



## I. Understanding Plant Nutrition



Eighteen elements are considered essential for plant growth. Carbon, hydrogen, and oxygen are primarily supplied by air and water. Plant roots absorb the remaining 15 elements from the surrounding soil. These elements are divided into three groups based on their relative abundance in plants: Primary Nutrients (or Major Nutrients), Secondary Nutrients (or Minor Nutrients), and Trace Nutrients (or Micronutrients). Although the Major Nutrients are needed in the greatest quantities, a deficiency of any one nutrient can prevent plant growth, or reduce it to unsatisfactory levels. Even though some soils may already contain these nutrients, they may not be in a form available for plant growth. The best way to ensure that all of the nutrients are available in the soil is through regular applications of plant foods. Table 1 provides more information on each nutrient, its deficiency symptoms, and possible plant foods to cure the deficiency.

# Plant Food Fundamentals

## T I P S H E E T

<b>Primary Nutrients</b>	<b>Function</b>	<b>Deficiency Symptoms</b>	<b>*Solutions</b>
Nitrogen	Vigorous growth & dark green color	Light green leaves; stunted growth	Dried Blood, Garden Manure, Cottonseed Meal, Ammonium Sulfate, Urea
Phosphorus	Root development & flowering	Smaller yields of seeds & fruit; purplish leaves, stems & branches;	Rock Phosphate, Bone Meal, Single Super Phosphate, Triple Super Phosphate
Potassium	Overall hardiness & disease resistance	Reduced yields; Spotted or curled leaves; Weak root system	Sulfate of Potash, Sulfate of Potash Magnesia, Muriate of Potash, Greensand
<b>Secondary Nutrients</b>	<b>Function</b>	<b>Deficiency Symptoms</b>	<b>*Solutions</b>
Calcium	Plant vigor; Aids in uptake of nutrients	Deformed terminal leaves; Poor root growth	Garden Lime, Garden Gypsum
Magnesium	Essential part of chlorophyll	Yellowing of older leaves	Garden Lime, Sulfate of Potash Magnesia
Sulfur	Dark green color; Seed production	Yellow leaves; Stunted, spindly plants	Garden Sulfur, Sulfate of Potash, Gypsum
<b>Trace Nutrients</b>	<b>Function</b>	<b>Deficiency Symptoms</b>	<b>*Solutions</b>
Boron	Increases flowering & fruit development	Terminal buds die; Less flowers & fruit develop	Garden Manure, Bone Meal
Chlorine	Helps control water loss & moisture stress	Plants wilt; yellow leaves	Muriate of Potash, Garden Manure, Greensand
Cobalt	Improves growth & transpiration	Reduced growth and yellowing of foliage	Greensand, Kelp, Cottonseed Meal
Copper	Helps produce chlorophyll	Yellow, wilted leaves; Lack of flowering	Garden Manure, Greensand
Iron	Promotes dark green leaves	Yellow leaves	Greensand, Garden Manure, Cottonseed Meal
Manganese	Helps produce chlorophyll	Intervenous chlorosis in younger leaves	Garden Manure, Greensand
Molybdenum	Essential in some enzyme systems	Pale green, rolled or cupped leaves	Greensand, Lime (makes it more available)
Sodium	Aids water regulation & photosynthesis	Plants wilt	Kelp, Garden Manure, Bone Meal, Greensand
Zinc	Enzyme & growth hormone production	Yellow leaves, Rosetted (clustered) leaves	Garden Manure, Greensand, Cottonseed Meal

\* Espoma Tones contain ALL 15 essential nutrients so they can cure all of the above nutrient deficiencies.

For more information about our products and services please contact our customer support department at:

The Espoma Company • 6 Espoma Road, Millville, NJ 08332 • Telephone: 1-888-ESPOMA1 (888-377-6621) • Fax: 856-825-1385 • [www.espoma.com](http://www.espoma.com)