ALBION®
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Understanding Your Albion Soil Analysis

by Kevin Dickinson

Plant growth and crop production is highly dependent on the fertility of the soil and the other factors that affect the ability of the plant to absorb nutrients from the soil. The better we understand the various characteristics of our soils, the better decisions we can make on how we can manage them to produce our crops efficiently.

Various methods of soil analysis have been developed to determine the availability of mineral nutrients to plants. Analysis can also detect many of the other factors that influence nutrient availability in the soil. From these results we can determine the quantities of fertilizers and soil amendments that are required to optimize these factors and improve nutrient availability to the plants.

Sampling

Representative sampling of the entire field is important. Sub-samples should be taken from 15 to 20 different areas of the field and mixed to make one sample (see Figure 1). Any areas that appear different from the average of the field should either be disregarded or sampled separately.

Soil pH

pH is a measure of the acidity or alkalinity of the soil solution. The range of pH is from 0 to 14, where a measurement of 7 is neutral. Soils with a pH of less than 7 are acid, while a soil with a pH above this level is alkaline. The solubility and therefore the availability of all plant nutrients are dependent on soil pH as shown in Figure 3. Each crop has an optimal pH range within which it grows best.

In acid soils we test for Buffer pH. From this result we can determine the amount of residual acidity or H^+ in the soil. Some laboratories report this result as excess aluminum (Al^{3+}).

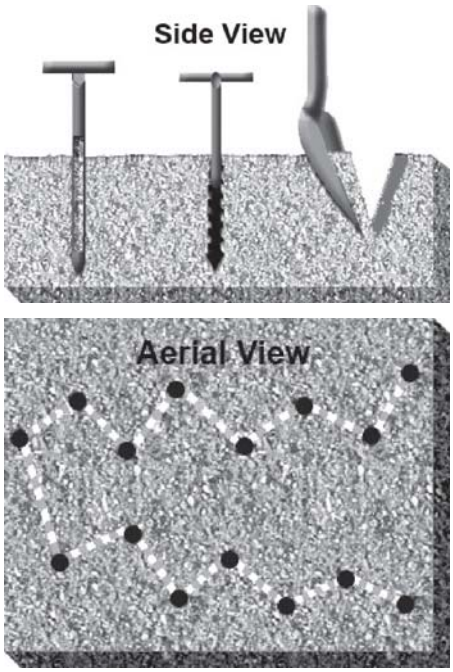

Figure 1. Collection of a Soil Sample

From this result we can determine the quantity of lime needed to neutralize the soil and bring the pH into the optimal range for the crop.
Excess lime or free calcium carbonate in the soil is reported on a qualitative basis. A rating of Low means that essentially no excess lime is present. Lime content rated as Medium or High will have the effect of maintaining a high pH in the soil. The application of acid-forming materials to alkaline soils will dissolve the lime from the soil. Excess lime must be eliminated from the soil before these applications will have any effect on the soil pH.

Organic Matter

Organic matter is an important component of the soil that influences its structure. It improves the infiltration rate of water and the water-holding capacity of the soil. As organic matter decomposes, it becomes an important source of nutrients, particularly nitrogen. ENR on our report stands for Estimated Nitrogen Release which is the approximate amount of nitrogen that will become available from the organic matter over the course of the growing season.

Nutrient Ratings

All of the nutrient levels on our soil report are rated as Very Low (VL), Low (L), Medium (M), High (H), or Very High (VH). The ranges for these ratings for each nutrient are listed in Table 1 on page 3 of this newsletter. In general, it is best if the nutrients are maintained within a range of Medium to High to sustain optimal crop production.

Macronurients

Nitrate is the most readily available form of nitrogen to the plant. It is also readily leached below the root zone with downward movement of

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Soil Analysis Report

Date of Report: 11-Oct-04

Sample	Field Identity	Lab Number	Crop Name	Yield Goal
1	BLOCK 10	16818	LEMONS	0

Soil pH	Buffer pH	Hydrogen H meq/100g	Organic Matter %	Organic Matter ENR lbs/acre	Nitrate Nitrogen N ppm-N	Sulfur S ppm-S	Phosphorus P ppm-P	Potassium K ppm-K	Calcium Ca ppm-Ca	Magnesium Mg ppm-Mg	Sodium Na ppm-Na
6.0	6.9	1.02	1.5	60 L	27 M	72 VH	58 VH	92 VL	2071 H	374 H	105 M

