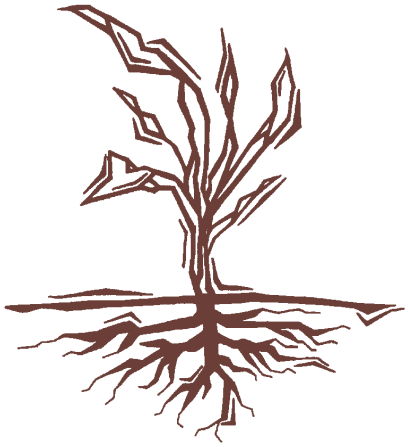

SOIL

Soil Test Explanation no. 0.502

by J.R. Self[1]

Quick Facts...

Colorado State University routinely analyzes soil samples for pH, soluble salts, organic matter, nitrate nitrogen, phosphorus, potassium, zinc, iron, copper, manganese, lime and soil texture.

Additional tests for gypsum and the sodium adsorption ratio (SAR) may be run in the laboratory.

Nutrient levels are reported as parts per million (ppm) of the elemental nutrient.

Included in a report from the Colorado State University Soil Testing Laboratory are interpretations that relate results to fertilizer and management suggestions.

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Routine Soil Tests

Soil pH, determined by the 1:1 soil:water method, indicates the acidity or alkalinity of soil based on a scale of 0 to 14. On the pH scale, 7.0 is neutral, values below 7.0 are acid, and those above are alkaline. Most Colorado soils are alkaline, having a pH between 7.0 and 8.0. A pH value above 8.5 indicates that the soil may contain.

Soluble salts are measured by the electrical conductivity of a 1:1 soil: water mixture and are reported in mmhos/cm. Crops vary markedly in their tolerance to soluble salts. Therefore, the values must be interpreted in relation to the specific crop. (See Table 1.)

Organic matter (O.M.), reported as percent of total soil, contains about 95 percent of all soil nitrogen (N). About 30 pounds N per acre will be released (mineralized to nitrate) during the cropping season from each 1 percent O.M. present. Nitrogen release rates will be slower in mountain meadow and other high elevation soils.

Nitrate nitrogen, reported in ppm NO_3-N, is soluble and readily available for plant uptake and is therefore considered equally available as fertilizer N. To determine the approximate pounds of NO_3-N/acre-foot (1 acre to a depth of 1 foot), multiply the soil test value (ppm) by 3.6. For example, 10 ppm x 3.6 = 36 pounds NO_3-N/acre to a depth of one foot.

Phosphorus, potassium, zinc, iron, copper and manganese interpretations are given in Tables 2 through 7. When the soil test is very low to medium, fertilizer response is expected. Fertilizer recommended for high-testing soils is for maintenance (to maintain soil fertility at that desirable level). No fertilizer is recommended for soils testing high for dryland production. For the micronutrients, no fertilizer is recommended when the test indicates adequate. To date, there has been no confirmed field crop response to copper or manganese fertilization in Colorado. This test is an availability index. It does not measure the total amount in the soil, but only that fraction extractable by the soil test.

Lime ($CaCO_3$) is reported as percent free lime. In the routine test, values are reported as low (0 to 1 percent), medium (1 to 2 percent), and high (above 2 percent). Specific values are determined and reported only when a sodium evaluation is requested on a sample. In this case, the percent free lime content is important in determining whether elemental sulfur will be an effective amendment in sodium reclamation. The lime content has no direct bearing on

Table 5: Available iron (ammonium bicarbonate-DTPA test).

Test values* in ppm[1]	Irrigated and dryland production
0-3.0	Low
3.1-5.0	Marginal
above 5.0	Adequate

[1]Values below 10.0 may be deficient for turf and many ornamentals.

Table 6: Available manganese (ammonium bicarbonate-DTPA test).

Test values* in ppm	Interpretation
0-0.5	May be low
above 5.0	Adequate

Table 7: Available copper (ammonium bicarbonate-DTPA test).

Test values* in ppm	Interpretation
0-0.2	May be low
above 2.0	Adequate

* These tests are an availability index. They do not measure the total amount in soil, but only that fraction extractable by the soil test.

soil test interpretations for fertilizer recommendations by the Colorado State University Soil, Water and Plant Testing Laboratory.

Texture is estimated by the hand-feel method. Nitrogen management suggestions are adjusted according to soil texture. It is important on sands, loamy sands and sandy loams that nitrogen applications be split to avoid mid- or late-season deficiency. It's also recommended that high nitrogen rates be split for many crops.

Additional Soil Tests

Sodium adsorption ratio (SAR) is determined by saturated paste extraction and is reported as a special ratio of sodium to calcium plus magnesium.

This test evaluates the sodium content of soil. A value of 13 or greater indicates an excess of sodium will be adsorbed by the soil clay particles. Excess sodium can cause soil to be hard and cloddy when dry, to crust badly, and to take water very slowly.

The **gypsum test** is conducted if the SAR is greater than or equal to 13. Total gypsum is reported in meq. (milliequivalent) $CaSO_4$/100g. If sufficient native gypsum is present, sodium-affected soils may be successfully treated without addition of amendments such as gypsum or sulfur. The gypsum supplies soluble calcium to replace the adsorbed sodium. Reclamation can proceed if drainage of the land is possible. A gypsum recommendation is provided if the gypsum test shows insufficient gypsum in sodic soils.

Table 1: Tolerance levels of crops for soluble salts.

Test values in mmhos/cm	Interpretation
0-2	Satisfactory for crops
2-4	Affects sensitive crops
4-8	High for many crops
above 8	Very high for most crops

Table 2: Available phosphorus (ammonium bicarbonate-DTPA test).

	Interpretation	
Test values* in ppm	Irrigated production	Dryland production
0-3	Very low	Low
4-7	Low	Medium
8-11	Medium	High
12-15	High	
above 15	Very high	

Table 3: Available potassium (ammonium bicarbonate-DTPA test).

	Interpretation	
Test values* in ppm	Irrigated production	Dryland production
0-60	Low	Low-medium
61-120	Medium	High
121-180	High	
above 180	Very High	

Table 4: Available zinc (ammonium bicarbonate-DTPA test).

	Interpretation	
Test values* in ppm	Irrigated production	Dryland production
0-0.50	Very low	Low
0.5-0.99	Low	Marginal
1.0-1.50	Marginal	Adequate
above 1.50	Adequate	

[1]J. Self, Colorado State University Cooperative Extension soil test specialist.