

Nutrient Guide

Major, Secondary and Minor Elements

Mineral nutrients are classified as major, secondary and minor elements. This classification describes the relative amounts of each element present in plants, but is not intended to reflect its importance to the plant. All of the essential elements are necessary for proper plant growth, but the major and secondary elements are needed in greater quantities than the minor elements.

No one essential nutrient is of greater or lesser importance than another. Following is a list of the major, secondary and minor elements. Each has its own special role in the proper growth and development of the plant.

Major Elements

- + **Nitrogen** (in fertilizer stated as N). An essential part of all living matter. Nitrogen-containing compounds make up about half of the living and reproductive substance of plant cells. Nitrogen is the basis for amino acids that combine to form proteins. Nitrogen is associated with vegetative growth as well as its deep green color.
 - **Nitrogen deficiency** is noticed in tissue that has turned light green or yellow. When a deficiency occurs, it is first noticed on the older leaves or blades since nitrogen is easily moved (mobile) from the older to the newer growth. The blades start dying at the tip and progress along the midrib (center of the blade) until the entire leaf is dead.
- + **Phosphorus** (in fertilizer stated as available P_2O_5). It is the key nutrient in seedling development since it contributes so much to initial root development and seed formation. It is directly related to the vital growth processes; without it, there is a marked reduction in growth of established tissue.
 - **Phosphorus deficiency** is most likely to be observed in seedling growth when new seedlings are slow to develop. On established plants, the blades may appear dull green and tend to turn purple in cold weather. These symptoms are first noticed on the older blades since phosphorus is so mobile within the plant.
- + **Potassium** (in fertilizer stated as exchangeable potash or K_2O) is found in all plants in relatively large quantities. It is involved in various biochemical reactions, including the production of sugars and starches. Potassium also plays a role in maintaining turgor pressure, which is associated with disease resistance, strengthening cell walls, increasing winter hardiness, and drought resistance.
 - **Potassium deficiency** first appears on the older leaves since potassium is a mobile element. The blades become streaked with yellow, turn brown at the tips and eventually die. Susceptibility to disease and winter injury is also increased.

Secondary Elements

- + **Calcium** is an important constituent of plant cell walls, thereby giving overall strength to the growing plant. Calcium is also essential for good root development and may serve to neutralize some toxic compounds present in the plant.
 - **Calcium deficiency** first shows on the younger new growth since this element is not readily moved within the plant. Symptoms are generally noticed as blades develop reddish brown leaf margins that may curl and die. However, these symptoms are sometimes difficult to observe and many times are completely lacking.
- + **Magnesium** is an integral part of the chlorophyll molecule, which means it is essential for photo-synthesis. Magnesium is also associated with phosphorus uptake and utilization within the plant.
 - **Magnesium deficiency** is first noticed on older leaves since this element is mobile. Green or yellow-green strips turn to bright red, and the plant becomes more susceptible to winter injury.
- + **Sulfur** is an integral part of certain amino acids and, therefore, proteins as well. Together with nitrogen, this element makes new protoplasm for plant cells.
 - **Sulfur deficiency** has symptoms that resemble those of a nitrogen deficiency since the two elements are so closely associated. Since sulfur is rather immobile, the younger leaves exhibit a light-green or yellowing. Eventually, the leaf tips turn brown and curl. Deficiencies are almost always associated with soils low in organic matter.

Minor Elements

- + **Manganese** activates numerous enzymes involved in photosynthesis.
 - **Manganese deficiency** appears as yellow-spotted or chlorotic leaves on the new growth, since this element is relatively immobile.
- + **Iron** has an integral part in chlorophyll production and is also a part of many enzymes.
 - **Iron deficiency** symptoms include chlorotic or even white young leaves due to a reduction or loss of chlorophyll.
- + **Copper**, like iron, is an important part of chlorophyll production and essential to many enzymes.
 - **Copper deficiency** symptoms appear first on new leaves because copper is not easily moved throughout the plant. Symptoms include stunted yellow plants with brown leaf tips.
- + **Boron** is essential to carbohydrate metabolism and sugar movement within the grass plant.
 - **Boron deficiency** is usually characterized by slow growth and a pale green color on younger leaves.
- + **Chlorine** has a role in plant nutrition that is not clearly understood, but it is believed to be part of an enzyme essential for photosynthesis.
 - **Chlorine deficiency** usually shows as wilted leaves that become chlorotic, often the result of reduced root growth.
- + **Molybdenum** activates an enzyme system controlling the conversion of nitrates to protein in the plant.
 - **Molybdenum deficiency** is characterized by a pale yellow, bleached and withered appearance on the older leaves (indicating this element is quite mobile).
- + **Zinc** regulates sugar consumption and chlorophyll production in the leaves.
 - **Zinc deficiency** symptoms include a yellow, white or mottled appearance between the veins of the leaf and light colored streaks in grass blades, while the outside margins remain green.