Excess Lime Rating	Chloride Cl ppm-Cl	Soluble Salts E.C. mmho/cm	Zinc Zn ppm-Zn	Manganese Mn ppm-Mn	Iron Fe ppm-Fe	Copper Cu ppm-Cu	Boron B ppm-B	Cation Exchange Capacity C.E.C. meq/100g	Percent Base Saturation (Computed) %K	%Ca	%Mg	%Na
LOW	50.83	0.5 VL	6.3 VH	4.8 L	20.0 H	3.4 VH	0.8L	15.1	1.6	68.4	20.4	3.0

Soil Fertility Recommendations — Metalosate® Foliar Application — Soil Amendments

Nitrogen N	Phosphate P_2O_5	Potash K_2O	Sulfur S	Calcium Ca	Magnesium Mg	Zinc Zn	Manganese Mn	Iron Fe	Copper Cu	Boron B	Multi-mineral MM	Lime	Gypsum
LBS/ACRE				OZ/ACRE								TONS/ACRE	
160		250		0	0	0	0	0	0	8	40	1.3	0

This report applies only to the sample(s) tested. Samples are retained for a maximum of thirty days after analysis.
Albion Advanced Nutrition
By: DB

Figure 2. Albion Soil Report

NOTE: *Your report may appear somewhat different. The font for this illustration has been enlarged for the results.*

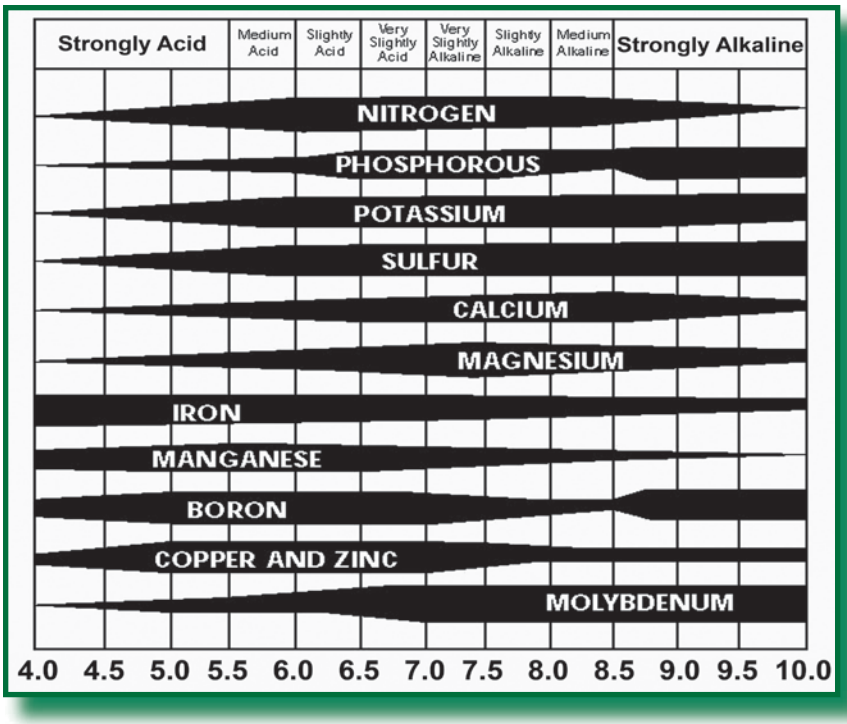

Figure 3. How Soil pH Affects Availability of Plant Nutrients

water. When compared to the total demand of the crop, the amount of nitrogen from this source along with the Estimated Nitrogen Release will give us an indication of the nitrogen we need to apply as a fertilizer.

Sulfur must be present in the soil in soluble-sulfate forms to be available to the plant. Like nitrate, sulfate can be lost from the soil with downward movement of water if it is not absorbed by the plants. Therefore, the applications of nitrogen and sulfur should be carefully timed to meet the demand of the crop.

Phosphorus can be found as calcium phosphates in alkaline soils and as iron and aluminum phosphates in acid soils. All of these forms are slowly soluble in the soil. The solubility of these phosphates are highly dependent on pH. One can usually manipulate the availability of phosphorus by changing the pH of the soil.

Major Cations

Potassium, calcium, magnesium, and sodium are present in the soil as positively charged elements or cations. Soil particles have a negative charge and can hold cations on their surfaces. The quantity of cations that a given amount of soil can hold is referred to as the Cation Exchange Capacity or C.E.C. Soils of a fine texture have a higher C.E.C. while coarse textured soils have a lower capacity to hold cations.

