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### SOIL NUTRIENTS

TERMS, DEFINITIONS, OPTIMUM LEVELS AND DEFICIENCY SYMPTOMS

#### **Organic matter:**

That living portion of the soil.

Placed in two categories

- 1) Humus : very stable
- 2) Organic materials subject to fairly rapid decomposition.

#### **pH:**

Term used to describe the H<sup>+</sup> concentration in the soil. Less than pH 7.00 is acidic, pH of 7.00 is neutral and pH greater than 7.00 is basic. Preferred pH range for most crops is 6.0 to 7.0.

#### **Buffer pH:**

The term buffering defines the resistance to change in pH. Soils have a buffering system built in which are compounds that can maintain the pH of a soil solution within a narrow range when small amounts of acid or base are added.

### **MACRO NUTRIENTS**

#### **Nitrogen:**

It is a very important plant nutrient and can be controlled by man.

Plays a major role in the formation of proteins.

Deficient crops exhibit stunted growth and the leaves appear yellow in color.

Severe deficiency of nitrogen results in the leaves turning brown and dying.

Legumes: although legumes produce their own nitrogen it is still important to monitor the nitrogen levels in the soil.

**Phosphorus: (P)** Proper levels: Insures proper root development and growth. Leads to earlier maturity.

Essential for seed formation. Greater cereal straw strength. Improved disease resistance.

Normal yields: usage is 25 - 30 lbs / acre

**Potassium: (K)** Plant requirements are high. Very mobile element. Important in the conversion of nitrogen to protein .

Deficiency symptoms: Weakening of the straw of grain crops resulting in lodging.

Reduction of yield. Decrease in resistance to disease.

**Calcium: (Ca)** Found in abundant quantities in the leaves of plants. Deficiency symptoms: Failure of the terminal buds of plants to develop. Root tips underdeveloped, resulting in stunted plant growth. In corn, shortage of calcium prevents the emergence and unfolding of new leaves. Plant roots and tips do not elongate. Hinders protein synthesis.

**Magnesium: (Mg)** Mobile element. Enhances chlorophyll content which directly affects nitrogen metabolism.

Deficiency symptoms: Shows in the lower leaves first, interveinal chlorosis (only the vein remains green).

**Sulfur: (S)** Deficiencies are linked to sulfur free fertilizers. Can cause accumulation of nonprotein nitrogen, which directly effects ruminant animals. Related to the production of oils in such crops as soybeans.

## TRACE MINERALS

**Boron: (B)** Deficiency symptoms: First visual symptom: growth of terminal buds stop, followed by the death of young leaves. The sequence of death is that first the young leaves turn pale green, followed by tissue breakdown and if continues the leaf twists, resulting in death.

**Zinc: (Zn)** Deficiency symptoms: Interveneal chlorosis followed by a reduction in shoot growth. Common term is rosetting or a broad band of bleached tissue on each side of the midrib, beginning at the base.

**Manganese: (Mn)** It is a very immobile element, resulting in foliar applications when deficiency symptoms appear. Deficiency symptoms usually appear in the younger leaves first. In broadleaved plants the symptom is one of interveneal chlorosis, which also occurs in members of the grass family.

**Iron: (Fe)** Iron is a catalyst to help form chlorophyll and act as an oxygen carrier. Iron helps to form certain respiratory enzyme systems. Deficiency shows up as a pale green leaf color (chlorosis) with sharp interveneal color differences.

**Copper: (Cu)** Necessary to form Chlorophyll and act as a catalyst in several plant processes. Copper deficiency includes chlorotic leaves, curling and failure to flower.

## OPTIMUM RANGE GUIDELINES

Compare your results, under “**LABORATORY DATA**” (bottom of soil report), with optimum ranges below. These guidelines apply to most crops, including turf, with a **8-12 CEC** (cation exchange capacity).

## MACRO NUTRIENTS

|               | <i>P</i> | <i>P</i><br><i>Elemental</i> | <i>P2O5</i><br><i>Oxide</i> | <i>K</i> | <i>K</i><br><i>Elemental</i> | <i>K2O</i><br><i>Oxide</i> | <i>Mg</i> | <i>Mg</i><br><i>Elemental</i> | <i>MgO</i><br><i>Oxide</i> | <i>Ca</i> |
|---------------|----------|------------------------------|-----------------------------|----------|------------------------------|----------------------------|-----------|-------------------------------|----------------------------|-----------|
| <i>Ppm</i>    | 40-60    |                              |                             | 120-200  |                              |                            | 250-360   |                               |                            | 1000-3000 |
| <i>Lb/ac</i>  |          | 80-120                       |                             |          | 240-400                      |                            |           | 300-600                       |                            | 2000-6000 |
| <i>Lb/ac</i>  |          |                              | 185-275                     |          |                              | 285-500                    |           |                               | 480-960                    |           |
| <i>% sat.</i> |          |                              |                             | 3-5%     |                              |                            | 10-20%    |                               |                            | 50-70%    |

**NOTE: Optimum ranges for CEC's other than 8-12 use the following formulas:**  
 For K2O use: CEC x 31 and CEC x 18.8 for the **top** and **bottom** of the range respectively.  
 For MgO use: CEC x 60 and CEC x 20 for the **top** and **bottom** of the range respectively.

## TRACE MINERALS

| <i>MINERAL</i> | Manganese -Mn | Iron – Fe | Copper – Cu | Zinc - Zn | Boron – B | Sulfur – SO4 |
|----------------|---------------|-----------|-------------|-----------|-----------|--------------|
| <i>Ppm</i>     | 15 - 45       | 12 – 50   | 0.5 – 2.0   | 1.0 – 4.0 | 0.6 – 2.0 | 10 - 20      |