EXTENSION
College of Agriculture, Biotechnology & Natural Resources

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Fact Sheet 19-17

Know the Status of Your Soils Before You Plant

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The first important thing to know about soil is that "soil is not dirt." Dirt is soil out of place, just like a plant out of place is a weed. Soil is a naturally occurring mixture of minerals (sand, silt, clay, gravel, stones) and organic matter. The composition of soil varies from one location to another. However, an ideal soil has, on average, a composition by volume of 45 percent minerals (sand, silt and clay), 25 percent water, 25 percent air and 5 percent organic matter.

Before planting any crop, it is important to know the properties and nutrient content of the soil through soil testing. Soil testing is a reliable tool for learning about key characteristics of the soil and its fertility levels. It is an inexpensive way to help growers make effective nutrient management decisions, thus maximizing crop productivity and net profits. Soil testing can also help improve the environment by reducing surface and ground water pollution from overfertilization.

Importance of soil testing

Getting soil tested through a soil testing laboratory can help growers to make informed decisions on:

1. Nutrient status and application rate: The amount of nutrients in soil varies from one geographic location to another, among cropping systems, and depending on soil management practices. Even though soils may have a large amount of nutrients, not all the nutrients are in forms that can be taken up by plants. Soil test results will provide information to the grower about the type of soil and basic soil properties, such as pH, electrical conductivity, etc. It will also determine the amount of available nutrients in the soil. Getting soils tested for nutrient status is the only accurate way to determine the amount of fertilizer needed to grow a crop. University of Nevada, Reno Extension recommends that fertilizer rates should always be based upon soil test results and crop needs. This will optimize plant growth and yield. This approach can also minimize environmental impacts and maximize net profits.

A soil test can also help the grower to know about soil texture (Figure 1). Soil texture is the relative proportions of sand, silt and clay in the soil. Knowing the texture of soil can help a grower to make better decisions about timing of fertilizer application (split or one-time application) and irrigation needs. For instance, it is always recommended to do more

frequent and smaller amounts of fertilizer (nitrogen and potash) applications on lighter-textured or sandy soils to avoid leaching losses, as compared to applying fertilizer to heavy or clay soils. Also, crops growing in sandy soils need more frequent irrigation than those growing in clay soils.

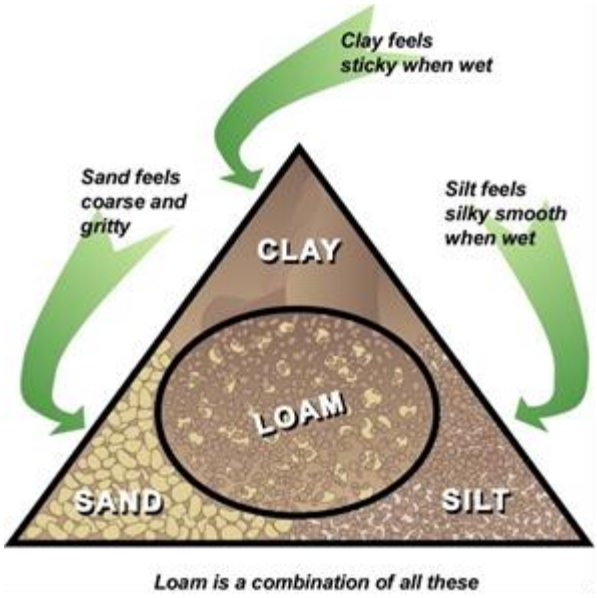

Figure 1: *Soil texture. Adapted from Natural Resources Conservation Service Bozeman Montana.*

2. Crop selection: A soil analysis report can help the grower to select a crop based upon soil properties, especially soil pH. The pH of a soil is the most important factor affecting crop production, as it influences the availability of nutrients. For instance, when soil becomes too acidic, an important nutrient, phosphorus, becomes unavailable to plants, while another nutrient, aluminum, becomes more available and can cause toxicity. In addition, some crops can grow in a wide range of soil pH levels, while others can grow well only in a narrow range of soil pH levels. For example, blueberries prefer a pH range of 4.3 - 5.0. However, soybeans grow well in a pH range of 6.5 - 7.5. So, it is important to research whether the crop can perform in a particular soil's pH level.
3. Diagnosing plant problems: A soil test is an important tool for diagnosing plant problems, especially nutrient deficiencies or toxicities. Nutrient deficiencies occur when an essential nutrient is available in amounts less than needed by a growing plant. Nutrient toxicity occurs when a nutrient is available in excess of plant needs, and decreases growth and crop quality. Getting the soil tested is one of the basic tools for diagnosing nutrient imbalances.

Time and frequency of soil testing

Soil samples can be collected at any time of the year, but it is recommended to sample around the same month of the year to reduce seasonal variations in soil test records. In general, the most important time to test soil is after harvest and before planting of a subsequent crop. Generally, soil should be sampled every two to three years for most crops. However, for high-value cash crops, soil should be sampled and tested before each crop is planted. It is also advised to get soil tested for phosphorus and nitrogen contents prior to manure application.

