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

Table 10. Soil moisture content for different soils at different depths averaged over all sampling days.

Treatment/Depth	Soil moisture (Vol.%) 5 cm Sand	5 cm Sand/Soil	15 cm Sand	15 cm Sand/Soil	25 cm Sand	25 cm Sand/Soil
Primer	9.3 a	16.1 a	15.3 a	20.1 a	24.3 a	25.1 a
Midorich (high)	10.1 b	15.9 b	13.4 b	20.7 a	21.3 b	24.9 a
Midorich (low)	9.4 a	16.2 b	13.3 bc	20.8 a	22.5 b	21.2 b
Water	9.7 ab	18.1 b	12.6 c	20.7 a	18.7 c	25.7 a

† values in columns followed by the same letter are not significantly different from each other (a=0.05, Fisher's LSD test for multiple comparison of means).

For depths greater than 5 cm, high sand content rootzones treated with Primer wetting agent show significantly greater water holding capacity than rootzones treated with water or Midorich soil conditioner. At 5 cm depth Midorich treated sand columns showed significantly greater soil moisture content compared to columns treated with water or Primer.

The Sloping Green

This project continues to receive considerable attention. Turf was established in 1998 on three mixes: sand; sand: peat: and sand: soil. The sand plots established most slowly due to low water holding capacity and were the slowest to green up in the spring. As expected, after application of adequate water sand plots dried out faster than sand: peat or sand: soil plots. On some dates the sand: peat plots performed better than sand: soil plots. This was reflected in the soil moisture levels observed in the plots and in the surface temperature measurements. When the topmix in thinner at the high part of the plot there was more moisture in the soil than when the regular 12 inch depth was used. Moisture data support our hypothesis that modification of the depth enhances moisture conditions in the green. Sand plots exhibited more dollarspot than on other mixes. More insights and data are presented on this study elsewhere in the proceedings in a paper authored by Dr. Bernd Leinauer.

Golf spike traction survey

A special thanks to Dr. John Rogers III, John Hardy, and John Sorochan whose help was instrumental in conducting this survey. Alternative spikes have become anything but alternative as the majority of golf courses in America have banned 8mm metal spikes. The banning began, in part, by golfers demanding faster green speeds. As a result golf course superintendents went to tighter mowing heights on the putting surface. The shorter turf required meticulous management practices that resulted in the uplifting of the turfgrass plant from the soil as golfers traversed the green in metal spikes. This uplifting of the plant, commonly called "Christmas trees" by pro golfers, led to a small group a private clubs banning the 8mm metal spike in the early to mid 90's. However, it was probably damage to infrastructure that created the landslide of golf clubs that has banned the metal spike. In January of 1995, 55 golf course in the world had banned metal spikes, by January of 1998 over 3000 courses joined in the ban. Through this time-span (with the aid of numerous research) it has become commonly accepted that the 8mm spike produced the most damage to the putting surface and to infrastructure. It has also been commonly accepted that the alternative spikes are more comfortable on the legs and lower- back after a round of golf. However, it is also regarded as fact that the 8mm metal spike produced the best traction during the swing and on wet slopes. For this reason Michigan State University (MSU) conducted a survey on July 13, 1999 to find-out if there are any alternative spikes on the market that produce traction that is superior or equivalent to the banned 8mm metal spike.

The study was conducted at the Forest Akers East Driving Range in East Lansing on July 13, 1999. Seventy volunteers from across Michigan, Indiana and Ohio took part in the survey. All participants were capable of wearing size 11 golf shoes. While signing in to participate in the survey participants were asked to NOT look at the soles of their shoes while lacing them on. Afterwards, the participants began an obstacle course by lacing on a pair of golf shoes and proceeded to the tee and hit golf balls. After hitting the golf balls they were asked to rate the golf shoe for traction on a scale of 1 to 5. 1 =

excellent traction, 2 = very good, 3 = good, 4 = fair, and 5 was considered poor traction. Next, the participants proceeded to traverse a dry slope, a wet slope, and then concrete. On both dry and wet slopes the participants walked up and down the slope in a method that made a large "W". After traversing each of the stations they were asked to give the golf shoe a traction rating using the identical scale. The volunteers repeated the course wearing nineteen different pair of golf shoes with different soles or spikes inserted into each.

A pair of Foot-Joy Classic golf shoes with no spike inserted into them was included to give validity to the survey. If these leather-soled smooth bottomed golf shoes were not regarded as providing the worst traction than the study would have had little merit. Fortunately, these check pair of shoes were considered to supply far worse traction than any other treatment in the survey (except on dry flat pavement).

