

Central Spine  
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UNDERSTANDING FERTILIZERS  
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Soil is the key to plant growth. Sixteen chemical elements are necessary for growth of plants. Thirteen are soil derived nutrients that normally enter plants through the roots.

The functions of soil-derived plant nutrients are divided into three groups.

1. PRIMARY PLANT NUTRIENTS

- (a) Nitrogen
- (b) Phosphorus
- (c) Potassium (potash)

Primary because the soil normally cannot provide them in the relatively large quantities needed for healthy plant growth.

NITROGEN (N)

Promotes rapid growth.  
Increases yields of leaf.  
Chlorophyll formation (green color).  
Regulates uptake of nutrients.  
Delays flowering and fruiting.  
Protoplasm or protein formation.

PHOSPHORUS (P)

Hastens maturity (conversion of starch to sugar).  
Cell division or formation.  
Stimulates early root formation and growth.  
Stimulates blooming and aids in seed formation.  
Protoplasm formation.

POTASH (K)

Develops stems and leaves.  
Increases disease resistance.  
Delays maturity . . . slightly.  
Aids in protein production in plants.  
Improves quality of fruits (fleshy fruit formation).  
Catalyst in Iron uptake.  
Aids in formation of anthocyanin (red color of leaves and fruits).  
Essential to the formation and trans-location of starches, sugars, and oils.  
Helps development of tubers.

## SECONDARY AND MICRO-PLANT NUTRIENTS

Until recently little attention was given to the importance of the "secondary and micro elements" - Calcium, Magnesium, Sulfur, Boron, Manganese, Copper, Iron, Molybdenum, Zinc and Chlorine in plant foods. It was thought that most of our soils contained sufficient natural supplies. Also, commercial plant foods supplied considerable quantities of these elements as impurities and carriers of the primary nutrients.

The development of more highly refined materials carrying more nitrogen, phosphorus, and potassium has reduced the supplies of some secondary and micro elements in plant foods. Also, with intensive cropping, greater emphasis on higher yields, and with our soils becoming older and more depleted, the need for all essential elements becomes more pronounced.

### 2. SECONDARY PLANT NUTRIENTS

- (a) Calcium
- (b) Magnesium
- (c) Sulfur

These are called secondary because they also are required by plants in fairly substantial quantities. Adequate amounts are present in some areas and lacking in others.

#### CALCIUM (Ca)

Promotes early root hair formation and growth (feeder roots).

Neutralizes poisons produced in the plants.

Increases calcium content of food and feed crops.

Improves general plant vigor.

Translocation of sugars.

#### MAGNESIUM (mg)

Is an essential part of chlorophyll.

Necessary for the formation of sugar.

Helps regulate uptake of other plant foods.

Acts as carrier of phosphorus in the plant.

Promotes formation of oils and fats.

Aids in seed formation.

#### SULFUR (S)

Is an essential ingredient of protein.

Helps maintain dark green color.

Stimulates seed production.

Encourages more vigorous plant growth.  
Promotes nodule formation on legumes.

### 3. MICRO-NUTRIENTS

- (a) Boron
- (b) Copper
- (c) Iron
- (d) Manganese
- (e) Molybdenum
- (f) Zinc
- (g) Chlorine

Micro or trace nutrients are so-called because they are required by plants in very small quantities. These elements are available in adequate quantities in some soils. Sandy soils and peat and muck soils are most often deficient. When any micro-nutrient is deficient, crop yields will suffer.

#### BORON (B)

Essential in calcium uptake.  
Increases yield or improves quality of fruit and vegetables.  
Important for seed production of legumes.  
Bud growth (terminal bud formation).  
Needed particularly on muck soils.

#### COPPER (Cu)

Intercellular metabolism.  
Oxidizer in plant processes.  
Important in reclaiming and utilizing peat and muck soils.

#### IRON (Fe)

Associated with production of green chlorophyll.

#### MANGANESE (Mn)

Accelerates germination and maturation.  
Increases availability of calcium, magnesium, and phosphorus.  
Promotes soil oxidation.  
Aids in the synthesis of chlorophyll and functions of photosynthesis.

#### MOLYBDENUM (Mo)

Essential in nitrogen fixation and utilization by legumes.  
Corrects Whiptail of cauliflower and Yellow Spot of citrus.

May be important in acid soil regions on such crops as tomatoes, beets, crucifers, and legumes.

ZINC (Zn)

Necessary for normal chlorophyll production and growth. Controls use of other elements in plant. Often deficient in available forms in alkaline or highly limed soils.

CHLORINE (Cl)

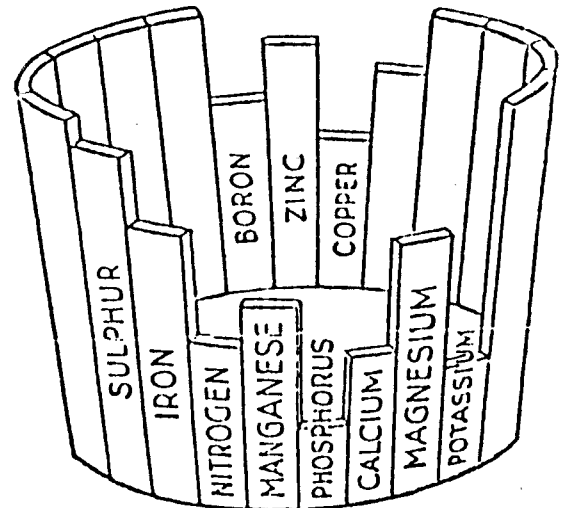
Most recent addition to the list of known essential plant nutrients.

