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How Mowing Affects Turf

Cutting height, frequency and mower adjustment are interrelated for the care of fine turf.

By Thomas L. Watschke
Associate Professor
Turfgrass Science
Penn State University

The effects of mowing (height, frequency and equipment adjustment) on turfgrasses are usually detrimental. The results are reduced roots, rhizomes, carbohydrate storage and increased succulence. Aesthetic quality however, improves because of increased shoot density if height is lowered within the tolerance range of the species. Mowing is necessary to maintain a groomed appearance. Use of the turf dictates mowing management. Successful turf managers adequately compromise the physiological status of the plant with the demands of the clientele utilizing the facility.

Cutting height. Cutting height can be defined as the distance above the soil surface at which the turf is clipped. Turfgrasses vary in their tolerance to cutting height. Growth habit and location of leaf primordia dictate the height at which a species will best respond. Bentgrasses, for example, have leaf primordia located near the soil surface, while the primordia of tall fescue are about one inch above the soil.

Cultivars of the same grass also exhibit different tolerance to height of cut. The improved cultivars of Kentucky bluegrass (Pennstar, Merion, Fylking, Baron and many others) tolerate closer mowing than Delta, Kenblue and Newport. Although the location of leaf primordia is a partial explanation, leaf angle is probably more important in explaining these cultivar differences. Improved cultivars have leaves that, once they are fully expanded, are almost parallel to the soil surface. During mowing, these leaves are clipped only a slight amount each time and consequently they are able to maintain photosynthesis on a unit area basis and continue to produce carbohydrates. This minimizes the utilization of reserve carbohydrate for new leaf growth and allows root and rhizome growth to continue. By contrast, when cultivars that have upright leaves are mowed closely, little leaf area remains and utilization of reserve carbohydrate is required to produce new leaves. While these new leaves are being produced the photosynthesis per unit area is reduced as is root growth. Turf resistance to environmental stresses (particularly drought and heat) is closely related to carbohydrate status and root growth.

The top to root ratio of all turfgrasses is altered as the height of cut is lowered. The closer the cutting height is to the soil surface, the shorter the root system becomes. A foliar priority for reserve carbohydrate is the most commonly cited reason for the decline in roots. Clipping may also affect the concentration and translocation of root growth regulators that are synthesized in leaves.

Rhizome and stolon growth do not have as direct a relationship with defoliation as root growth. A lowering of cutting height within the tolerance range for a given species can actually increase growth of vegetative propagules. For example, it is a common practice to mow closely during the early establishment of creeping bentgrass to increase stolon growth. Kentucky bluegrass and creeping red fescue have rhizomes that provide a source of new plants when the turf becomes injured. Continued close mowing can reduce rhizome production and reduce overall sod strength. This can lead to poor footing which can cause serious problems, particularly on athletic fields.

Succulence of turfgrasses can be increased when the cutting height is lowered. A succulent condition, combined with reduced rooting places the plant in a weakened condition. Resistance to stress and disease attack thus becomes lowered at a time of the year when turfgrass pathogens are most active. Consequently, the severity of turf diseases is increased for a given plant species when it is maintained at the lower end of its clipping tolerance range. Increased succulence of tissue also increases the demand on the root system for adequate moisture to maintain turgidity. Therefore, wilting occurs more readily when turf is clipped closely. The simultaneous conditions of reduced rooting and increased succulence requires intensive irrigation management to maintain turfgrass quality.

Some turfgrasses, particularly low growing types like the bentgrasses and Bermudagrasses can be adversely affected when the cutting height is too high. Puffiness and thatch accumulation often occur which diminishes turf quality, returning these low growing turfs to their propeer height must take place over a farily long period of time to avoid scalping.

Not all effects of mowing are deleterious. Closer mowing within the tolerance range of a species can stimulate tillering and consequently increase shoot density. Increased density improves appearance, provides a more playable turf, and is a positive response to mowing. This response is positive only as long as the height is still within the tolerance range for the species. This phenomenon often becomes an important management tool to manipulate plant competition. Tall fescue competition can be reduced in a Kentucky bluegrass stand if the mowing height is lowered to near the limit of the bluegrass tolerance. This may be particularly valid when accomplished just prior to winter.

Another example of the effects of mowing on plant competition would be a mixed stand of Kentucky bluegrass and annual bluegrass. When mowed closely, *Poa annua* will increase in shoot density, while Kentucky bluegrasses will decrease. Although the Kentucky bluegrass will continue to produce

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rhizomes, the *Poa annua* will maintain a competitive advantage above the ground.

