

use only the exchangeable calcium ion, Ca⁺². Deficiencies occur most frequently in sandy soils, soils that are extremely acidic (i.e., with pH <5.0), or soils saturated with sodium. Deficiency symptoms include distorted appearance in young leaves; leaves that turn reddish brown along their margins before becoming rose-red; and leaf tips and margins that wither and die. Roots are short and bunched. An excess of calcium may bind other soil nutrients, especially phosphorus, magnesium, manganese, iron, zinc, and boron, thereby limiting their availability to plants.

Calcium is an immobile nutrient in plants. It does not move from older leaves to new ones and must be supplied continuously. Calcium is usually added in a liming program or by irrigating with water high in calcium; in Florida's high-pH soils, this element occurs naturally. Commercial sources of calcium include calcitic and dolomitic limestone, gypsum, superphosphates, shells, slags, and water treatment residue (Table 14).

Table 14. Characteristics of primary calcium and magnesium sources used in turf fertilizers.

Source	Nutrient Percentage			Salt Index per Unit of Nutrient ^a	Acidifying Effect	Comment
	N	P ₂ O ₅	K ₂ O			
Calcium Carriers						
Gypsum (calcium sulfate) - anhydrite	0	0	0	---	Neutral	Contains 24% S and 41% calcium oxide; has little effect on soil pH.
- hydrated	0	0	0	---	Neutral	Contains 19% S and 33% calcium oxide; has little effect on soil pH.
Magnesium Carriers						
Magnesium sulfate (Epsom salt)	0	0	0	---	Neutral	Contains 13% S and 10% Mg.
Potassium magnesium sulfate	0	0	18	---	Neutral	Contains 22% S and 11% Mg.

^aGenerally, the higher the salt index/unit of nutrient, the higher the burn potential of the particular fertilizer material.

b. Magnesium

Magnesium is essential for chlorophyll production in plants. Chlorophyll molecules contain approximately 7% magnesium. Magnesium also is essential for many energy reactions, for example, sugar formation, and acts as a carrier of phosphorus. It also regulates the uptake of other plant nutrients. Deficiencies occur primarily in sandy soils (soils low in CEC) or in soils with extremely high pH levels, especially when clippings are continuously removed. Deficiencies can occur in soils with less than 40 lbs per acre of Mehlich-I extractable magnesium. High calcium and potassium levels also tend to reduce magnesium uptake.

Magnesium is a mobile element in plants and is easily translocated from older to younger plant parts as needed. Symptoms of deficiency include a general loss of green color, starting with the bottom (young) leaves. Veins remain green; older leaf margins turn a blotchy cherry-red color with stripes of light yellow or white between the parallel veins. Necrosis eventually develops. Sources of magnesium include dolomitic limestone, sulfates of potash and magnesium, magnesium sulfate (Epsom salt), oxide, and chelates (Table 14).