Table 11. Key for Traction Survey

Treatment No.	Spike/Cleat	Shoe	Abbreviation
1	8 mm metal	Foot Joy Dry Joys	DJ 8mm
2	Big Foot	Foot Joy Classics	FJC bf
3	DTL	Etonic Difference 2000	ETNC dtl
4	None	Foot Joy Classics	FJC
5	Black Widow	Foot Joy Classics Dry	FJC* bw
6	Softspike XP	Foot Joy Dry Joys	DJ
7	DSS-1	Etonic Difference	Etonic diff
8	EXP.1	Nike Zoom Air	NZA
9	Softspike XP	Foot Joy Soft Joys	SJST
10	Softspike XP	Foot Joy Turf Masters	TM
11	Green Keepers	Foot Joy Dry Joys	DJ gk
12	GreenSpike	Foot Joy Dry Joys	DJ gs
13	Comfort Cleat	Ashworth	AW dnt
14	Tred-Lite MT	Dunlop	DUN tl
15	DWT	Etonic Difference 2000	Etonic dwt
16	Black Widow	Foot Joy Classics	FJC bw
17	Softspike XP	Foot Joy Classics	FJC ssxp
18	Softspike XT	Foot Joy Classics	FJC ssxt
19	DBW	Etonic Difference 2000	ETNC dbw

Data regarding traction during the golf swing is presented in Table 12. In Table 11 a legend for the shoe and inserts is provided for comparison with Tables 12-15. A pair of Dry Joys with the 8mm metal spike inserted into them received the highest percentage of excellent ratings. However, through statistical analysis of ordinal data all treatments followed by the same letter, in parenthesis, is the same. Given this there were four other treatments found to provide the same amount of traction during the swing in our survey. Those four treatments were The Etonic Difference with factory standard DSS-1 cleats, a pair of Foot Joy Classic Drys with the Black Widow spikes, a pair of Foot Joy Classics with the Big Foot cleat, and a pair of Dry Joys with GreenKeepers inserted into their sole. At the other end of the scale were the check pair of shoes with nearly 50% of the participants giving the check shoes a rating of poor and another 33% rating the shoe as fair. No other product performed as poorly as the check pair of shoes. In Figure 1 a pair of Dunlops with theTred-Lite MT spike insert is positioned as the pair of spikes providing the worst traction during the swing. However, nearly 60% of the participants rated the traction as ether "Excellent or "Very Good" with another 26% rating the traction as "Good". It is noteworthy that all treatments with letter "B" following it provides the statistically same amount of traction.

Data regarding traction while traversing a dry slope is given in Table 13. Once again the 8mm metal spike received the highest percentage of "Excellent" ratings with the GreenKeepers inserted into a pair of Dry Joys and the Black Widow inserted in Foot Joy Classic Drys providing traction equivalent to the 8mm spike. The check shoe received unacceptable ratings in excess of 70% of the time.

Data regarding traction while traversing a wet slope is given in Table 14. Under these condition the 8mm metal spike provided traction that none of the alternatives could equal and the check shoes received their worst traction rating with over 80% of the participant's giving them an unacceptable rating.

Traction results while traversing dry flat concrete are presented in Table 15. The Nike Zoom Air

with the EXP.1 spike, Etonic Difference with DSS-1 spike, GreenKeepers inserted in the Dry Joys, and Big Foot cleats inserted in the Foot Joy Classics received the highest ratings. At the other end of the scale was the 8mm metal spike receiving an unacceptable rating over 50% of the time. No other treatment performed as poorly as the 8mm metal spike under these conditions.

Overall the alternative spikes performed satisfactorily. In no particular order the GreenKeepers inserted into a pair of Dry Joys, the Black Widow inserted in Foot Joy Classic Drys, Big Foot inserted into Foot Joy Classics, and the Etonic Difference with the DSS-1 spike yielded stability results on turf mimicking that of the 8mm metal spike. It is noteworthy that some of the participants in the survey mentioned that it was difficult to rate the shoes for traction while ignoring the differences in comfort among the different pairs of shoes. However, the results indicate they did a good job of ignoring the comfort dilemma. This is most evident when considering that the check, a pair of Foot Joy Classics with no spikes, consistently performed the worst on turf while the Big Foot cleats that performed equal to the 8mm metal spike was also inserted into Foot Joy Classics. In closing, it was reported by the PGA that in April of 1999 the majority of golfers wore alternative spikes during a tournament for the first time in PGA history.