Plants, like humans and animals, need not only enough food, but a balanced diet if they are to make healthy growth and produce top yields. When any one of the plant food elements is not available to the plant in sufficient quantity, growth is affected whether or not the deficiency is acute. The plant cannot produce top yields.

Water and air supply the three remaining chemicals (Carbon, Hydrogen, and Oxygen), giving us the 16 known essential plant food elements.

"LAW OF THE MINIMUM"

This can best be illustrated by looking at crop yields as a barrel with each plant nutrient as one of the staves. The barrel can only fill up to the shortest stave. Plant yield can only go up to the point where one nutrient or another (or some other growth factor) is in sufficient supply to support the plant's needs. No matter how much Nitrogen, Phosphorus, or Potash you may apply, the Micro elements deficiency would not be corrected.

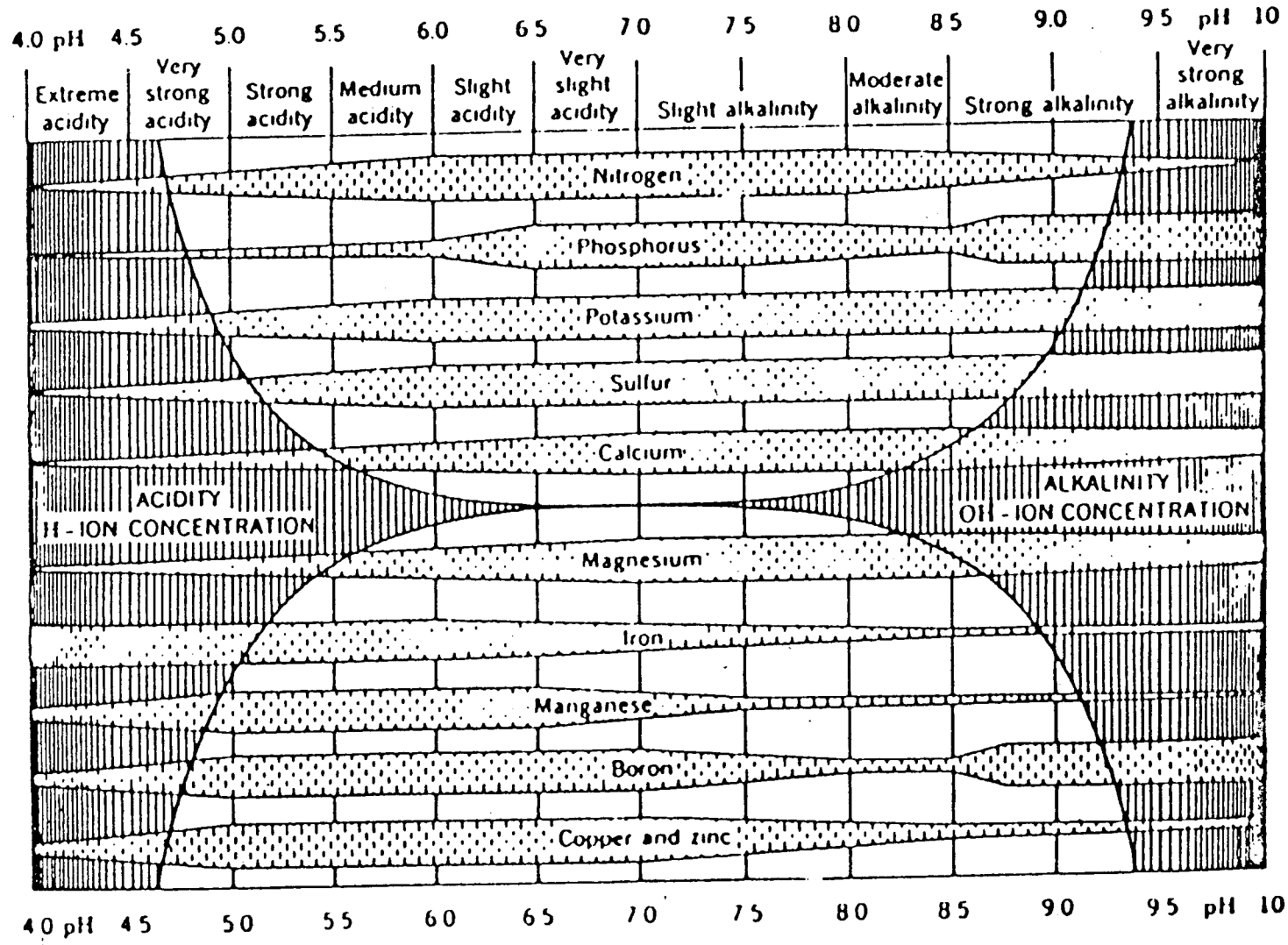


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# Soil Uptake Of Nutrients In Relation To Acidity Or Alkalinity

WIDE LINE SHOWS STRONGEST UPTAKE  
ACIDITY ALKALINITY

pH



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