Environmental Institute for Golf

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Management strategies for thatch and mat in ultradwarf bermudagrasses

Although ultradwarf bermudagrasses have many qualities that produce excellent putting greens, they also produce large quantities of thatch and mat that require intensive management.

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The ultradwarf bermudagrasses being used on new or reconstructed golf greens — TifEagle, Champion, Mini-Verde, FloraDwarf and Classic Dwarf — have shown superior visual quality, exceptional tolerance to low mowing heights and remarkable putting characteristics. Researchers have found that these newer bermudagrass varieties provide uniform, upright turf with narrower leaves and greater root biomass. Unfortunately, because of their more intensive lateral growth, most of these varieties tend to produce and accumulate more thatch and mat compared to older varieties like Tifdwarf and Tifgreen. Superintendents have discovered that a more intense maintenance program must be incorporated into their annual schedule of cultural practices to maximize the improved qualities of these newer bermudagrasses (4).

Photos courtesy of Matt Gregg

Figure 1. One of the drawbacks of the ultradwarf bermudagrasses is that they develop large accumulations of organic matter.

Thatch

Thatch is a tightly intermingled layer of living and dead stems, leaves and roots of grass that develops between shoots and the soil surface (1) and is formed primarily from periodically sloughed roots, stolons, rhizomes and mature leaf sheaths and blades (2,5). Thatch is only one constituent of the organic matter layer below the turf canopy. The second layer, *mat*, consists of highly decomposed organic matter intermixed with mineral soil from the profile makeup or from topdressing (Figure 1).

Together thatch and mat comprise the accumulation of organic matter on a green. The accumulation of partially decayed organic matter below the turf canopy increases the chances of scalping by greens mowers, increases disease and insect infestations, and possibly enhances localized dry spot severity and fairy ring occurrence.

Thatch and mat often occur as a result of the imbalance between the accumulation and the decomposition of surface organic debris (1), that is, the turfgrass production rate of viable roots, stolons, rhizomes, sheaths and leaves exceeds the decomposition rate. When environmental and agronomic conditions favor excessive accumulation of thatch and mat, the turf may suffer from reduced water infiltration, low water retention, reduced tolerance to cold temperatures and reduced pesticide effectiveness.

A limited layer of mat, about 0.5 inch (≤ 12.7 millimeters), is desirable for proper ball bounce, limiting soil temperature extremes and contributing to the green's durability against foot traffic (1).

The objective of this study was to determine whether topdressing and vertical mowing reduced thatch and mat accumulation on a TifEagle bermudagrass green.

Materials and methods

This study was conducted from 2001 to 2003 on Clemson University's TifEagle bermudagrass golf green, which was constructed with 85:15 sand:peat root-zone mix according to USGA recommendations. This research green was constructed in 1999 and sprigged with registered TifEagle sprigs. The green was mowed daily at 0.16 inch (4 millimeters) and irrigated as needed to maintain favorable growing and playing conditions. The green was aerified twice in 2001 (May 15 and June 16) with 0.6-inch (1.58-centimeter) hollow-core cultivator tines. After the cores were allowed to air-dry on the turf surface, they were removed using a backpack blower. The research area was not aerified in 2002, and no additional mechanical practices (including grooming, brushing and topdressing) other than those required by the investigation were performed from 2001 to 2003.

Fertility applications totaled 8.0 pounds nitrogen/1,000 square feet (390 kilograms/hectare); 0.8 pound phosphorus/1,000

square feet (42 kilograms/hectare) and 3.4 pounds potassium/1,000 square feet (163 kilograms/hectare) for each year. Throughout the two-year study, a 4:1:2 fertilizer was applied every three weeks during the growing months, with 0.75 pound (0.34 kilogram) nitrogen per application. Phosphorus and potassium were applied as needed to maintain high soil test levels. Lime was applied as necessary to maintain a soil pH of approximately 6.5.