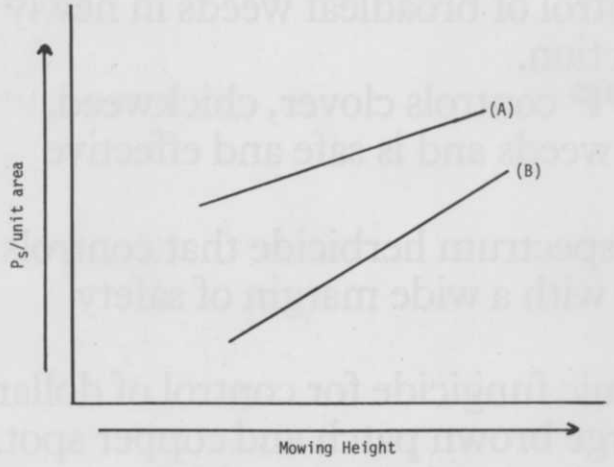
Leaf texture is also affected by mowing. Unclipped turf of any species has wider leaf blades than when it has been mowed. In general, the closer the mowing the finer the texture. Finer texture is desirable in most cases. The fine textured leaves of close clipped bentgrasses have better putting quality than would the leaves of unclipped bentgrass. Annual bluegrass leaves become quite fine textured when mowed at putting green height. High cut turf has wide leaves which provides good light interception. However, since closer mowing can increase the number of shoots per unit area, any disadvantage associated with reduced width would be offset.

Frequency. Frequency and cutting height are interrelated. Generally, as the mowing height is lowered, frequency must be increased to maintain quality. Mowing frequency is primarily dictated by shoot growth rate.

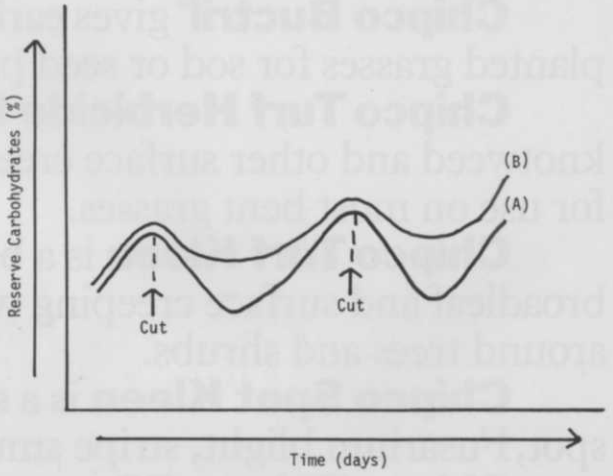
To avoid scalping, the frequency must increase when growth rate increases. As a general rule, no more than one-third of the foliage should be removed. When frequency does not change commensurate with an increased shoot growth rate, each mowing will remove an excessive amount of leaf tissue. The plant is then given an unnecessary physiological shock. Defoliation of three-fourths of the leaves can result in almost complete root growth stoppage for as long as two weeks. Reserve carbohydrates are translocated and utilized for new shoot growth. With severe scalping, root growth not only stops, sometimes there can be considerable root death. When this occurs, the turf stand will not tolerate stresses and is more disease susceptible.

Turfgrasses vary considerably in their shoot growth rate. Tall fescue and ryegrasses can have a rate nearly three times more rapid than bentgrass. Frequency, however, is usually increased on the bentgrass because of the closeness of cut, particularly on golf greens. Nitrogen fertility greatly increases the shoot growth of all turfgrasses. At times changes in the nitrogen fertility program can manipulate plant growth rate and affect mowing frequency.

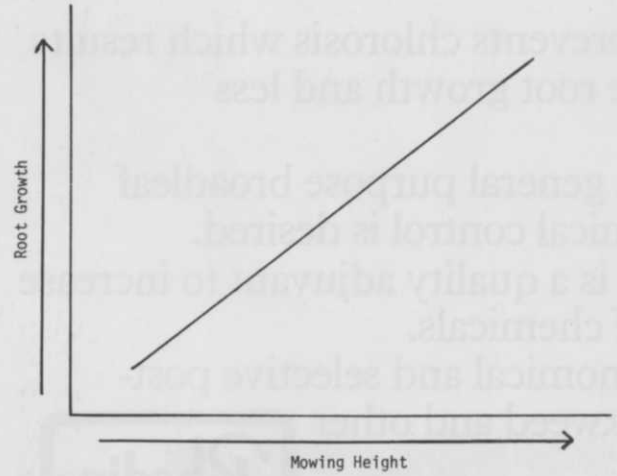
Generally, the effects that mowing frequency have on turf are the same as those previously cited for mowing height. When mowing fre-



