THE ROLE OF NITROGEN IN THE GROWTH AND QUALITY OF TURFGRASSES

Dr. James B. Beard
Department of Crop and Soil Sciences
Michigan State University

Turfgrasses require nitrogen in the largest amount of any of the essential plant nutrients, with the exception of carbon, hydrogen, and oxygen. Thus, nitrogen is usually applied in the greatest amounts of any of the nutrient elements. Nitrogen is a vital constituent in many important living plant components including:

(a) Chlorophyll which is vital for photosynthesis.

(b) Amino acids and proteins that make up the living protoplasm of the cell.

(c) Nucleic acids that function in the hereditary transfer of specific turfgrass characteristics.

(d) The enzymes and vitamins involved in catalyzing metabolic plant reactions.

The turfgrass plant cannot function properly and complete a recurring plant cycle without nitrogen. This nutrient is highly mobile within the plant. Actively growing turfgrasses normally have a nitrogen content ranging from 3 to 6% on a dry matter basis. The young, actively growing tissues usually contain a higher nitrogen content.

NITROGEN EFFECTS ON TURFGRASSES

The level of nitrogen nutrition can affect the turf in a number of ways including (a) shoot growth rate, (b) root growth, (c) shoot density, (d) color, (e) disease proneness, (f) heat, cold, and drought hardiness, (g) wear tolerance, (h) recuperative potential and rate, (i) composition of the turfgrass community, and (j) seedhead development.

Shoot Growth

The shoot growth rate is particularly responsive to the nitrogen nutritional level since it is a vital constituent of chlorophyll, proteins, and enzymes required for growth. The shoot growth rate, shoot density, and respiration rate all increase as the nitrogen nutritional level is increased.

Root Growth

Initially, as the nitrogen level is increased from a limiting range there is a stimulation in root growth. However, this does not continue indefinitely. At a certain point the quantity of carbohydrates available for supporting both shoot and root growth becomes limiting. When this occurs the shoots have priority

over the roots for the available carbohydrates. This results in a distinct suppression in root growth while the shoot growth rate continues to respond to higher nitrogen levels. Excessive stimulation of shoot growth by high nitrogen levels can actually cause a dieback of the root system. Rhizome and stolon growth are also affected similarly to the roots.

Color

The color of a turf is directly correlated with the level of nitrogen nutrition since it is a vital constituent of chlorophyll which gives the green coloration. As a result, color is commonly used as a visual indicator of the level of nitrogen nutrition. Development of a yellowish discoloration of chlorosis signals the onset of the nitrogen deficiency in the tissue and indicates that a nitrogen fertilizer application should be made.

Disease Proneness

The severity of disease incidence on disease susceptible turfgrass species is affected by the nitrogen nutritional level. Higher nitrogen fertility levels cause a soft, succulent tissue that is more delicate. These characteristics usually increases the proneness of turfgrass to certain disease causing fungi. Included in this category are: (a) Helminthosporium leaf spot, (b) brown patch, (c) Typhula blight, (d) Fusarium patch, (e) Ophiobolus patch, (f) Fusarium blight, and (g) gray leaf spot. However, not all diseases are enhanced by higher nitrogen fertility levels. For example, facultative saprophytes that cause such diseases as dollar spot, rust, and red thread are generally more severe on nitrogen deficient turfgrasses. This relationship between increased disease proneness and a minimum nitrogen nutritional level is attributed to the rate of vertical shoot growth. Rapidly growing leaves that are experiencing a fungal infection will be removed more frequently by mowing.

Heat, Cold and Drought Hardiness

The hardiness to heat, cold and drought stress is also affected by the level of nitrogen nutrition. A certain minimal level of nitrogen is required for maximum tolerance to these environmental stresses. However, at higher nitrogen nutritional levels the degree of hardiness that the plant can achieve is reduced significantly . This is associated with an increase in the tissue hydration level caused by the higher levels of nitrogen.

Wear Tolerance

The relative wear tolerance is affected similarly. An adequate level of nitrogen nutrition is required for a rapid recuperative rate from wear effects but excessive levels will increase the succulence and delicate nature of the tissues thus reducing the wear tolerance. On the other hand, the recuperative potential is significantly reduced at higher nitrogen levels primarily because of a reduction in the carbohydrate reserves.

Composition of the Turfgrass Community

The relative degree of competition between species or cultivars within a turfgrass community is strongly influenced by the level of nitrogen nutrition. For example, in Kentucky bluegrass-red fescue communities, the Kentucky bluegrass will tend to dominate at higher levels of nitrogen nutrition whereas the red fescue can compete more successfully and usually becomes dominant at minimal

levels of nitrogen nutrition. Similar types of responses can occur in blends where the components have different nitrogen nutritional requirements. The level of nitrogen nutrition also affects the competitive ability of turfgrass species in resisting the encroachment of certain undesirable weed species, particularly the broadleaf weeds.

SELECTING THE LEVEL OF NITROGEN NUTRITION

It is important to maintain a controlled level of nitrogen fertilization that (a) avoids excessive amounts of leaf growth requiring more frequent mowing, (b) does not stimulate shoot growth to the extent that root growth is impaired, and (c) exhaust the carbohydrate reserves to the extent that the recuperative potential is limited. Excessive nitrogen fertilization is usually a greater problem on intensively cultured turfs than a nitrogen deficiency. When this occurs the depth and extent of the root system is restricted which causes a decreased nutrient and water absorption capability. Excessively high nitrogen nutritional levels also stimulate thatch accumulation and puffiness on greens.

The actual nitrogen level utilized will vary depending on the turfgrass species, soil texture, quantity of water applied through irrigation, and growth rate desired. The nitrogen requirement for turfgrass species and cultivars ranges from 0.2 to 2.0 pounds of actual nitrogen per 1000 sq. ft. per growing month.