UNDERSTANDING TURF MANAGEMENT
The fifteenth in a series
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MOWING

The mowing of turf is a complex issue involving the interaction of height, frequency, mowing equipment, species, stress and turf use.

Mowing height and frequency requires a balance between beneficial and adverse effects. Mowing increases turf quality through better tillering, thus providing more shoots per unit of ground area. On the other hand, mowing decreases root growth due to the removal of leaf blades which in turn reduces photosynthesis. Mowing decreases tolerance to stress including wear from play, drought, high and low temperatures, disease and weed competition.

A knowledge of the location of the growing point or meristematic region is essential in the understanding of the physiology associated with mowing of turf grasses. The meristematic region is that section of the plant where active cell division occurs. In dicots (a plant group to which many weeds belong) the growing point associated with stem elongation is located at the tip of the plant so that the youngest leaves are at the top of the stem. In the monocots (the group to which turf grasses belong) the growing point seldom moves above the soil surface, except where seed head formation occurs. New leaves are continually produced by lateral bud development around the growing point and each individual leaf elongates by cell division in a region at the base of the leaf, know as an intercalary meristem. As these cells enlarge and mature the leaf elongate. Thus the mower is cutting of the oldest part of the leaf while new leaf tissue is being formed at the base (Figure 1).

The intercalary meristem of an individual leaf remains active in cell division for only a short time (weeks) so that by the time the leaf becomes visible most active cell division has ceased. Cell enlargement or growth of each cell continues, however, forcing the sheath and the leaf higher, requiring the cutting of the turf. Mowing so close to the soil surface as to damage the intercalary meristematic region results in what is called scalping and death of the plant.

The repetitive removal of the top of a grass plant disrupts the normal procedure for the seasonal development of the plant. Normally, at the commencement of spring growth, one or more of the principle tillers existing at the base of the plant begins a process of internode elongation, elevating the growing point above the soil surface. Elongation of the stem is designed to elevate the seed head above the leaf canopy to promote flowering, pollination and seed dispersal. Under most turf conditions, with the exception of annual bluegrass and some cultivars of bluegrass and ryegrass, stem elongation never occurs and the plant remains in an unnatural vegetative condition throughout the season; in other words during a major part of the year it is under a stress of forced vegetative reproduction. Turf grasses, however, have developed varying degrees of tolerance to repeated removal of top growth as pasture grasses have developed varying degrees of tolerance to repeated close grazing.

Vegetative reproduction is a desirable means by which the density of the stand is increased by tiller development from lateral buds at the base of each tiller. Both mowing height and frequency have an impact on the degree of tillering that is obtained. Mowing, in removal of the older part of the leaf, removes the section responsible for hormone production which suppresses tiller development. Furthermore, the amount of tillering induced by mowing will be greater during those periods of the year when the plant would not normally be attempting seed production - fall and very early spring.

Increasing the mowing height will obviously increases the amount of the plant remaining above the soil surface (Table 1). Increasing the amount of material re-

Fig. 1: A schematic representation of the meristematic regions in a turfgrass tiller from which new growth originates.

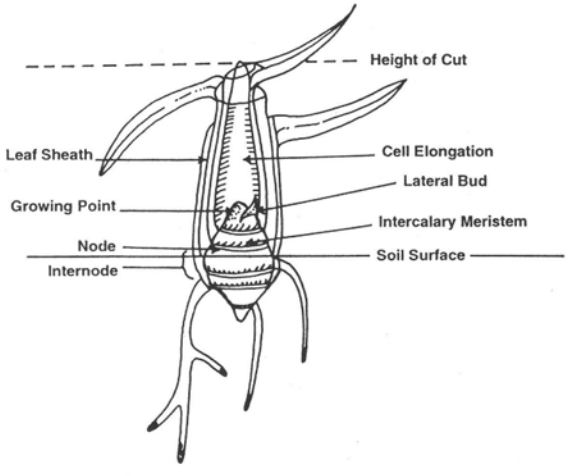

Table 1: The weight of green material (verdure) remaining following mowing Kentucky bluegrass at several heights.