In addition, it is recommended that sandy soils be sampled and tested every two to

three years and clay soils be tested every three to four years. Soil should also be re-tested every year if nutrient levels are too high or low in previous tests to determine the changes in nutrient levels. If there are problems that occur during the growing season, collecting and analyzing the soil is recommended.

Soil sampling tools

Tools needed for soil sampling are:

1. Soil sampler (stainless steel probe or shovel)
2. Clean plastic buckets or plastic trays
3. Sampling bags
4. Label or markers

Figure 2: *Soil samples can be collected by using probes. Photo by Maninder K. Walia.*

Figure 3: *Shovel for collecting soil sample. Photo by Maninder K. Walia.*

Soil sample collection

Soil samples should be collected by dividing the field into similar units or blocks based upon differences in the soil. These differences could be in color, soil types, slope, drainage, degree of erosion, prior management, different crop or manure history, etc. Several random samples should be collected from each area of each unit or block (two or three subsamples per acre) in a zigzag pattern (Figure 4). Sample to the same depth to ensure uniformity. For uniform fields, a simple random pattern across the field should be used to collect at least 15 to 20 soil cores to equal depths.

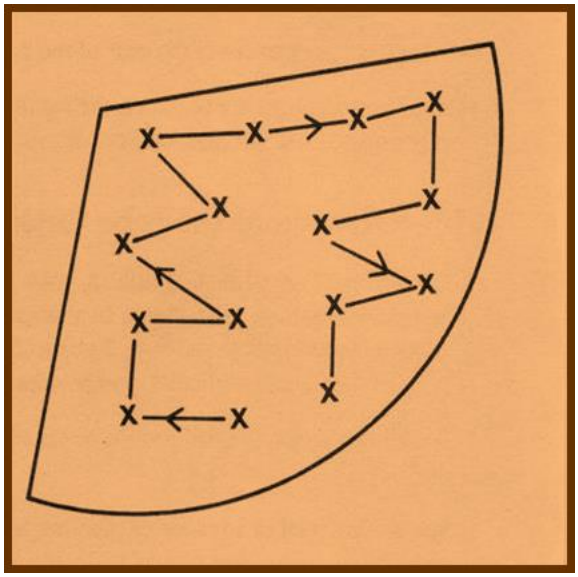

Figure 4: *Take several samples from random sites throughout the area to be tested to ensure a representative sample from the area. Adapted from University of Nevada, Reno Extension Fact Sheet 09-13.*

Soil sampling soon after fertilizer or manure applications should be avoided. In addition, soil sampling in or near unusual areas, such as dead furrows,

areas near windbreaks or fence lines, feedlots, fertilizer bands in fields, roads, manure piles, low areas, salty spots, and old building sites, should be avoided.

Basic steps to follow for collection of representative soil samples are:

1. For normal tilled crops, first remove and discard the surface litter or dead plant material.
2. Then, dig down to a plough depth of 15 cm (6 inches) for shallow-rooted crops and 30 cm (12 inches) for deep-rooted crops (Figure 5). Most samples are taken from the surface to the tillage depth (6 inches) for field crops. This sampling depth is important as this zone has most of the root activity and also fertilizer applications are restricted to this tillage depth. However, in light-texture soils, where excessive leaching of nutrients occurs, separate deeper samples, down to 15-60 cm (6-24 inches), should be collected and analyzed to determine available nitrogen and sulfur in some cases, since nitrate-nitrogen and sulfate-sulfur are mobile nutrients in the soil and will move below 15 cm (6 inches) soil layer via leaching.
3. If an auger is not available, collect samples by making a “V”-shaped cut to the desired depth in the sampling spot using a shovel (Figure 3). Remove and collect thick slices of soil from top to bottom of the exposed “V”-shaped cut. Never use brass or galvanized tools or containers for soil sampling, as they will contaminate the sample and will lead to misleading results. Also, avoid soil sampling during wet conditions.
4. All collected samples should be placed together in a clean plastic bucket or plastic tray. Break up any lumps or clods before mixing samples.
5. Mix all the collected samples together thoroughly to make a composite sample. Any material other than soil, such as roots, pebbles, stones, etc., should be removed.
6. From the composite sample, a mixed sample of about 1 pint (2 cups) should be placed in a clean soil sampling bag provided by the laboratory or in a plastic zipper bag. Discard any leftover soil from the sample. Label the bag with the required information, such as name, location, field area, previous crop grown, sample collection date, depth, and subsequent crop to be planted, along with a list of tests requested. The information provided and soil analysis results will help to generate the nutrient recommendations for the upcoming crop.

Figure 5: *Soil sample collected by using soil probe. Photo by Maninder K. Walia.*

7. Select a laboratory to be used for soil sample analysis. Follow the instructions carefully and mail the sample, along with the completed information sheet and payment. It is

always best to take a photo of the labelled sample bag before mailing to the laboratory, for future reference.

It is important to note that some laboratories accept the soil samples without air-drying. Other laboratories require the sample to be air-dried under shade on parchment paper at room temperature before packaging for shipment to the laboratory for analysis. Do not oven-dry the soil samples.

