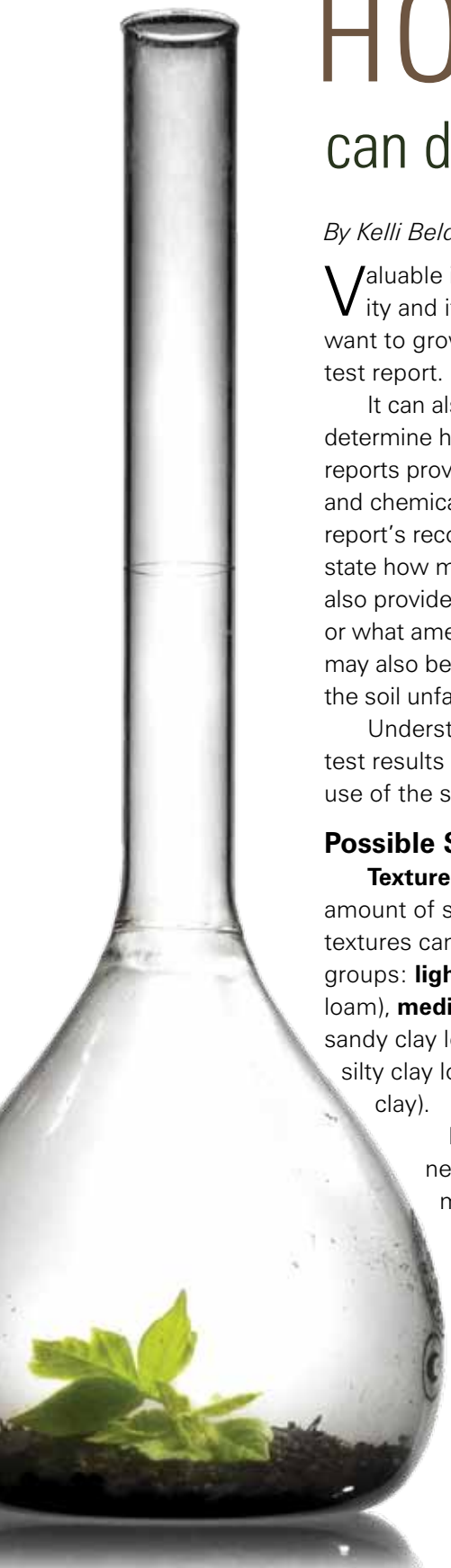


HOW A SOIL TEST

can determine suitability of soil for plants

By Kelli Belden

Valuable information about soil quality and its suitability for the plants you want to grow can be gleaned from a soil test report.

It can also provide information to help determine how to manage the soil. Most reports provide a summary of the physical and chemical test results used to make the report's recommendations. The report will state how much fertilizer is needed and may also provide how often watering is needed or what amendments are appropriate. There may also be warnings about properties of the soil unfavorable for good plant growth.

Understanding how to interpret soil test results will allow you to make the best use of the soil.

Possible Soil Tests

Texture: Soil texture describes the amount of sand, silt, and clay in a soil. Soil textures can be divided into three broad groups: **light** (sand, loamy sand, and sandy loam), **medium** (loam, silt loam, silt, and sandy clay loam), and **heavy** (clay loam, silty clay loam, sandy clay, silty clay, and clay).

Light soils drain quickly and need to be watered frequently to maintain enough water for good plant growth. Light soils allow soluble nutrients like nitrate and sulfate to be leached (travel through and out of the soil layer with water) quickly. Two or three small applications of soluble nutrients over the growing season will help prevent loss of valuable fertilizer.

Medium-textured soils are usually the most favorable for plant growth. They generally hold the most plant-available water and usually have adequate nutrient-holding capacity.

Heavy soils are often characterized by slow water-infiltration rates and high potential nutrient-holding capacity. They hold more water but generally do not release as much of it to the plants as a medium soil will release. Heavy soils may require more phosphorus but are less prone to nutrient leaching losses and require less frequent irrigation than lighter soils.

Very light and very heavy soils usually create management problems for the grower. Soil texture is not easily modified, and soil texture problems are usually corrected by careful water management and building up soil organic matter.