Topdressing

Topdressing treatments were: no topdressing, topdressing weekly at a depth of 0.01 inch (0.03 centimeters), topdressing every two weeks at a depth of 0.02 inch (0.06 centimeters) and topdressing monthly at a depth of 0.05 inch (0.12 centimeter) from May to September (Figure 2). Monthly total topdressing depth was identical for each treatment, with differences in frequency and rate. Topdressing was applied using a drop spreader. Topdressing treatments were applied May through September of 2001 and 2002. The particle size and physical properties of the topdressing sand were identical in 2001 and 2002.

Vertical mowing

Verticutting (or vertical mowing) was performed with a vertical mower, with tempered-steel tungsten-tip blades 7.5 inches (190 millimeters) in diameter. Each of the 15 blades was 0.08 inch (2 millimeters) in width; blades were spaced 1 inch (25 millimeters) apart. Vertical mowing treatments took place in May and September of each year. Depths of vertical mowing were: 0.25 inch (0.6 centimeter), 0.75 inch (1.9 centimeters) or 1.25 inches (3.2 centimeters).

Data collected

Treatment effects were assessed by measuring thatch depth, weight loss on ignition and overseeding establishment. Thatch depth and weight loss on ignition were measured three times yearly in May, June and September of 2001 and 2002. Ratings for overseeding establishment, which was a combination of turf coverage and uniformity, were taken twice monthly from November to January of each year.

Weight loss on ignition and thatch depth were measured by sampling two cores per plot; each core measured 0.75 inch (1.9 centimeters) in diameter and 2 inches (5.08 centimeters) in depth. To measure weight loss on ignition, cores were dried and placed in a furnace to burn off all organic matter. The remaining soil was reweighed to determine the amount of organic matter lost by burning. Thatch and mat depth (in millimeters) was measured at two points on opposite sides of each uncompressed core. Thatch depth measurements were observed from the closest point below the green foliar tissue to the interface of the soil surface and mat horizon.

Poa trivialis L. overseeding establishment was investigated following three different vertical mowing depths and multiple topdressing rates. Plots were seeded on Sept. 15 ± 3 days with the *Poa trivialis* L. cultivar Sabre at 435.4 pounds/acre (488 kilograms/hectare) each year. Visual ratings were made twice monthly to determine overseeding establishment by rating plot coverage and uniformity of plot area. Overseeding establishment was rated on a 1-10 scale, where 10 = 100% overseeding coverage per given plot. A rating of 7 or below was considered unacceptable.

Figure 2. Research has shown that a regimen of topdressing applications can help decrease thatch and mat.

Results and discussion

This investigation was a two-factor experiment, with topdressing and vertical mowing representing the two separate factors. This design allowed topdressing to serve as the main plot treatment in strips over the subplot treatments, vertical mowing. Each plot measured 3.2 feet by 3.2 feet (1 meter by 1 meter) and had three replications.

Topdressing and vertical mowing

In this experiment, we tested the effect of the combination of topdressing and vertical mowing on thatch and mat. Because the combination of topdressing and vertical mowing did not have an enhanced effect, the results of the experiment are reported as individual treatments.

Topdressing

During the two-year experimental period, topdressing did not increase or reduce thatch or mat as measured by thatch depth. Adding topdressing did not significantly reduce organic matter content as measured by weight loss on ignition. Statistically, topdressing did not affect *Poa trivialis* L. establishment.

Vertical mowing

Impact on organic matter content. Organic matter content was measured from samples from all the vertical mowing treatments. Vertical mowing at 0.75 inch (1.91 centimeters) significantly decreased organic matter content approximately 16% from May 2001 to September 2002. This response occurred only within this treatment; changes are not in comparison to the control or other vertical mowing treatments.

In the other vertical mowing treatments (0.25 and 1.25 inches [0.64 and 3.18 centimeters]) and the untreated control, organic

matter content increased 1% to 20% (Table 1). Responses occurred only within treatments; changes are not in comparison to the control or other vertical mowing treatments.

Analysis of data from each sampling period showed no significant difference in organic matter content among vertical mowing treatments. Vertical mowing is not a one-time, quick cure for proper removal of organic matter. However, when this cultural practice is incorporated into a regular regimen, the benefits can be seen over time.

