

Taking Good Soil Samples for Efficient Plant Growth and Water Use

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Rio Grande Regional Soil and Water Series

Optimizing Plant Growth for Efficient Water Use

Contain, retain and conserve. Water resources—worth recouping.

Using representative soil samples from fields allows farmers to customize recommendations to fit soil conditions. This helps determine proper fertilizer needs for optimal plant growth and water use efficiency. Uniform sampling areas provide comprehensive soil fertility and organic matter maps of each field. Today, when grid and area sampling is commonplace, comprehensive knowledge of fields can be obtained when sampling is done carefully.

MATERIALS NEEDED

Soil sampling bags (wax paper or paper), information sheets for the soil lab, these soil sampling instructions and information about soil tests as well as diagrams or printouts about soil associations/grids/areas/previous sampling maps will help determine where to sample. Sampling tools to help collect a good sample include: spade, shovel, trowel or soil probe (auger or tube); clean pail (plastic or Teflon-lined if a zinc test will be run); and clean gloves to mix the samples that will be collected as a composite sample.

WHEN AND HOW TO SAMPLE

Ideally, the best time to sample is before spring fertilization or after harvest from uniform sampling areas with similar management. The number of separate samples to be analyzed is determined by several factors, including management zones, visually dissimilar areas, soil-type differences and historical variations in a field as well as sampling method (hand sampling/grid sampling/area sampling). Field composite samples should include at least 10 to 15 cores or

shovel slices in areas no larger than 40 acres, if all locations are fairly similar. For small areas, such as lawns or gardens, five to six cores may be enough.

Avoid or sample separately any odd or dissimilarly treated areas not representative of the overall soil area, such areas include dead furrows, back furrows, old livestock lots and lanes, old fence lines, fertilizer spill areas, small, unique field/area depressions as well as fertilizer bands or small manured areas that are different than the main area being sampled. Take samples in a random zigzag pattern unless working within specific constraints of the grid or area samples. Take equal-sized cores or shovel slices, generally to 6-inch depths after nondecomposed plant materials are pushed aside. Take samples, if possible, where the less mobile nutrient additives, such as phosphorus or potassium, are not stratified (nutrients recently mixed in the upper soil area), because unusually high levels can alter the soil test results.

In the case of deep-rooted perennial plants like alfalfa, deeper subsurface sampling also may be needed to ascertain deeper pH or salinity problems. Perennial sod crops may require sampling to only a 4-inch depth after discarding the upper 4 inch of plant material to optimize the sample for analysis. Sample often and take new samples over cropping seasons to ensure optimum growth and water use by plants. Ideally, sample every one to three years or once every crop rotation to obtain a good fertility map of field areas.

Conservation tillage and reduced tillage systems require changes in sampling procedures. Depending on tillage type and fertilizer placement, samples may require varying depths. For example, on turf do not include the thatch but take only soil at about 4 inches deep. An orchard sampling depth is better at 10 inches; a subsoil sample for deep-rooted crops to study avail-

able nitrogen problems may require depths of 10 to 15 inches. Samples from regular tillage may be decreased to 8 inches if not compacted, reduced till to 6 inches, no-till to 8 inches, and a continuous ridge till to 4 inches or angled slightly to 6 inches. Also, if using subsurface irrigation systems, the sample depth may be modified depending on irrigation source and depth. Take soil samples, if possible, from between drip tape or lines at a depth that will represent where the upper 60 to 80 percent of the plant roots growing in the field will be. If the crop is fairly shallow rooted, a 4-inch sample depth may be adequate. On the other hand, a deeper-rooted crop with drip tubing below 6 inches should be sampled to the 6-inch depth.

Before sampling, identify and number the sample bag. After pulling a subsample from the mixed cores and placing in the sample bag, close the bag securely. Fill out the information sheet on the sample. Sample and/or field location are for the farmer's information, while soil type and other additional information is for the testing lab as recommendations are adjusted for certain physical and chemical differences unique to certain soils. Also, air-dried samples generally are best to use and send to the laboratory for analysis.

CHOOSING THE PROPER TEST AND LAB

Sending the soil sample to a lab for the appropriate test is as important as obtaining a representative sample. Soil tests may vary, depending on the lab, how results are reported and the approach used to make recommendations. Several general tests can be obtained on soil. The **routine or standard test** determines soil pH, salinity, nitrates and phosphorus, potassium, calcium, magnesium, sodium and sulfur levels, giving a recommendation for the basic nitrogen-phosphorus-potassium (N-P-K) needed on a selected crop. For an extra fee, some labs may use a **macronutrient test** to figure calcium, magnesium, sodium and sulfur. In our region, the lab instructions mailed with the soil sample should request the **Olsen test** or sodium bicarbonate test for analyzing phosphorus, because it is more accurate with the high pH soils of arid and semiarid regions than acid-extracting procedures. Alkaline soils that contain free calcium carbonate can decrease phosphorus activity in soils, causing a relatively insoluble calcium and phosphorus

salt to form and allowing clays saturated with calcium to retain phosphate. Thus, using the Olsen test, which better corrects this problem, can be more accurate than an acid-extraction test (such as the Mehlich procedure) on many New Mexico soils. The **micronutrient test** estimates zinc, iron, manganese and copper levels that are available to plants. The **boron test** generally used when legumes are grown on sandy soils or if crops are irrigated with low-quality water to prevent micronutrient tie-up or overapplication of boron. The **salinity test** measures major cations in the soil, so that the Sodium Adsorption Ratio (SAR) can be calculated when saline or sodic irrigation water is used, evaporation rate or transpiration exceeds rainfall, previous tests show high sodium or salinity levels, or salt water or fertilizer spills have occurred. Also, the soil's **cation exchange capacity (CEC)** is a test that tells the amount of positively charged cations that a given weight of soil or cmoles (equivalent to milliequivalents (meq)/100 g soil) can hold. As CEC increases, the mobility of the cations (such as sodium) decreases as they are held by the soil. This information tells how salinity in irrigation water can be more or less buffered by the soil and which soils are more prone to accumulating salt.

Several other tests may be offered by soil laboratories that can further help farmers profile their management and fertilizer needs for specific crops. Farmers can consult with a county agricultural agent or soil conservationist to determine which tests to use. Additional information as well as soil sampling bags can be obtained at a local county Extension office.



Rio Grande Basin Initiative

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