Organic matter: Organic matter (decayed plant material or composed manure) is important in maintaining desirable soil chemical and physical properties. Some

WHY IS THIS IMPORTANT?

Organic matter improves water-holding capacity (especially plant-available water), permeability, aeration, and resistance to compaction. Organic matter increases the soil's ability to absorb and hold plant nutrients and will release nutrients as it decomposes.

herbicides are adsorbed (gathered on a surface in a condensed layer) by organic matter and can cause their effectiveness to change. Consult the herbicide product label for specific information on possible interactions with organic matter. Many Wyoming soils contain less than 2 percent organic matter and will benefit from organic matter accumulation.

Lime estimate: Lime is a source of calcium, an essential plant nutrient, but high-lime soils (lime content greater than 2 percent), which are common in Wyoming, require more phosphorus for good plant growth. Some plant nutritional imbalances may be observed in high-lime soils because of excess calcium or the higher pH of the soil.

WHY IS THIS IMPORTANT?
Excess lime can increase the requirement for added phosphorous and potassium.

Soil Paste pH: pH is a measure of the acidity or alkalinity of a soil. A pH above 7.0 is alkaline; a pH below 7.0 is acidic. The pH of most Wyoming soils is between 7.0 and 8.5. The optimum pH for most crops will fall between about 6.0 and 7.0, but many plants will tolerate a wide range in soil pH. Perhaps the most common problem with soil-pH extremes is nutritional imbalance. Very acidic soils can be improved by liming, but alkaline soils resulting from high lime are not easily changed. A very high pH (one over 8.5) may indicate the presence of sodium. Soils high in sodium often have undesirable physical properties, such as slow permeability and poor aeration. Sodium-affected soils are not easily reclaimed but may benefit from organic matter and adding gypsum. Consult your UW Extension educator if sodium problems are suspected. You will need to request additional tests to determine how to correct a sodium problem.

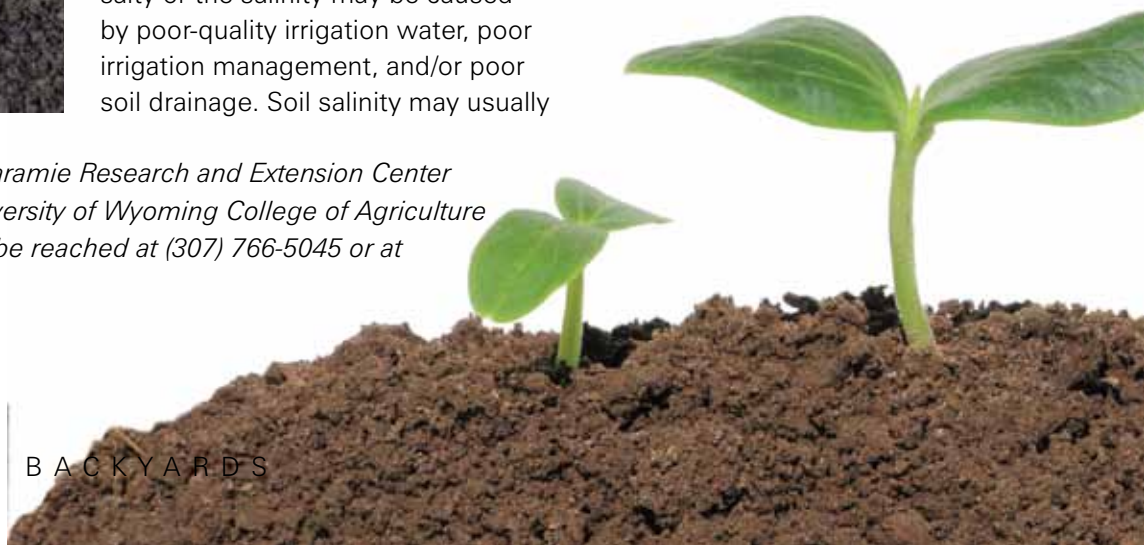
WHY IS THIS IMPORTANT?
Soil pH controls many chemical processes in the soil, especially the availability of nutrients to plants.

