

Table 7. Relative nutrient ranges for creeping bentgrass, from leaf analysis.*

Element	Low	Sufficient	High
----- % -----			
Nitrogen	<4.5	4.50 - 6.00	>6.00
Phosphorus	<0.3	0.30 - 0.60	>0.60
Potassium	1.8 - 2.1	2.20 - 2.60	>2.60
Calcium	<0.5	0.50 - 0.75	>0.75
Magnesium	<0.25	0.25 - 0.30	>0.30
----- ppm -----			
Boron	<8	8 - 20	>20
Copper	<8	8 - 30	>30
Iron	<100	100 - 300	>300
Manganese	<50	50 - 100	>100
Zinc	<25	25 - 75	>75

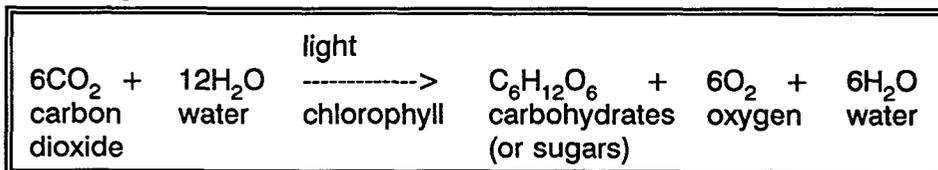
*After Jones, Wolf, and Mills.

PLANT NUTRITION AND TURF FERTILIZERS

I. Plant Nutrition

Proper fertilization is essential for turfgrasses, enabling them to sustain desirable color, growth density and vigor, to better resist diseases, weeds and insects, and to provide satisfactory golf course playability. Turf plants need 16 elements, which are divided into two categories: *macronutrients* and *micronutrients* (Table 8). Macronutrients can be further subdivided into primary nutrients (nitrogen, phosphorus, and potassium), and secondary nutrients (calcium, magnesium, and sulfur). Carbon (C), hydrogen (H), and oxygen (O), macronutrients obtained from air and water, are the building blocks for photosynthesis. When combined in the presence of chlorophyll and light, these three nutrients form carbohydrates, the sugars that provide plant growth.

Photosynthesis



Carbon dioxide is absorbed by plants through leaf stomata and water is absorbed through roots. Therefore, fertilizer practices affecting root growth and function, as well as the opening and closing of stomata, indirectly influence a plant's ability to produce food through photosynthesis.

Simple carbohydrates produced from photosynthesis generate more complex compounds, such as starch and amino acids, which require carbon, oxygen, and hydrogen, in addition to other elements. These remaining essential elements, absorbed into plants mainly through roots, exist in the soil solution