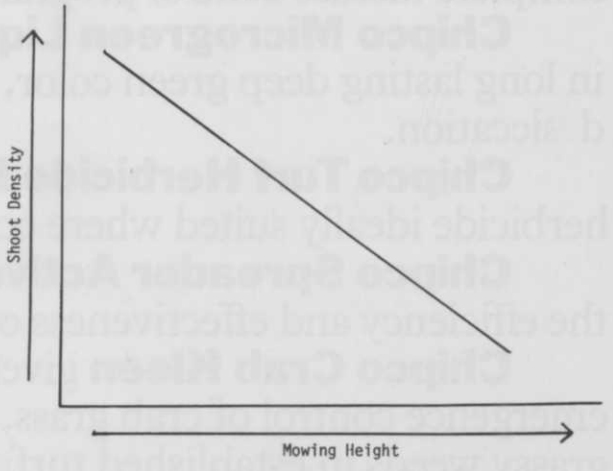
The effects of mowing on the photosynthesis (Ps) per unit area of upright type Kentucky bluegrasses (A) compared to those more decumbent (B).



The effect of close mowing on reserve carbohydrate depletion in upright (A) and decumbent-type Kentucky bluegrasses (B).



The effect of mowing height on root growth.

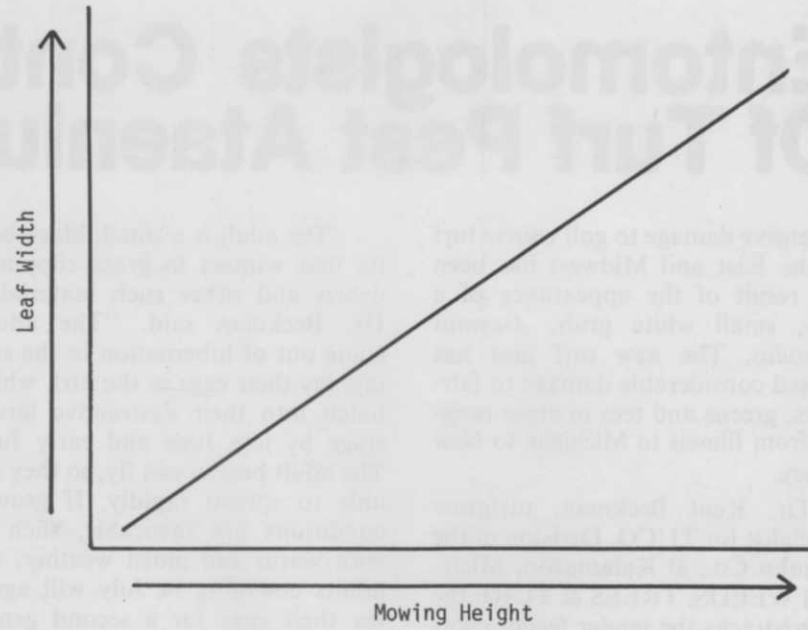


The effect of mowing height (in the tolerance range for a species) on shoot density.

quency is increased, the shoot growth rate will usually decrease. The advantage of this reduced shoot growth rate with more frequent defoliation is that the amount of leaf removed each mowing is small, and the clippings will fall down through the leaf canopy. This can eliminate the necessity of catching clippings. These small pieces of leaf clippings are approximately 70 percent water and easily decomposed compounds. Consequently, decomposition occurs rapidly and only contributes a small amount to thatch.

Mower adjustment. Adjustment for rotary mowers only refers to blade sharpness. Dull rotary mower blades tend to shred grass leaves rather than cut them. The fiber content of the vascular system (veins) is high and resists cutting, and consequently will shred. A severe reduction in aesthetic quality will result because the exposed shredded veins dehydrate and turn brown. These bruised, shredded leaves are not only unattractive, but provide points of entry for pathogens.

Reel-type mowers that are not sharp can result in a "banding" of leaf blades which districts from the appearance. Reel mowers that are sharp, but out of adjustment, do not cut cleanly, leaving a ragged edge. Misadjustment can also result in "rippling" of the overall canopy which is unattractive wven though the cut may be satisfactory. Turf that has a high leaf fiber content (ryegrasses and tall fescue) must be cut with sharp, properly adjusted equipment to insure optimum appearance. □



Entomologists Continue Study Of Turf Pest Ataenius Spretulus

Extensive damage to golf course turf in the East and Midwest has been the result of the appearance of a new, small white grub, *Ataenius spretulus*. The new turf pest has caused considerable damage to fairways, greens and tees in areas ranging from Illinois to Michigan to New Jersey.