Height of Cut	Gram Fresh Weight/ 10 m^2
(in)	(g)
0.3	1.5
0.5	2.5
0.75	12.5
1.5	20.5
2.5	27.5

(From: Madison, J.H. 'Practical Turfgrass Management' Van Nostrand Reinhold Co., Toronto)

Table 2: The influence of mowing height and moisture content on the impact resistance (hardness) of bluegrass on a sandy loam soil.*

Mowing Height	Moisture Content Wet	Dry
(cm)	(meters/sec^2)	
3	497	773
9	518	740
15	529	720

*From Zebarth, B. (1984) M.Sc. Thesis, Univ. of Guelph.

Table 3: The relationship of mowing height to soil temperature in a Kentucky bluegrass turf.

Height of Cut	Soil Temp. @ 1 .0 Inch
(inches)	(°F)
0.75	93
1.0	90
1.5	83

(Note: Air temp. 5 ft. above turf = 98 °F; Turf surface temp. = 109 °F)

Table 4: The relationship of mowing height to water use by turf-type tall fescue.

Height of Cut	Evapotranspiration
(inches)	(inches/day)
0.75	0.25
1.5	0.33
3.0	0.50

(Note: Measurements made under Nebraska conditions in June)

maining after mowing would be expected to enhance the resiliency or cushion for the athlete on a sports field. Impact resistance studies, however, have demonstrated that the amount of vegetation has only minor effects on surface hardness relative to that of increasing the moisture content of the soil (Table 2). On the other hand, increasing the verdure may limit ball bounce and distance of ball roll in many sports.

The well being of the turf, within limits, requires the higher cutting heights for increased photosynthetic activity, greater root and rhizome growth, greater weed control and less susceptibility to disease. Eliot Roberts of The Lawn Institute calculates each 1/8 inch increase in cutting height of bluegrass adds 375 ft^2 of leaf surface area per 1,000 ft^2 of turf surface.

Raising the mowing height also reduces the soil temperature, reducing heat stress (Table 3), but at the same time increases the water use of the grass (Table 4).

Even a well-managed turf may be seriously damaged when mowed following a delay in cutting due to a protracted wet spell. Raising the height of cut, followed by a step-wise lowering to the original height can reduce the damage caused by the removal of an excessive amount of leaf material and smothering due to bunching of clippings.

Frequency of mowing is determined by how much leaf material is desirable to remove at any one time. A general rule of thumb is that not more than 1/4 to 1/3 of the leaf blade should be removed at any mowing. The less material removed, the lower the 'shock' effect on the plant. The 'shock' is the mowing effect on decreasing the rate of root elongation and tiller bud development. Since root elongation has an important role in water uptake by the turf the 'shock' effect of excessive removal of tissue will intensify water stress during periods of drought.

Mowing height and frequency depends on the species and use of the turf. Bentgrass on a bowling green requires daily mowing at 1/4 inch. In contrast bluegrass on a soccer field may require mowing at 2.5 inches every 3 days in early May whereas in August weekly mowing will suffice.

The mowers used in cutting turf are of three principal types - reel, rotary and flail.

Reel mowers are used for precise cutting and particulary at low cutting heights such as on bowling greens where the roll of the ball is vital. A disadvantage of a reel mower is the tendency to leave unsightly seed stems which are pushed down ahead of the reel. A reel mower cannot effectively mow grass shoots or weeds that are higher than the height of cut plus the radius of the reel. Thus a 6-inch diameter reel set to cut at 2 inches will not mow 5-inch high grass, except under very dry conditions and will not clean-cut grass over three inches tall.

Rotary mowers are used for general cutting and when properly set will provide a uniform surface. At heights over five inches sufficient 'suck' to lift the grass blades upright for an even cut can be a problem. Uncut, laid over grass in the tractor wheel marks can be unsightly and damaged the turf through smothering. They are less expensive to maintain than reel mowers. Both reel and rotary mowers may show a wavy appearance following mowing if excessive speed is used.

Flail mowers are best used for rough cutting or vegetation control. Cutting heights of over six inches may be used and debris in the grass is not as damaging to the machine.

Sharpness is the prime consideration in the maintenance of all the types of mowers. Dull mowers leave a bruised and frayed leaf tip which turns an unsightly grey to brown within a couple of days. Ryegrass, in particular, requires a sharp mower because of the tough vascular bundles in the leaf. The cut end, with its organic exudates (bleeding), is an excellent portal of entry for pathogens, thus clean, surgical cut is most desirable.

Mowing is a daily decision of the turf manager. A fixed mowing schedule may be administratively desirable, but the health of the turf is decided by daily, on-site assessment of the need for mowing of each field and the height of cut to be used.