The cations are often evaluated in relation to the C.E.C. The optimal ranges for the levels of potassium, calcium and magnesium as a percentage of C.E.C are shown in Table 1. Sodium is detrimental to the soil structure and should be reduced to as low as possible.

Soluble Salts

Soluble salts in the soil are measured as Electroconductivity or E.C. of the soil solution. Excess salts are detrimental to

Table 1. Soil Nutrient Ratings

Nutrient		Very Low (VL)	Low (L)	Medium (M)	High (H)	Very High (VH)
ENR-Nitrogen	(ppm)	<55	55-72	72-100	100-122	>122
NO3-Nitrogen	(ppm)	<10	10-20	20-30	30-40	>40
Sulfur	(ppm)	<5	5-10	10-20	20-30	>30
Phosphorus	(ppm)	<8	9-14	15-24	25-40	>40
Potassium	(ppm)	<40	40-120	120-200	200-280	>280
Calcium	(% of CEC)	<30	30-50	50-67.5	67.5-82.5	>82.5
Magnesium	(% of CEC)	<8.5	8.5-10	10-15	15-25	>25
Sodium	(% of CEC)	<1.5	1.5-2.0	2.0-3.5	3.5-5.0	>5.0
Sol. Salts	(mmho/cm)	<0.75	0.75-2.0	2.0-3.5	3.5-5.0	>5.0
Zinc	(ppm)	<0.5	0.5-1.0	1.0-3.0	3.0-6.0	>6.0
Manganese	(ppm)	<4	4-8	8-12	12-30	>30
Iron	(ppm)	<5	5-10	10-16	16-25	>25
Copper	(ppm)	<0.3	0.3-0.8	0.8-1.2	1.2-2.5	>2.5
Boron	(ppm)	<0.3	0.3-0.9	0.9-1.5	1.5-2.0	>2.0

plant growth. Therefore, we need to maintain this level as low as possible. The only way to reclaim saline soils is to wash the excess salts below the root zone with the application of a large amount of good quality water. Good drainage must also be provided so the salts can be removed from the soil.
Chloride has recently been found to be an essential element for plant growth. However, in high concentrations this element can cause a detrimental increase in the E.C. of the soil. In addition, many crops are sensitive to chloride toxicity. Soils containing an excessive amount of chloride should be treated the same as saline soils. Leaching the soil with good quality irrigation water can wash this element below the root zone.

Micronutrients

The micronutrients include iron, manganese, zinc, copper, boron, and molybdenum. Plants use lower quantities of these elements than the macronutrients. This does not mean they are less important, however. We need to make sure that adequate quantities of these elements are available to the plants.

The metals iron, manganese, zinc, and copper are much more soluble in low pH solutions. We often see deficiencies of these elements in alkaline soils while excesses and even toxicities are common in acid soils.
Boron is not held by the soil particles. Therefore, it can be leached below the root zone with the downward movement of water.

Since plants only need small quantities of the micronutrients, it is easy to for the plant to get too much of one or more of these elements. An excess level, or toxicity, can be just as harmful to the plant as a deficiency. Furthermore, interactions between the elements can reduce or enhance the availability the nutrients.
From all of these results, we can determine the amounts of each element that may need to be applied as a fertilizer. We can also make recommendations for amendments to adjust the factors in the soil that affect plant growth.

Conclusion

Soil analysis is a very important tool that can be used to determine the quantities of fertilizers required, diagnose problems, and if any amendments are needed. However, a number of factors cannot be measured in a laboratory. Soil temperatures, moisture, compaction, and drainage all can influence the ability of the plant's ability to absorb nutrients. For this reason we also need to make observations in the field.

Plant-tissue analysis is another tool we can use to determine the amounts of each nutrient being absorbed by the plant. Albion has developed the TEAM® program to evaluate the results of plant tissue analysis. This program evaluates the actual levels of the nutrients as well as the interactions between them. It then makes recommendations for foliar applications of Metalosate® products based on this evaluation.

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The efficiency of the production of our crops depends on our ability to gather relevant data and to use it to make informed decisions. Albion Advanced Nutrition operates a full-service laboratory to provide you with these analytical services. In addition, our agronomists are available to assist in the interpretation of the results and to make recommendations for an optimal nutrient program for your crop.

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