Thatch and mat depth. Vertical mowing at a depth of 1.25 inches (3.18 centimeters) reduced thatch and mat depth to 0.9 inch (23 millimeters), which was approximately 6% less than the depth of thatch and mat in the control, which was 0.96 inches (24.4 millimeters). Thatch and mat depth was 0.96 inches (24.3 millimeters) for the 0.25-inch (0.64-centimeter treatment) and 0.95 inches (24.2 millimeters) for the 0.75-inch (1.91-centimeter) treatment. Neither of these depths was significantly different from the control, and these vertical mowing treatments did not affect thatch and mat depth.

Quality of turf coverage and uniformity establishment of overseeded turf

Obtaining satisfactory winter overseeded turf depends on overseeding date, seed bed preparation, species used and fertilization (6).

Figure 3. In this study, vertical mowing adversely affected the quality of the establishment of overseeded turf.

With the blade widths and blade spacings used in this study, vertical mowing reduced *Poa trivialis* L. establishment (Figure 3). Compared to the control, ratings taken 90 days after vertical mowing showed that the treatment reduced coverage and uniformity of overseeding establishment by 34% at the 0.25-inch (0.64-centimeter) treatment; 30% at the 0.75-inch (1.91-centimeter) treatment; and 36% at the 1.25-inch (3.18-centimeter) treatment. These results are reflected in the ratings for turf coverage and uniformity shown in Figure 4. At 60, 75 and 90 days after treatment, all vertical mowing treatments decreased turf coverage and uniformity to the same extent (Figure 4).

Unacceptable *Poa trivialis* L. establish-

OM VS. VERTICUTTING

Treatments[‡]	% organic matter by weight[†] Beginning (May 2001)	Middle (Sept. 2001)	End (Sept. 2002)	% OM change[§]	% OM gained/lost
No vertical mowing	2.90a	3.70a	3.48a	+0.58b(a)	+20
Vertical mowing[‡]					
0.64 centimeter	3.23a	3.57a	3.39a	+0.16b(a)	+5
1.91 centimeters	3.85a	3.76a	3.25a	-0.60a(b)	-16
3.18 centimeters	3.18a	3.48a	3.19a	+0.01ab(a)	+1

[†]Rating period includes initial (before treatment application, May 2001), September 2001 (middle), September of 2002 (end); each rating period is statistically analyzed independently; means followed by the same letter are not significantly different from each other.
[‡]Rows signify vertical mowing depth at each of the two application timings (May and September) of each year with 0.08-inch (2-millimeter) blades on 1-inch (25-millimeter) spacings. Vertical mowing responses were averaged over all topdressing treatments.
[§]% OM change is the percentage of organic matter by weight gained or lost from the initial measurement (May 2001) to the end of the experiment (September 2002). Statistical letters in parentheses represent significant change of each independent treatment from the beginning to the end of the experiment.

Table 1. Percent organic matter content by weight at different sampling periods following various vertical mowing treatments on Tifeagle bermudagrass at Clemson University, 2001-2003.

ment in our study was attributed to the severity of vertical mowing practices. Vertical mowing with blade spacings of 1 inch (25 millimeters) produced rows in which the seed fell, thereby restricting overall turf establishment to these rows and reducing uniform seed distribution. The final outcome was that the rows contained the majority of applied seed (Figure 4).

Conclusions

Variable rates of topdressing on TifEagle bermudagrass did not reduce the percentage of organic matter content by weight. However, previous research has found that topdressing over a longer period may reduce organic matter accumulation and provide other benefits such as a smoother, faster putting surface (4).

Vertical mowing at a depth of 0.75 inch (1.91 centimeters) significantly reduced organic matter content approximately 16% by weight from May 2001 to September 2002. The response occurred only within this treatment; changes are not in comparison to the control or other vertical mowing treatments. However, when a comparison was made among all mowing treatments, minimal reductions in thatch and mat depth were observed.