It is advisable to contact the selected laboratory before taking a sample, to confirm the type of test needed is still being offered and to receive special instructions to follow regarding collection, packaging, mailing, and information to be submitted with the sample.

There is a list of laboratories provided in Table 1 at the end of this fact sheet. The laboratories listed belong to the North American Proficiency Testing program (a program of the Soil Science Society of America).

Soil sample analysis

A standard soil test will provide information on soil pH, cation exchange capacity, lime requirement index and contents of some nutrients (phosphorus, potassium, calcium and magnesium). Soil testing laboratories can also provide information on soluble salts, nitrate and ammonia nitrogen, total nitrogen and carbon, soil texture, organic matter, and other major and minor nutrients for additional fees. Laboratories may provide, for a fee, recommendations based upon the soil analysis and crop needs. Laboratory results and recommendations usually will be sent back in two weeks. However, any incomplete forms or inaccurate payments will delay the processing of samples and receipt of results.

Interpreting your soil analysis report

Once you have received your soil analysis results, use the following tool to make decisions:

How to Read a Soil Analysis Report (SP 10-12), https://www.unce.unr.edu/publications/files/ho/2010/sp1012.pdf.

Results from the laboratory will help producers to make the most of fertilizer, manure and amendment (lime, gypsum, sulphur, etc.) applications for crop production. This will also help producers to recognize changes in soil fertility over time and adjust application rates based upon crop needs, thus avoiding over-application of nutrients, saving the associated cost, increasing fertilizer use efficiency, and reducing the environment degradation at the same time.

Acknowledgement

Funding for this publication was provided by the Agriculture and Food Research Initiative Competitive Grant award number 2017-70006-27198 from the USDA National Institute of Food and Agriculture (NIFA).

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Table 1: List of testing laboratories and their contact information.

Name of the laboratory	Address	Phone number
A & L Western Laboratories http://www.al-labs-west.com/	1311 Woodland Ave., Suite 1 Modesto, CA 95351	209-529-4080
AGQ Labs, USA https://agqlabs.us.com/	2451 Eastman Ave., Suite 1 Oxnard, CA 93030	805-981-2972
Agri Test/Nevada Analytical Services http://agritest.com/	855 Mill St., Suite 2B Reno, NV 89502	775-284-3970
Analytical Lab, Inc. https://analyticallabsinc.com/	1804 N. 33rd St. Boise, Idaho 83703	208-342-5515
AV Labs, Inc. https://www.avlabsonline.com/	64 N. Broadway Ave. Othello, WA 99344	509-488-2468
Cascade Analytical, Inc. http://www.cascadeanalytical.com/	3019 G.S. Center Road Wenatchee, WA 98801	509-662-1888
Central Analytical Lab https://cropandsoil.oregonstate.edu/cal	3079C Ag Life Science Building Corvallis, OR 97331	541-737-2187
Denele Analytical, Inc. https://denelelabs.com/	1232 South Ave. Turlock, CA 95380	209-634-9055
Dellavalle Lab, Inc. http://www.dellavallelab.com/	1910 W. McKinley Ave., Suite 110 Fresno, CA 93728	559-233-6129
Soil, Water and Plant Testing Lab http://www.soiltestinglab.colostate.edu/	200 West Lake St. Campus Deliver 1120 A-320 NESB Fort Collins, CO 80523-1120	970-491-5061
Stukenholtz Laboratory Inc. http://stukenholtz.com/	2924 Addison Ave. E. P.O. Box 353 Twin Falls, IB 83303-0353	208-759-3050
Sunland Analytical Lab http://sunland-analytical.com/	11419 Sunrise Gold Circle, # 10 Rancho Cordova, CA 95742	916-852-8557
Tremblay Consulting http://www.tremblayag.com/	394 S. 335 E. Jerome, ID 83338	208-324-1148
UC Davis Analytical Lab https://anlab.ucdavis.edu/	University of California Davis, CA 95616-5270	530-752-0147
University of Idaho Analytical Science Lab https://www.uidaho.edu/cals/analytical-sciences-laboratory	875 Perimeter Drive Moscow, ID 83844	208-885-6111
Utah State University Analytical Lab http://usual.usu.edu/	1541 N 800 E North Logan, UT 84341	435-797-2217
Waypoint Analytical https://www.waypointanalytical.com/	4741 E. Hunter Ave., Suite A Anaheim, CA 92807	714-282-8777
Western Environmental Testing Lab http://www.wetlaboratory.com/	475 E. Greg St., Suite 119 Sparks, NV 89431	775-355-0202
Western Laboratories, Inc. https://westernlaboratories.com/	211 U.S.Highway 95 Parma, ID 83660	208-649-4360
Wonderful Laboratories https://www.wonderfulnurseries.com/home/wonderful-laboratories.html	449 N. Zerker Road Shafter, CA 93263	661-772-8048

Note: University of Nevada, Reno Extension does not recommend or endorse any particular laboratory, nor does the exclusion of a lab imply any condemnation. All of this information is subject to change at any moment.