Dr. Kent Beckman, turfgrass specialist for TUCO, Division of the Upjohn Co., at Kalamazoo, Mich., told WEEDS, TREES & TURF the grub attacks the tender feeder roots of grass and usually works about a half-inch below the soil surface. "Damage first appears as localized dry spots," he said. "And many turf managers have made the mistake of irrigating the dry-appearing areas without investigating below the soil surface."

Dr. Beckman received his B.S. in forestry at the University of Washington, and his Ph.D. at Oregon State University majoring in biology, plant pathology and biochemistry. He has been involved in turf research for 12 years.

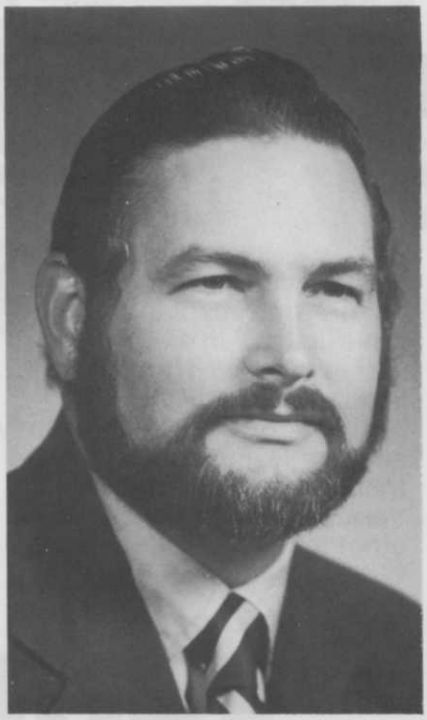
The grub pest particularly likes *Poa* and bentgrass turf, although it has been found in bluegrass and other grass species, he said.

He said the grub has probably existed in some areas before, but was usually identified as something else. He says particularly during the last three or four years that which was described as dry spots may have in reality been the results of the *Ataenius* grub. The grub's sudden wide-spread appearance was attributed largely to ideal weather conditions and a general lack of insecticide programs on fairways and cutbacks in other areas due to economic strains. Entomologists are currently studying the new pest in an effort to learn more about it. Turf conference programs recently have had many programs on the grub, and research on the grub is currently in the process of being funded.

"The adult is a small, black beetle that winters in grass clippings, debris and other such materials," Dr. Beckman said. "The adults come out of hibernation in the spring, lay their eggs in the turf, which hatch into their destructive larvae stage by late June and early July. The adult beetles can fly, so they are able to spread rapidly. If growth conditions are favorable, such as with warm and moist weather, the adults emerging in July will again lay their eggs for a second generation to follow in August."

He said the tiny, white grub is about the same thickness and length of a sharpened pencil lead. He adds that it also has a brownish head and a dark posterior like that of more common white grubs.

"Damage may first appear to be turfgrass wilting about the size of a golf ball which can spread to cover several square yards," he said. "And although it only takes about 30 grubs per square foot to begin damaging turf, as many as 50 per square inch have been found." Early control is important and special care must be made to insure a complete kill as resistance to various insecticides has been observed.



Dr. Beckman

"Damage from the grub appears in July or August, so one should begin looking for the pest in three-day intervals during the middle to latter part of June," he said. "If a dry-appearing area is spotted, positive identification can be made by pulling up small patches of turf. Turf that has been invaded by the tiny grub will peel back like carpet, he said, and the grubs can be seen working from the soil surface through the first half-inch of the soil."

Because the grub has demonstrated a resistance to some insecticides, control in some areas has been erratic.

"High populations of the grub have been found in areas that had been previously treated with dieldrin, heptachlor and chlordane," he said. "Resistance to these cyclodiene insecticides has been found on courses in Ohio, Connecticut, New York and New Jersey."

"One of the best materials available for controlling the pest is Proxol 80 SP," Dr. Beckman said. "It is essential to get the chemical through layers of thatch to where the grubs are working in order to obtain control of white grubs and the mini-grubs are no exception. Water will carry the material down to the grubs which explains why water-soluble products have proven so effective."

He said the chemical should be applied at 3¾ ounce per 1,000 square feet, or equivalent per acre, either early in the morning or late afternoon, followed by thorough irrigation of the turf which carries the material down to the grub feeding zone. He advises inspection 12 to 24 hours following chemical applications to insure that desired levels of control were obtained. □

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