Turf coverage and uniformity of all overseeding stands was unacceptable after all vertical mowing treatments because *Poa trivialis* L. seed settled in the vertical mowing grooves, producing seeded rows. However, researchers have found that, when blades are closer together (4), vertical mowing is beneficial in increasing soil oxygen levels and opening the turf canopy. In addition, three to five days after vertical mowing, the severed stolons begin to regenerate, increasing new lateral growth (3).

Several years of aggressive mechanical regimens may be necessary to remove a persistent layer of organic matter.

THE RESEARCH says . . .

- **The ultradwarf bermudagrasses** such as TifEagle tend to accumulate more thatch and mat and therefore require more-intensive cultural practices to maintain high quality and health.
- **During the two-year** experimental period, topdressing did not increase or reduce thatch or mat in the TifEagle bermudagrass green and did not affect *Poa trivialis* L. establishment.
- **In these experiments,** vertical mowing reduced thatch and mat by a small amount in only one treatment, but had a negative effect on the establishment of the overseeded grass, *Poa trivialis*.
- **The severity of** the vertical mowing, particularly the blade widths and the spacing of the blades, is believed to be the reason for its negative effect on establishment of the overseeded grass. Vertical mowing produced deep furrows in which the seed settled, producing rows of seed rather than uniform coverage.
- **These results do** not agree with those of previous researchers who were studying other grasses. Using topdressing for a longer period of time may reduce organic matter accumulation and provide a smoother, faster putting surface.

NITROGEN VS. ZOYSIA ESTABLISHMENT

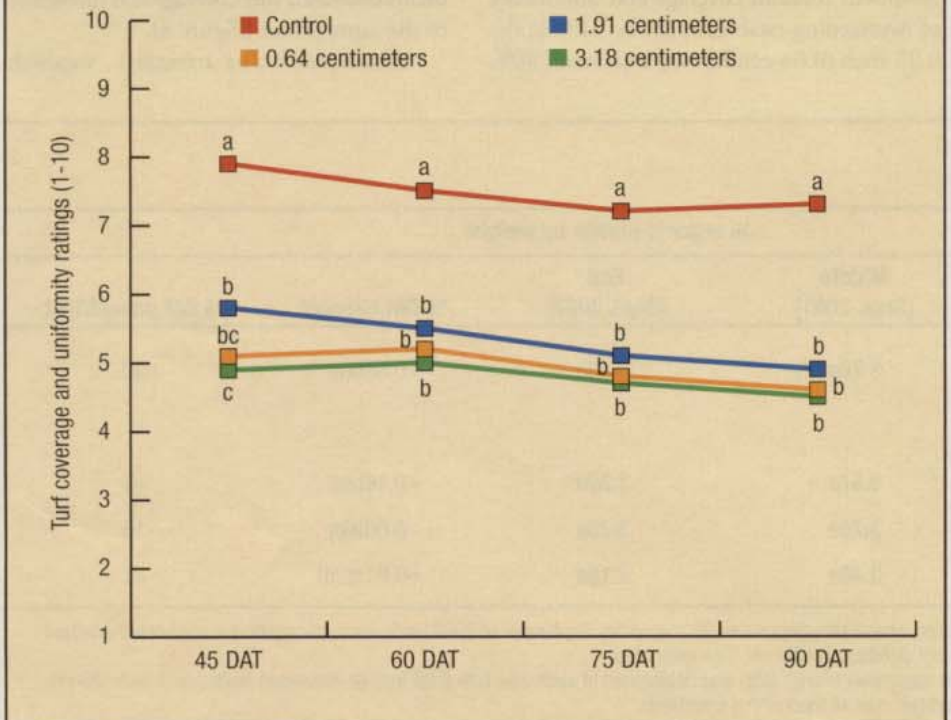

Figure 4. The quality of *Poa trivialis* overseeding establishment following vertical mowing practices on a TifEagle bermudagrass golf green was rated on a 1-10 scale, where 10 = best turf and less than 7 was unacceptable. Within days after treatment (DAT), data points followed by the same letter are not significantly different from each other.

Acknowledgments

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