TURFGRASS CULTURAL PRACTICES REPORT

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Leaf Mulch Studies

Since 1990 three studies have been conducted at the Hancock Turfgrass Research Center (HTRC) that examine the feasibility of mulching leaf litter into existing turfgrass canopies. The first study examined different leaf rates (50 and 100 lbs. dry leaves / 1000 sq. ft.) and the timing of nitrogen fertility. The objectives were to determine if there were any negative effects of mulching tree leaves into the existing turfgrass canopy with a lawn mower and if the nitrogen fertility would enhance leaf litter decomposition. The study ended in 1996 concluding that there were no negative effects of mulching the leaves into the turf at the rates applied and that the nitrogen treatments did not aid in the degradation of the leaf litter. The second study was initiated in October, 1991 to examine the effects of mulching different leaf types (oak and maple) at a rate of 100 lbs. dry leaves per 1000 sq. ft. into a Midnight Kentucky bluegrass turf using a rotary push-mower. This study was concluded in the fall of 1998. Objectives included were to determine if the different leaf types would have an effect on soil pH and or turfgrass quality. Turfgrass quality increased on plots that had maple leaf treatments due to the fact that fewer broadleaf weed growth was observed in these plots. No differences were observed regarding soil pH for the duration of the field experiment. Soil cores taken in the fall of 1998 concluded that there was an increase in the amount of organic matter in plots that had oak and maple leaves mulched into them compared to the check plot (Table 1). Tissue analysis of clippings collected in October of 1998 also found that the grass plants that came from plots having leaves mulched into them also had a greater percentage of carbon and nitrogen. However, the carbon nitrogen ratio was not affected.

Table 1. % of Organic Matter in the Thatch Layer and the % of Carbon and Nitrogen in the Turfgrass Clippings of Poa pratensis cv. Midnight from October of 1998

	% Organic Matter	% C in turf tissue	% N in turf tissue	C/N Ratio
Control	7.5 b	1.7 b	0.13 b	13
Oak leaves	8.9 a	2.1 b	0.16 a	13
Maple Leaves	8.4 a	2.1 b	0.16 a	13
LSD at (0.05)	0.7 *	0.1 *	0.01 *	N.S.

* Significant at 0.01 probability level.
Means in columns followed by the same letter are not statistically different at the 5% level using the LSD mean separation test.

The previous studies led us to conclude that there were more benefits than negatives for turf managers and homeowners that mulch tree leaves into their existing sites. The question became "Could there be an expanded roll for turfgrass in the leaf litter collection process"? With decreasing landfill space many states have looked to farm fields as a means of alleviating their leaf litter disposal. Truckloads of leaves were taken to farms and the leaves were tilled into the soil. However, it was found that this activity had the potential to increase the C/N ratio to 50 to 1. When the C/N ration goes above 30 to 1 nitrogen inputs are required to put the system in balance to make nitrogen available to the plant for uptake. It was also determined that some loading of heavy metals was taking place due to the collection process of the leaf litter and automobile parts were being reported by farmers who partook in the exercise. With that in mind our third leaf mulching study was initiated in October of 1995. The objective was to determine if low maintenance turfgrass sites could take heavy loads of deciduous leaves and maintain their usefulness. The study consisted of mulching a mix of deciduous leafs into an existing sunny seed mix turf (Kentucky bluegrass, perennial rye, and fine fescue). Excessive dry leaf rates of 150, 300 and 450 lbs. per 1000 sq. ft. were mulched in with the aid of a mulching mower. Two mower deck heights (1.5 and 3 inches) were included in the study to determine if deck height had a significant impact on the degradation of the leaf

three inches. In Table 4 the latter of these three samples is reported. The other two are currently being analyzed in the laboratory. As the amount of leaf litter applied increased, the percentage of carbon and nitrogen increased in the soil thatch layer. However, the increases were such that the C/N ratio did not significantly increase and was maintained well below the 30/1 ratio.

