Servi-Tech Laboratories
*Making the Planet More Productive*

# UNDERSTANDING AND INTERPRETING YOUR SOIL ANALYSIS REPORT

All analyses and recommendations are based on the sample as submitted to the laboratory. We assume that a soil sample accurately represents the soil and crop conditions in the field or area that is sampled. We assume a standard surface sample depth of 8 inches, unless specified differently. All fertilizer application rates are recommended as "actual nutrient" or "pounds of plant food", so must be adjusted for the analysis of the particular fertilizer material. It may also be necessary to modify or adjust the calculated fertilizer recommendations to fit individual financial circumstances, land tenure issues, or other conditions.

## SOIL PROPERTIES

**Soil pH** is a measurement of the acidity or alkalinity in the soil water that may affect soil nutrient chemistry, root growth, and other processes.

| Soil pH | General rating |
|---|---|
| < 5.4 | Strongly acid |
| 5.4 – 5.7 | Moderately acid |
| 5.8 – 6.4 | Slightly acid |
| 6.5 – 7.2 | Neutral |
| 7.3 – 7.6 | Slightly alkaline |
| 7.7 – 7.9 | Moderately alkaline |
| > 7.9 | Strongly alkaline |

**Buffer pH** is a second measurement that is triggered when the soil pH is 6.2 or less. It is used only to calculate the amount of liming material required to neutralize soil acidity for about three to five years after application. Liming material rates are given as tons per acre of pure calcium carbonate ("ECC lime") to adjust the soil pH to 6.0, 6.5, or 7.0. Field application rates must be adjusted for the liming material quality.

**Soluble salts** are a measurement used to estimate the total ion content (or "dissolved minerals") found in the soil water. Levels above the moderate range suggest a potential for soil salinity to affect growth of certain plant species. Additional tests are needed to diagnose specific soil salinity problems.

| Soluble salts, mmho/cm | General rating |
|---|---|
| < 0.2 | Very low |
| 0.3 – 0.7 | Low |
| 0.8 – 1.2 | Moderate |
| 1.2 – 2.5 | Moderately high |
| 2.5 – 5.0 | High |
| > 5.0 | Very high |

**Excess lime** is a rating of the reactive carbonates in the soil. The rating is expressed as "NO", "LO", or "HI" for the relative amount of visible effervescence (or "fizzing") when using dilute acid. High excess lime often indicates potential for iron deficiency chlorosis problems.

**Organic matter (%OM)** is a measure of the percentage of total carbon-containing materials in a soil sample. The organic matter content may affect certain herbicide application rates and may affect fertilizer rate recommendations for nitrogen or sulfur.

**Cation exchange capacity (CEC)** is the capacity of the soil to hold positively charged ions ("cations") on soil particle surfaces. CEC is calculated from the analysis results of potassium (%K), calcium (%Ca), magnesium (%Mg), sodium (%Na), and buffer pH (%H). Cation exchange capacity is affected by the soil clay and organic matter content, so CEC can be considered a generalized indicator of soil texture. If excess lime is "HI", the CEC value may be artificially inflated and overestimate the clay content.

| CEC, meq/100g | Typical texture |
|---|---|
| < 6 | Very sandy soils |
| 5 - 12 | Sandy soils |
| 10 - 25 | Loamy soils |
| 20 - 40 | Clayey soils |
| 35 - 50 | Clay soils |

**Exchangeable sodium** (% Na) may indicate potential for soil structure breakdown and water percolation problems.

| % Na | Sodium hazard |
|---|---|
| < 4 | Very low |
| 4 - 7 | Low |
| 8 - 11 | Moderate |
| 12 - 18 | High |
| > 18 | Severe |

## MOBILE NUTRIENTS

**Nitrogen** fertilizer recommendations depend on the individual crop, yield goal, and available soil nitrogen. Each crop has its own specific nitrogen requirement, multiplied by the yield goal to establish a crop nitrogen requirement for the growing season that follows sampling. Recommended fertilizer rates can be calculated by subtracting the available soil nitrogen from the annual crop requirement. Rates may also be adjusted with credits for subsoil nitrogen, organic matter, manure, and/or previous legume crops. Nitrate ($NO_3$-N), the mobile form of nitrogen, is primarily used to identify plant-available soil nitrogen. Soil nitrogen content is calculated as:

lb N/ac = ppm $NO_3$-N * sample depth increment, inches * 0.3

"Sample depth increment" is the depth from the top to the bottom of the sample. For example, a surface soil sample with an 8-inch depth increment begins at the "top" (or the soil surface at zero inches) extending downward to include the soil at a maximum depth of 8 inches. An 8-to-24-inch subsoil sample is collected to include soil from 8 inches below the surface ("top") to 24 inches below the surface ("bottom") and has a sample depth increment of 16 inches. "0.3" is a factor to convert the nitrate result to pounds per acre.

