TURFGRASS NUTRITION AND STRESS

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Each season turfgrass communities are exposed to numerous environmental stresses that affect their quality and useage. The turfgrass manager is faced with developing practical cultural systems that will help the plant withstand these stresses. Mowing height and frequency, irrigation, fertilization, and pesticide applications are combined into cultural systems that can be manipulated to benefit the grass plant and maintain it for its principle use. This article will be confined to the influence of turfgrass nutrition on plant ability to withstand stress.

Turfgrasses are exposed to heat, drought, desiccation, cold, shade, pests, and traffic during the course of a growing season. Alone or in combination, these stresses can seriously impair turfgrass growth and recuperative potential.

HEAT STRESS

Under most field conditions, heat and drought stress are closely associated. Many turfgrass nutritional aspects that affect heat tolerance also influence drought tolerance. A minimum level of nitrogen nutrition is essential to maintain adequate growth to withstand heat stress. However, when excessive nitrogen nutrition is practiced the turfgrass plant becomes more prone to high temperature injury. This is generally associated with an increase in tissue moisture content and succulence. The tissue is more prone to injury. Increased potassium with increased nitrogen improves heat tolerance when compared to high nitrogen levels alone. Similarly, adequate phosphorus levels are needed to maintain sufficient root and rhizome growth. High nitrogen and phosphorus nutritional levels interact to reduce heat hardiness of turfgrass plants.

DROUGHT STRESS

When water is limiting or preventing turfgrass growth, the plant is drought stressed. Slow growing plants tend to have smaller cells and increased cell-solute content with increased drought hardiness. Factors such as high nitrogen nutrition levels increase cell size and tissue moisture content, and reduce drought tolerance. Potassium deficiency reduces drought resistance. Low potassium levels result in increased transpiration and promote wilt. Adequate potassium levels enhance water retention and increase cell turgor pressure. Phosphorous deficiencies are associated with a reduction in extent and depth of turfgrass rooting which in turn affects the plants ability to tolerate drought stress.

DESICCATION

Winter desiccation is a prominent environmental stress factor on turfs growing in the Great Plains. Adequate N-P-K levels are essential to maintain turfs that can recover from this injury. Potassium deficient turfs are prone to desiccation. Turfs receiving excessive nitrogen are also prone to injury. Nitrogen and iron interact to influence the degree of winter desiccation injury. Iron, with proper application timing, can reduce some of the detrimental aspects of nitrogen on winter desiccation.

LOW TEMPERATURE STRESS

Vigorous-actively growing turfgrass plants lack low temperature hardiness. They tend to have high tissue moisture content and reduced carbohydrate levels.

Low potassium levels and high nitrogen levels result in reduced low temperature tolerance. Increased potassium fertilization levels reduce the detrimental influence of increased nitrogen on turfgrass low temperature tolerance. Nitrogen-potassium ratios approaching 2:1 have been suggested as the optimum for minimizing injury. More work is needed in this area to delineate the relationship of nitrogen and potassium in minimizing direct low temperature injury, especially in conjunction with hardened versus non-hardened plants.

SHADE

Many turfgrass areas are exposed to some degree of shade, during the course of a day. Prolonged periods of low light intensity stress the turfgrass plant. Turfs growing in heavy shade are succulent and more disease prone. Excessive nitrogen nutrition increases tissue succulence, reduce carbohydrate synthesis, and produces tissues that are prone to injury from disease and wear. In addition, surface fertilization encourages tree root competition. Deep fertilization should be practiced to encourage deeper tree root growth and minimize tree-grass, root competition. Excessive surface applications of fertilizer in the shade can affect the turfgrass community. Red fescue, the desirable turfgrass species for many shaded areas in Michigan, can be driven-out of the turfgrass community by excessive nitrogen.

PESTS

Turfgrass pests influence the quality and use of a turf. Actively growing plants that are adequately fertilized are essential to maintain the recuperative ability of a turf and increase its potential to withstand pests such as insects, nematodes, and fungi.

Kentucky bluegrass billbug and sod webworm are more active on lush well fertilized turfs than on slow growing or dormant turfs. Injury by these insect pests is greatest on this kind of turf. However, adequate N-P-K levels must be maintained in order to encourage the recuperative potential of the turf. Fertilization practices alone cannot eliminate the insect injury and pesticides must be used when infestations interfere with turfgrass quality and use.

Weed competition increases with inadequate levels of nutrition. Nutrient imbalances can also influence weed competition. High soil phosphorus levels encourage clover and annual bluegrass competition in turfs. Increased sulfur levels reduce annual bluegrass competition.

Nutritional level influences turfgrass disease incidence. Nitrogen level and timing of its application influences disease development. Early-spring applications of water-soluble or readily-available nitrogen increases leaf spot and Fusarium blight problems on susceptible turfs. Low nitrogen nutrition tends to increase the susceptibility to dollar spot, rust, and red thread. While, high levels of nitrogen nutrition promote leaf spot, brown patch, Ophiobolus patch, Pythium blight, Fusarium blight, snow mold, and stripe smut. Phosphorus level influences the susceptibility to stripe smut. High phosphorus levels reduce the incidence of stripe smut and Ophiobolus patch in susceptible turfs. Potassium reduces dollar spot and red thread severity. Sulfur reduces the severity of Fusarium patch and Ophiobolus on susceptible turfs.

TRAFFIC

Intense traffic results in increased turfgrass wear injury and compaction problems. Adequate N-P-K levels are essential to maintain desirable verdure to

cushion the crown against injury and maintain sufficient recuperative potential. When nutrients are lacking, wear tolerance and recuperative potential decline. Wear tolerance increases with nitrogen, until a critical nutritional level is reached. At this point added nitrogen results in succulent tissues with thin cell walls that are prone to wear injury. Turfgrass wear tolerance increases with additional potassium nutrition.

SUMMARY

The influence of turfgrass nutrition on the ability of the plant to withstand stress is complex and constantly interacts with the environment and other cultural practices. Nutritional programs that maintain adequate growth for recuperative potential should be promoted. Nutritional programs that encourage excessive growth should be avoided. This makes good economic sense, and promotes more efficient energy and resource utilization.