Table 4. Carbon/Nitrogen Ration in Thatch Soil Layer Measuring 3" Below Verdure. September 1999

Leaf Mulching Rate	% C	% N	C/N ratio
Control	1.6 c	0.13 c	12.7
150 lbs. / 1000 sq. ft.	2.0 bc	0.14 bc	14.8
300 lbs. / 1000 sq. ft	2.5 ab	0.18 ab	14.2
450 lbs. / 1000 sq. ft.	2.8 a	0.19 a	14.5
LSD at (0.05)	0.5 *	0.04 *	N.S.

* Significant at 0.01 probability level.
Means in columns followed by the same letter are not statistically different at the 5% level using the LSD mean separation test.

Soil samples collected in September of 1999 are reported in Table 5. Samples were obtained from the standard 0-3" depth. No significant differences were observed regarding the soil pH or the amounts of phosphorous, potassium, or calcium regarding leaf loading.

Table 5. Soil Test Results 0-3" Depth September 1999

Leaf Mulching Rate	PH	Lbs. P/A	Lbs. K/A	Lbs. Ca/A
Control	6.5			
150 lbs. / 1000 sq. ft.	6.5			
300 lbs. / 1000 sq. ft	6.7			
450 lbs. / 1000 sq. ft.	6.4			
LSD at (0.05)	N.S.	N.S.	N.S.	N.S.

* Significant at 0.01 probability level.
Means in columns followed by the same letter are not statistically different at the 5% level using the LSD mean separation test.

Putting Green Rootzone Study

This is a cooperative putting green study with J.N. Rogers III and J.M. Vargas Jr. The research was conducted at the Hancock Turfgrass Research Center on the campus of Michigan State University, East Lansing, Michigan on a 14,400 ft^2 (120 x 120 ft) experimental putting green constructed in summer 1992 and seeded in spring 1993 with Penncross creeping bentgrass. The three rootzone mixes were; an 80:20 (sand: peat) mixture built to USGA recommendations; an 80:10:10 (sand:soil:peat) mixture built with subsurface drainage; and an unamended sandy clay loam textured (58% sand, 20.5% silt, and 21.5% clay) "push-up" style green. The putting greens are 1600 ft^2 (40 x 40 ft), replicated three times, and have individual irrigation control. Each green was split for lightweight green rolling in 1995 producing greens that measured 17 x 35 ft. A collar separates these greens. In 1996 a nitrogen-potassium interaction study was initiated. On each green there are two nitrogen treatments and 3 potassium treatments. This area is funded in part by the United States Golf Association (USGA).

