

Learn more about fertilizers.

The role of each essential nutrient in plant growth and development is quite specific, and sometimes completely misunderstood. Each essential nutrient is equally important to plant growth, just in different quantities, a deficiency of any one can seriously impair overall plant growth and development.

Annual fertilizer input ratio for turf grass (soluble fertilizers)

Situation	Nitrogen	Phosphorus	Potassium
Low Maintenance	1.0	0.1	1.0
High Maintenance (e.g. lawns, fairways, sports fields)	2.0	0.2	1.5
Intensive Maintenance (e.g. greens, tee)	3.0	0.3	2.0

Note: Not applicable for foliar or slow release.

NITROGEN

This is the essential nutrient that is required in the largest amounts. Nitrogen nutrition affects turf in a number of ways including, shoot growth, root growth, shoot density, color, disease proneness heat/cold/drought hardiness, and recuperative potential.

Nitrogen Deficiency

The level of nitrogen is directly correlated with the color and shoot density of turf. A visual reduction in turf color or shoot density is a common indicator of nitrogen deficiency. A reduction in the shoot density of turf may favor the encroachment of weeds. It is interesting to note that the incidence of Dollar Spot, a rust disease, is most severe on nitrogen deficient turfs.

The symptoms of nitrogen deficiency include:

1. Color - older leaves appear as a pale green color changing to a pale yellow as symptoms develop. In the extreme cases a copper color develops on the leaf tips.
2. Shoot - the plant shoot density decreases and the plants become spindly.

Excessive Nitrogen Applications

An excessive application of nitrogen may lead to:

1. Excessive need for mowing

2. Stunting/death of roots due to excessive shoot growth
3. Thatch accumulation and puffiness in greens
4. Increased incidence of fungal pathogens including Fusarium and Ophiobolus.
5. Increased wilting and tendency for winter desiccation.

PHOSPHOROUS

Turf grass requires much less phosphorous than nitrogen or potassium, although phosphorous is still an important component of plant protein. Phosphorous is in its highest concentration in the young plant tissue, moving to the seed as the plant matures.

Phosphorous Deficiency

Visual symptoms first appear as a dark green discoloration of the older lower leaves. The plants tend to be spindly and dwarfed but not to the degree associated with nitrogen deficiency. As the deficiency progresses, the dark green coloration changes to dull blue-green and a purple discoloration appears on the leaf margin.

Phosphorous affects Turf grass in the following ways:

1. Plant establishment - phosphorous near seeds at planting stimulates rapid establishment.
2. Rooting - stimulates root growth and branching.
3. Maturity - higher phosphorous levels hasten maturity. A deficiency of phosphorous will usually delay maturity.

Turf grasses usually respond well to phosphorous application when the soil phosphorous level is less than 5mg/kg.

POTASSIUM

Potassium is an essential element in many plant growth and development processes, including protein and carbohydrate synthesis. High quantities of potassium are required by established turf.

Potassium Deficiency

General symptoms of potassium deficiency include drooping of Turf grass leaves; these may feel soft to the touch. An excessive degree of tillering may be noted. Moderate interveinal yellowing develops,

especially in the tips of the older leaves. The leaf yellowing progresses into tip burning, chlorosis and leaf rolling as the deficiency continues.

Turf grasses may not exhibit a visual response to potassium in terms of shoot color, density and growth. However, the potassium does influence turf grass in the following terms:

1. Rooting - Potassium enhances root development and branching.
2. Drought tolerance - high potassium levels contribute to improved drought tolerance. Potassium regulates the absorption and retention of water by plants, influencing the heat and hardness of turf grass.
3. Stolon and Rhizome development correlates well with the soil potassium levels.
4. Reduced wilting - Potassium levels are also linked to increased leaf turgor pressure that reduces the wilting tendency.
5. Disease resistance - higher potassium levels reduce the incidence of numerous fungal diseases of turf including fusarium patch and dollar spot.
6. Wear tolerance - is also reported to increase proportionally with the plant potassium level. The increased wear may be attributed to increased vigor and higher cellulose content. The wear tolerance around cups on putting greens is frequently increased by the application of potassium.

CALCIUM

Calcium is found in large quantities in turf grasses. Calcium functions as a part of the cell wall and as a neutralizer for potentially toxic substances in the cell. The presence of calcium ions also exerts a strong influence on the absorption of other ions by the plant. The uptake of potassium and magnesium is modified by the concentration of calcium ions in the soil solution.

Calcium Deficiency

The first symptoms appear in the younger leaves as a reddish-brown discoloration, developing along the leaf margin and gradually extending to the mid-vein. In older plants, the color fades to lighter shades of red roses and the tips become withered. A calcium deficiency results in an increase in the proneness disease such as pythium blight.

MAGNESIUM

Magnesium is an important nutrient in plant physiological processes, although it is not required in great amounts because it is recycled in many growth processes. Magnesium is essential for the maintenance for the green color in turf and it also influences the mobility of phosphorous within the plant. A high magnesium concentration in the soil may be toxic to turf grass.

Magnesium Deficiency

The deficiency symptoms for magnesium resemble those of calcium, the differences usually occur in the older lower leaves, with more of a cherry red color. Also, the coloring in 30 - 40% of the infected leaves is blotchy in a banded appearance.

SULPHUR

Sulphur is an important constituent of many plant proteins. A deficiency of sulphur will disrupt protein synthesis and impair plant growth.

Sulphur Deficiency

The deficiency symptoms resemble that of nitrogen deficiency. However, as well as an initial paling of the older, lower leaves, a faint scorch of the leaf tip advances towards the base of the leaf in each margin.

MICRONUTRIENTS

The micronutrients iron, manganese, zinc, copper, molybdenum, boron and chloride are just as important as the macronutrients but are required in smaller amounts.

IRON

This element is most commonly deficient in turf. Usually as a result of insolubility rather than an absence of the element. Deficiencies of iron are most common in soils that are either:

1. Alkaline
2. High in phosphate, manganese or zinc
3. High in organic matter
4. Waterlogged or excessively thatched

Iron Deficiency

Iron deficiency symptoms are quite similar to the symptoms for nitrogen deficiency except that the symptoms first appear on the younger leaves.

COPPER

Copper is highly toxic to plants except when in very dilute concentrations. Copper is necessary for the production of a plant hormone that encourages turf stolons. Deficiencies are most common on highly alkaline leached soils.

Copper Deficiency

Copper deficiency usually involves a bluish discoloration at the tip of the youngest actively growing leaf.

MOLYBDENUM

This element is required in extremely low concentrations by the plant and usually in its highest concentration in the topsoil and in highly alkaline soils.

Molybdenum Deficiency

A deficiency of molybdenum usually involves paling or interveinal chlorosis on the older lower leaves. The plant will become stunted if the deficiency continues.

BORON

Usually in its lowest concentration in highly leached acidic soils. In excess the element may be extremely toxic to turf.

Boron Deficiency

Boron deficiency takes a while to become obvious. At first the shoots become discolored and the shoots leaves become stunted and tend to form a rosette.