Physiological Aspects of Mowing Turfgrasses

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In recent years, due to lack of money, many park and school districts have been forced to curtail mowing frequency and, in many cases, raise mowing heights in attempts to maintain their turf with less input. At the other extreme, golf courses are under increasing pressure to lower mowing heights on tees, fairways, and putting greens to improve the playing surface for golfers. Selection of mowing height and frequency has generally been taken away from turf managers and is now dictated by budget or green committees.

Since mowing is the fundamental stress we apply to turf, it is important to understand what impact our mowing practices will have on vigor, appearance, and persistence of our turf. The following sections highlight some of the important physiological and developmental changes that occur when turf is mowed. Understanding these changes will allow you to predict what effect your mowing practices will have on your turf.

How Grasses Tolerate Mowing

In general terms, turfgrasses tolerate mowing because initiation and development of leaves, tillers, and other secondary shoots are not disrupted by periodic clipping. Two factors in particular account for this: 1) The stem apex remains close to the ground because internode elongation does not normally occur to a great extent in turf adapted species, and 2) the pattern of leaf development via intercalary meristems allows leaves to continue growth in spite of clipping.

To appreciate how turfgrasses respond to mowing, it helps to visualize the turf plant as a very simple machine. The shoots, via photosynthesis, provide carbohydrates to very young lateral shoots and the root system. The roots supply the shoots with water and minerals. Surplus fuel (carbohydrates) is stored primarily in the crown region. If something happens to the shoot system, (eg., it is removed via mowing), the immediate source of carbohydrates for the roots decreases. If enough of the shoot system is removed, roots will dieback. Storage carbohydrates are preferentially used by the injured shoot system to regenerate itself via axillary buds or existing, partially defoliated shoots. Normally, we can generalize that shoots have priority for available carbohydrates over roots.

Alberta (1960) showed very clearly that percent total soluble carbohydrates dropped in leaves, stubble, and roots of perennial ryegrass during the first four days after cutting. In this test, it took nearly 14 days for carbohydrates to return to precutting levels. Davidson and Milthorpe (1965) showed root extension of orchardgrass dropped dramatically following severe defoliation. While both of these tests were done under forage management conditions where infrequest severe cutting is the rule, other work indicates similar phenomena occur when turfgrasses are clipped. Crider (1955) noted that if more than 40% of the leaf surface area of Kentucky bluegrass is removed in a single mowing, the impact on root growth is severe. Removing smaller percentages of foliage resulted in continued root growth, although not as great as in unclipped plants.

Turf Responses to Mowing Height and Frequency

Most turfgrasses seem to perform best when mowed within a relatively narrow range of mowing heights. Optimum mowing height for a given grass will vary depending on where it is grown and under what site conditions. As mowing height is lowered within the optimum range for a grass, several developmental and physiological changes will generally occur. Invariably, leaf area index will decline. This is offset somewhat by an increase in shoot density. There is a decrease in carbohydrate synthesis and storage and as a result a decrease in total root production (Beard, 1973).

Mowing frequency affects turf in much the same way as cutting height. As frequency increases, shoot density increases, carbohydrate reserves decrease, rooting decreases, and there is less dry matter production (Beard, 1973). In general, the effects of frequency are more subtle than the effects of mowing height on these factors.

Optimum mowing height ranges for several common turfgrasses are list in Table 1. These heights are based on bench settings and on observations on turf performance in the Pacific Northwest. Because of our generally mild climate, we can get away with lower mowing than many other areas in the United States.

Several problems may develop when grasses are mowed above their optimum height range. Colonial bentgrass will develop false crowns at mowing heights above 1 inch. This is due primarily to internode elongation which yields a tree like plant with a tuft of foliage at the top. When this condition develops, the turf tends to scalp badly and generally looks brown after mowing. This trait is one of the reasons many turf managers don't care for bentgrass. To avoid false crowns all you have to do is lower the mowing height. Another problem occurs when Kentucky bluegrass is mowed too high. Stripe rust, **Puccinia striiformis**, which is severe on bluegrass during cool weather, is worse when the turf is mowed at 2 inches or higher. At higher mowing heights there is simply more mature leaf tissue in the canopy. These older leaves are definitely more susceptible to rust than young leaves. Perennial ryegrass generally shreds worse when mowed above 2 inches than at lower mowing heights. This is probably due to greater size and degree of vascularization in developing leaf blades under high mowing conditions. Finally, all grasses prone to thatch accumulation, such as Kentucky bluegrass and the fine fescues, tend to produce more thatch at higher mowing heights than at lower heights.

Mowing below the desirable lower limits for a turfgrass generally will result in reduced density and increased rate of invasion by better adapted grasses. Kentucky bluegrass, fine fescues, and even perennial ryegrass will generally be rapidly invaded by bentgrass, annual bluegrass, and/or **Poa trivialis** when mowed too low.

Summary

Several generalizations can be made regarding mowing practices. Mowing under any circumstances is a stress. Low, frequent mowing generally yields attractive turf that is under a high level of stress. Higher, less frequent mowing (within the optimum range) will yield healthier turf able to tolerate greater stress in terms of temperature, drought, etc. Mowing above the optimum height range will often result in poor turf quality. Mowing below the optimum range will generally lead to increased invasion by weedy species. Optimum frequency for mowing still appears to be that which will remove no more than 40% of the total leaf surface area of the turf. Infrequent, severe defoliation results in a depletion of carbohydrate reserves and temporary stoppage or even dieback of roots.

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Table 1 — Optimum mowing height ranges for turfgrasses in the Pacific Northwest.

Creeping bentgrass	3/16" - ½"
Colonial bentgrass	¼" - 1"
Annual bluegrass	1/8" - 1½"
Perennial ryegrass	¾" - 2"
Kentucky bluegrass	1" - 2"
Chewings fescue	¾" - 2"
Hard fescue	1" - 2"
Spreading fescue (Red)	1½" - 2 plus"
Tall fescue	1" - 2 plus"

[1] Presented at the 38th Northwest Turfgrass Conference, Sheraton Hotel, Spokane, WA, September 18-20, 1984.
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McLoughlin Accepts Additional Assignment

Gerard F. Hurley, NCA Executive Director, recently announced that Met GCSA Executive Director Jim McLoughlin had accepted the appointment to serve as Director of Research for the National Club Association.

The NCA has committed to establishing a national education program for golf club Directors and to developing the computer and software capabilities needed to support this and other related projects. Hurley advises, "Jim McLoughlin's experience with the MGA in New York and the GCSAA prepared him well for this important task."

McLoughlin will continue his work with the Met GCSA and feels the two assignments will complement each other in a natural way.

Speakers at CDGA Green Seminar