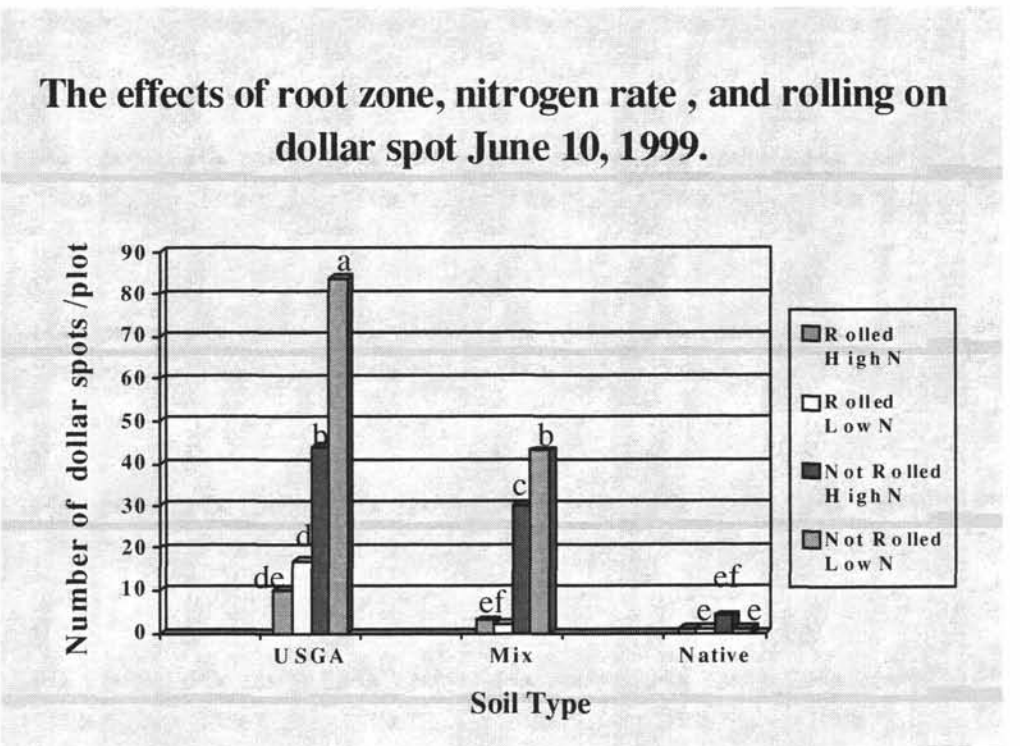
The greens were mowed six times per week at a cutting height of .157 inch and the collars were mowed three times per week at the cutting height of .375 inches. Lightweight green rolling was performed with an Olathe roller three times per week after mowing. The Olathe roller is commonly referred to as a "sidewinder" because the transport tires raise and the practice of rolling takes place perpendicular to the position of the operator. The Olathe has three smooth cylindrical rollers situated under the driver. Sand topdressing has been applied to the greens every two to three weeks throughout the growing season. The sand topdressing has exceeded 1.75 inches.

Beginning in June of 1996 differences in dollar spot activity have been recorded due to construction method and lightweight green rolling. Since that time two observations have persisted 1) the greater the fines in the original construction mix the lesser the degree of dollar spot infection and 2) plots receiving lightweight green rolling three times per week have produced less dollar spot activity than non-rolled plots.

On most dates plots receiving the higher rates of nitrogen displayed less dollar spot severity (Figure 1). Regarding soil type, it was originally hypothesized that as the sand topdressing layer increased, a depth would be obtained that would result in no statistically significant differences regarding the original root zone mix. The assumption was that the finer textured soil created an environment that was favorable to microorganisms that were antagonistic to the casual agents of dollar spot. However, when samples were obtained in the summer of 1998 revealing 54% of the root mass growing in the sand topdress media our thinking began to shift. It is now hypothesized that soil moisture is the driving force in our construction mixes displaying dollar spot activity. The saturated hydraulic conductivity of the different rootzone mixes lends support to this hypothesis.

Prior to the initiation of this study there were reports that golf course superintendents were concerned that lightweight green rolling would increase the severity of diseases like dollar spot. This logical thinking was supported by the fact that the dissemination of the fungus is restricted to the movements of infected leaf debris equipment, people, animals, water, or wind. However, plots that have received the lightweight green rolling have continually displayed less dollar spot symptoms than the non-rolled plots. There are several possibilities for this observation.

Figure 1.



When environmental factors favor dollar spot activity it is generally associated with high humidity that results in a layer of dew on the greens. It is important to note that the plots are mowed with buckets at sunrise. This timing removes the dew on the greens. It is conceivable that enough turgor pressure exists in the roots at this time of day that would allow gutation water to escape from the freshly cut turfgrass blades. Gutation water is rich in carbohydrates and amino acids, which is believed to provide an excellent growing media for dollar spot. Hypothetically, the practice of green rolling immediately after mowing may remove the gutation water along with clipping debris that did not end up in the bucket, this may also be a catalyst for the disease. This is evidenced by the fact that the rollers have a build-up of grass clippings after rolling that necessitate the washing of the machine. It is worthy of consideration that rolling may augment an increase of Ca^{2+} at the cut leaf tips. Calcium has been shown to build up in other plants when wounding

occurs. The mineral nutrient reduces the amount of excudate and decreases the possibility of infection at injured sights.