Table 1. Relative crop tolerance to soil salinity.

Relative crop salinity tolerance rating	Salt estimate at which yield loss begins (dS/m)
Sensitive	<1.3
Moderately sensitive	1.3 – 3.0
Moderately tolerant	3.0 – 6.0
Tolerant	6.0 – 10.0
Unsuited for most crops (unless reduced yield is acceptable)	>10.0

Salt estimate: Salt buildup, or soil salinity, is common in arid and semi-arid regions. The soil may be naturally salty or the salinity may be caused by poor-quality irrigation water, poor irrigation management, and/or poor soil drainage. Soil salinity may usually be corrected by improving soil drainage and leaching. A plant's sensitivity to salts can vary with growth stage. Many species are more sensitive to salts during germination and emergence than during the rest of their growth. Contact your UW Extension educator for specific crop salinity tolerances. In general, if the salt estimate is less than 2.0 dS/m (dS/m – deciSiemens per meter – is the unit used to measure salt content. It measures the electrical conductivity of the soil), salt should not be a significant problem.

WHY IS THIS IMPORTANT?
Salinity can be detrimental to plant growth and yield. Excess salts in the root zone hinder roots from withdrawing water from soil.



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NUTRIENT ANALYSES PROVIDE PULSE OF SOIL HEALTH

Laboratories use many methods for estimating nutrient availability. Read the explanation supplied by the laboratory for its methods to determine if the nutrient content in your soil is low, medium, or high.

There are 16 essential nutrients (oxygen, carbon, hydrogen, nitrogen, phosphorous, potassium, calcium, magnesium, sulfur, iron, zinc, manganese, copper, nickel, chlorine, and boron). Oxygen, carbon, and hydrogen are supplied by the air and water. For the others, we usually only see a plant nutrient response to the addition (when lacking) of nitrogen, phosphorous, potassium, iron, and zinc on our native Wyoming soils.

Nitrate: Nitrogen (N) fertilizer is the most frequently applied form of nutrient. Most nitrogen fertilizer will be transformed to the nitrate form if water and oxygen are present in the soil. Because nitrate is easily leached from soil, excess nitrate can end up in the ground water and become an environmental hazard (high levels in water can cause methemoglobinemia, or blue baby syndrome). Excess nitrogen can also be toxic to plants. Follow application recommendations carefully and do not exceed the recommended rate.

Phosphate: Phosphorus (P) is essential for all plants and is often applied as fertilizer because much of the P in the soil is in forms unavailable to plants. It functions as one of the major factors in photosynthesis, nutrient transport, and energy transfer. Phosphate application is often recommended when soil P has not been built up by fertilization. Phosphorus is considered immobile in soil, does not leach readily in the soil, and does not usually constitute an environmental hazard when soil erosion is prevented. Soil-test phosphate is an index of phosphorus availability and should not be considered a measure of the actual amount available to plants. Different labs use different methods for determining an available phosphorous index so be sure to only compare results between laboratories if they have used the same method.

Potassium: Potassium (K) is usually required by plants in relatively large amounts. Potassium is considered immobile in soils and does not usually constitute an environmental hazard. Most Wyoming soils have large K reserves, and K fertilizer applications are usually not necessary. However, some K deficiencies have been observed in soils that have been under production for a long time in areas where the soil is light in texture. Potassium analysis is recommended if the soil has not been tested for K recently. Potassium assists in photosynthesis, stronger stalks and stems, and movement of water, nutrients, and carbohydrates in plant tissue.

Micronutrients important in Wyoming: Iron (Fe) and zinc (Zn) are often abundant in Wyoming soils but are in forms unavailable to the plant. Deficiencies of these nutrients may be observed in susceptible plants growing in high-lime soils. Zinc may be applied to soil, but soil applications of Fe are often ineffective. When Fe and/or Zn deficiencies are confirmed, foliar treatments may be beneficial.

To learn more about soil properties, consider joining one of the Master Gardener programs offered in many Wyoming counties. Contact a local University of Wyoming Extension office for more information.