.

Interest in foliar feeding by practitioners and scientists has increased recently. Some fertilizer manufacturers have initiated research designed to develop a better understanding of how to facilitate more efficient nutrient uptake and use.

Foliar nutrient absorption is a physical and chemical process that is faster and more efficient than granular, but does not provide a soil reserve or bank. The best program(s) include both foliar and granular fertilization. Ultimately, that combination requires less nutrient input than granular only.

Foliar nutrition also addresses several common concerns including Integrated Pest Management (IPM) and minimizing nutrient loss from leaching and runoff.

We are currently in the third year of a study to determine the efficiency of foliar uptake based on individual nutrients applied, turf type, and temperature extremes. Four major universities are doing the work on four turfgrass varieties. This cutting-edge information will help turf managers better understand foliar nutrition and where to target nutrient amounts after soil and tissue testing have been completed.

Gary Grigg has more than 41 years experience as an agronomist and is co-owner of Grigg Brothers, www.griggbros.com.

Fertilizer program "bank"

Foliar nutrition provides rapid response, targets needed nutrients and balances spoon-feeding with lower rates and higher frequency.

When seeking a foliar product, pay particular attention to chelating agents, low salt concentration, buffering capabilities, and identifiable ingredients from a quality source.

Foliar feeding can be very helpful when plants have poor root structure, soil temperatures are extreme, turf is under stress, pH problems exist, water quality is poor, difficult growing conditions are present and new growth is needed quickly.

Turf managers need to look at their soil fertilizer program as a "bank." The soil tests show how much is on deposit. Balance nutrients on the cation exchange sites with soil-applied fertilizers. This is how sports turf managers have traditionally developed their fertility programs.

Tissue tests are also important and reflect withdrawals from the soil "bank."

In addition, if obviously needed, make the appropriate "deposit" directly to the plant with foliar nutrients, which bypass soil cation exchange and root absorption.

Remember to work both sides—the soil and the plant.