Twice annually since 1996 soil cores have been removed from the plots to measure physical properties of the soil. All calculations utilized to determine the physical properties were obtained using 1993 USGA specifications. As to be expected, the 80:20 mix has displayed a greater hydraulic conductivity than the 80:10:10 which has retained a greater infiltration rate than the native soil greens. This trend was also displayed in regards to total porosity and one of its components air filled porosity. Regarding the second component of total porosity, i.e. capillary porosity, the greater the amount of fines in the mix, the greater the water holing capacity. With use of the SAS program there have not been statistically significant changes in any of the physical properties over time. There have also been no statistically significant differences regarding lightweight green rolling pertaining to soil physical properties.

Green Speed Perception Survey

Eddie Stimpson introduced the Stimp meter in 1937. Its intended use was to provide uniformity in speed from green to green on individual golf courses. Mr. Stimpson states in his article, Introducing the Stimp, "To the greenskeeper who is harassed by two groups of members, half of whom want the greens faster and half of whom want them slower, it would be of some comfort to know that he was maintaining the standard conditions as measured by the Stimp Meter and was determined by the USGA." Fast forward to the 70's when improved technology allowed for thinner manufacturing of bedknives and the USGA gave a Stimp Meter to each of its member clubs. Golfers increased their demands for faster green speeds and began expect uniformity of green speed from golf course to golf course. This unrealistic demand expedited the tighter mowing heights and increased the stress on the golf course superintendent and his/her putting turf.

Relentless pressure remains on the superintendent to maintain fast green speeds, but what change in green speed can a golfer detect given today's low cutting heights? Surely a golfer can determine the difference in green speed between a green that Stimps 6' and one that Stimps at 7'. However, does that detectable difference in green speed exist when comparing a green that Stimps at 9' and one that Stimps at 10'? In an effort to answer these questions six pair of greens where maintained at three different mowing heights (3/16", 5/32", and 1/8") in preparation for an MTF Field Day Survey. One pair at each mowing height was managed to create a one-foot difference in green speed while the other pair was maintained to produce a half a foot difference in green speed.

Results indicate that regardless of mowing height a distance of one foot was detectable while differences in green speed of 8" or less were not detectable to our survey group. How could the turf manager utilize this data? Years of data verify that lightweight green rolling increases green speed by a foot on the day the green is rolled. However, the day after rolling there is generally a 6" difference that remains between the rolled and non-rolled greens (Table 6). Given this knowledge one superintendent might decide to roll his greens everyday in order to keep his green-speed at a maximum. However, another superintendent might decide to roll her greens every other day because the majority of the membership can not tell that the greens are 6" slower on days they are not rolled.

In closing the author's would like to quote the editor of *Golfdom: the Business Journal of Golf*, which published the 1937 article Introducing the Stimp. He wrote of the Stimp Meter, "As for its use in actual play, we have the definite idea that it's out – not only because of the mechanical phase but because the player actually couldn't make enough use of what he has learned about green speed to warrant use of the device. However, there may be something to the device as an instrument for greenkeepers who might want to answer arguments about the speed and uniformity of their greens." The editor then closed with the following insightful comment, "We toss Stimpson's interesting contribution into the lists for the arguments it will provide." Thanks!

Irrigation Timing, Turfgrass Species, Fertility Study

In this cooperative study with David Gilstrap, Kentucky bluegrass, tall fescue, and perennial ryegrass were subjected to three different irrigation regimes: none, 1/10 inch daily in early afternoon, and 1 inch per week at 5:00 a.m. A nitrogen-timing component was also included in the study. Nitrogen was applied as urea in all treatments except one in which it was applied as corn gluten meal. Data collection includes color and quality ratings, broad leaf weed counts, wilt ratings, and surface temperatures, which