

Testing, Testing

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What have you done to improve your soil fertility lately? The first step is to have your soil tested. Depending on the size and nature of your operation, you may need to have more than one test done. Fields that have different soil types and conditions (texture, color, water penetration and retention, etc.) or that have received varying fertilizer or cropping treatments should be tested separately.

Each soil test should be from an area large enough to permit separate management. A good rule of thumb is at least one test for each 20 to 25 acres.

You can hire a consultant to pull the soil sample, send it to a reputable lab and interpret the results for you with specific nutritional recommendations. Or you can do it for yourself. You'll need a basic understanding of soil science to interpret the numbers you get back from the lab. It is a waste of your time to have soil tests taken unless the results can be correctly interpreted and action taken.

Be sure you know just what the lab will test your sample for and how the results will be reported. Some labs use pounds per acre feet; others use parts per million (p.p.m.). Both are adequate to determine nutritional recommendations. Don't use a lab that reports in vague terms, such as low or high, or mixes results of nutrients together. Some labs give one value for both calcium and magnesium. You need to know how much you have of each.

Soil testing has traditionally been a wintertime occupation. But the levels of available minerals in the soil fluctuate according to the season. Maximum levels coincide with maximum plant demand in well-balanced soils. Potash, nitrogen and phosphorus can all vary up to 100% between the dormant and growing season in soils with 4 to 5% organic matter.

The time you test should make little difference as long as you keep the principles governing nutrient availability in mind. Enough soil records will explain the variation.

ESSENTIAL NUMBERS

The essential numbers you need to determine your soil fertility management program are the base saturation percent of the cation exchange capacity of calcium, magnesium, potassium, sodium, and hydrogen. What is cation exchange capacity (CEC) and how does it relate to soil fertility? The CEC is a measure of the ability of soil colloids to hold nutrients and trade them with plant roots as they are demanded. Soil colloids consist of clay and organic matter and are negatively charged. Cation exchange is simply positively charged ions changing positions.

Hydrogen ions from plant rootlets and soil microorganisms force nutrient cations via cation exchange into the soil solution where they can be taken up by root hairs and soil organisms or removed by drainage water.

The CEC value tells you the basic structure of your soil. The goal in soil fertility management is not so much to increase the CEC value of your soil but to create a balanced soil within whatever

soil type you have. A balanced soil would have calcium occupying 60%-70% of the CEC, magnesium 10%-20%, potassium 2%-5%, sodium 0.5% to 3%, and other bases the remainder.

BASE SATURATION

The base saturation percent of the CEC affects the rate of release of nutrients to plants. The plant uptake of a given cation can be affected by ions held in association with it. For instance, low amounts of exchangeable calcium will inhibit the uptake of boron and other nutrients. Likewise, in some cases a high percentage of exchangeable potassium will depress the availability of magnesium.

Calcium is the kingpin of nutrients as the soil colloid has to have a high amount for plant uptake. Calcium is used by plants in building cell walls, so it rarely shows up as deficient in petiole or leaf sampling. Soil tests must be used to check for this nutrient.

Calcium absorbed onto the soil colloid promotes the formation of a very desirable granular soil structure. Calcium stimulates soil microorganisms involved in the decomposition of soil organic matter and the synthesis of humus. But the calcium must be in equilibrium with the magnesium to create a favorable environment for bacteria and fungi. These decompose organic matter into carbon dioxide, carbonic acid, and other weak organic acids which help to convert and make available mineral elements to the plant.

All this makes for more efficient photosynthesis and optimum use of water, carbon dioxide, nitrogen, and mineral nutrients by plants. When there is an imbalance of calcium and magnesium, organic residues are decayed into alcohol, which kills soil microorganisms, or into formaldehyde, which preserves plant tissues.

WHAT NUTRIENTS DO

Nitrogen accounts for 16% to 18% of plant proteins and regulates the utilization of phosphorus, potassium, and other nutrients. Phosphorus stimulates root development, flowering and fruiting, and helps with disease resistance. Potassium is essential for photosynthesis and aids in the trans- location of vital sugars in plant structures which strengthens plant stalks and thereby increases disease resistance. A single atom of magnesium is required for every chlorophyll molecule.

Sulfur is used in building proteins and, if deficient, will pale leaves similar to nitrogen deficiency. Iron is involved in the production of chlorophyll, although it is not part of the chlorophyll molecule, and aids in the prevention of chlorosis. Boron is required for the trans- location of sugars and regulates flowering, fruiting, cell division, salt absorption, carbohydrate metabolism, water use, and nitrogen assimilation. The micro-nutrients zinc, copper, molybdenum, and manganese are involved with microorganism metabolism and are used by plants as catalysts or parts of enzyme systems.

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