**Sulfur** fertilizer rate recommendations are calculated by considering the annual crop requirement, yield goal, soil test sulfur, organic matter percentage, and soil texture. Fertilizer is only recommended for a single growing season.

**IMMOBILE NUTRIENTS**

The results for phosphorus (P), potassium (K), zinc (Zn), and other nutrient results are expressed as "parts per million" or "ppm". These results do not measure the total per acre quantity of nutrient, but are used to estimate the potential capacity of the particular soil to supply the nutrient of interest to the root system of a specific crop or plant throughout the entire growing season.

Fertilizer recommendations for phosphorus and potassium are based on nutrient sufficiency levels developed from field research. The soil analysis result indicates the probability that proper application of a fertilizer nutrient will improve yield.

The general approach for phosphorus and potassium is to recommend enough fertilizer to meet the current crop needs for 100% sufficiency plus an amount to gradually build the soil test to an optimum level over four to six years, then to maintain the soil test in the optimum range. Nutrient deficiency is not expected to limit yield when the soil analysis shows the nutrient is in the optimum range.

The recommended rates for zinc and other immobile nutrients are usually recommended as a one-time, broadcast application to raise the soil test to the respective sufficiency level for three to five years. Smaller, more frequent applications may be prudent, depending on the particular field situation.

The soil analysis ranges in the following table are considered to be general guidelines. The particular range may be different for individual crops or the range may be affected by a soil characteristic, like pH or texture.

| **Soil test ratings for immobile nutrients (based on 8-inch sample)*** | | | | | | |
|---|---|---|---|---|---|---|
| **Category – immobile nutrients** | **Very low** | **Low** | **Medium** | **Optimum** | **High** | **Very high** |
| *Probability of yield response to applied fertilizer* | *Very likely* | *Likely* | *Somewhat likely* | *Unlikely* | *Not expected* | |
| Phosphorus | | | | | | |
| Mehlich-3, ppm colorimetric P | < 6 | 6 - 14 | 15 - 24 | 25 - 35 | 36 - 50 | > 50 |
| Olsen bicarbonate, ppm P | <3 | 3 - 6 | 7 - 10 | 11 - 15 | 16 - 20 | >20 |
| Mehlich-3, ppm ICP-P | < 7 | 8 - 15 | 16 - 26 | 27 - 35 | 36 - 50 | > 50 |
| Bray-1, ppm P | < 5 | 5 - 12 | 12 - 22 | 23 - 30 | 31 - 40 | > 40 |
| Potassium, ppm K | < 60 | 60 - 120 | 121 - 160 | 161 - 220 | 221 - 280 | > 280 |
| Calcium, ppm Ca | < 100 | 100 - 200 | 201 - 300 | 301 - 2500 | > 2500 | > 5000 |
| Magnesium, ppm Mg | <25 | 25 - 50 | 51 - 75 | 76 - 100 | 100 - 200 | > 200 |
| Zinc, ppm Zn | < 0.3 | 0.3 - 0.5 | 0.6 – 0.8 | 0.9 – 1.2 | 1.3 – 2.0 | > 2.0 |
| Iron, ppm Fe | < 1.0 | 1.0 – 2.5 | 2.6 – 5.0 | 5.1 – 15.0 | 15 - 30 | > 30 |
| Copper, ppm Cu | < 0.1 | 0.1 – 0.2 | 0.3 – 0.4 | 0.5 – 0.8 | 0.9 – 1.5 | > 1.5 |
| Manganese, ppm Mn | < 0.5 | 0.5 – 1.0 | 1.1 – 3.0 | 3.1 – 6.0 | 6.0 - 10 | > 10 |
| Boron, ppm B | < 0.2 | 0.3 – 0.5 | 0.6 – 0.8 | 0.9 – 1.5 | 1.6 – 2.5 | > 2.5 |
| **Category – mobile nutrients**** | **Very low** | **Low** | **Medium** | **Optimum** | **High** | **Very high** |
| Nitrate-nitrogen, ppm $NO_3$-N | <5 | 6 - 10 | 11 - 25 | *** | 26 - 50 | > 50 |
| Sulfur, ppm S | < 2 | 2 - 5 | 6 - 10 | *** | 11 - 15 | > 15 |

***These ranges are provided for general crop production situations. The ranges may be different for individual crops or for specific soil situations.***
****Ranges for mobile nutrients are based on survey results. They are not based on sufficiency or probability of yield response***
*****The optimum range for mobile nutrients depends on the projected yield goal and other factors which are very specific to the crop and field situation.***