Table 12. Effects of Different Spikes on Traction During Golf Swing.

Spike Treatment	Poor	Fair	Good	Very good	Excellent
FJC (A)*	46%	33%	14%	5%	1%
DUN tl (B)	4%	12%	26%	43%	16%
ETNC dwt (BC)	3%	10%	24%	44%	18%
DJ gs (BC)	3%	10%	24%	44%	18%
AW dnt (BC)	3%	9%	23%	45%	19%
SJST (BCD)	3%	9%	22%	46%	21%
FJC ssxt (BCD)	3%	8%	21%	46%	22%
FJC bw (BCDE)	3%	8%	21%	46%	22%
NZA (BCDE)	3%	8%	21%	46%	22%
ETNC dtl (BCDE)	3%	8%	21%	46%	22%
DJ (BCDE)	2%	7%	20%	46%	25%
TM (BCDE)	2%	7%	19%	46%	25%
FJC ssxp (CDEF)	2%	7%	18%	46%	27%
ETNC dbw (DEFG)	2%	5%	16%	46%	31%
DJ gk (DEFGH)	2%	5%	15%	46%	33%
FJC bf (EFGH)	2%	5%	15%	45%	34%
FJC* bw (FGH)	1%	4%	12%	44%	39%
ETNC diff (GH)	1%	3%	10%	41%	44%
DJ 8mm (H)	1%	3%	9%	40%	48%

Spike Treatments followed by the same letter are not statistically different to the 5% level using the LSD mean separation test.

Table 13. Effects of Different Spikes on Traction While Traversing a Dry Slope of Turf.

Spike Treatment	Poor	Fair	Good	Very_Good	Excellent
FJC (A)*	29%	42%	21%	7%	1%
ETNC dtl (B)	2%	11%	28%	43%	15%
DUN tl (B)	2%	11%	28%	43%	15%
DJ gs (BC)	2%	10%	27%	44%	17%
FJC ssxt (BC)	2%	10%	27%	44%	17%
TM (BC)	2%	9%	26%	45%	18%
ETNC dwt (BC)	2%	9%	25%	46%	19%
AW dnt (BCD)	2%	8%	24%	46%	20%
FJC ssxp (BCD)	2%	7%	22%	47%	23%
SJST (BCDE)	1%	6%	20%	47%	26%
ETNC dbw (BCDE)	1%	6%	20%	47%	26%
NZA (CDE)	1%	6%	19%	47%	26%
FJC bw (DE)	1%	5%	16%	47%	32%
FJC bf (DE)	1%	4%	16%	47%	32%
ETNC diff (DE)	1%	4%	15%	46%	33%
DJ (E)	1%	4%	14%	45%	37%
FJC* bw (EF)	1%	3%	13%	44%	39%
DJ gk (EF)	1%	3%	12%	44%	40%
DJ 8mm (F)	0%	2%	7%	36%	55%

Spike Treatments followed by the same letter are not statistically different to the 5% level using the LSD mean separation test.

Table 14. Effects of Different Spikes on Traction While Traversing a Wet Slope of Turf.

Spike Treatment	Poor	Fair	Good	Very_Good	Excellent
FJC (A)*	49%	35%	13%	3%	1%
DUN tl (B)	4%	16%	37%	33%	10%
AW dnt (BC)	3%	11%	33%	38%	15%
FJC ssxt (BCD)	2%	10%	31%	40%	17%
TM (BCD)	2%	10%	31%	40%	17%
DJ gs (CDE)	2%	9%	30%	41%	17%
ETNC dtl (CDE)	2%	9%	30%	41%	18%
ETNC dwt (CDEF)	2%	8%	28%	42%	20%
SJST (CDEFG)	2%	7%	25%	43%	23%
FJC ssxp (CDEFG)	2%	7%	24%	43%	24%
ETNC dbw (CDEFG)	2%	7%	24%	43%	24%
NZA (DEFG)	1%	6%	23%	44%	26%
FJC bw (DEFGH)	1%	6%	23%	44%	26%
ETNC diff (EFGH)	1%	6%	22%	44%	28%
DJ (EFGH)	1%	6%	22%	44%	28%
FJC bf (FGH)	1%	5%	20%	44%	30%
DJ gk (GH)	1%	4%	18%	43%	34%
FJC* bw (H)	1%	3%	15%	42%	40%
DJ 8mm (I)	0%	2%	8%	32%	58%

Spike Treatments followed by the same letter are not statistically different to the 5% level using the LSD mean separation test.

Table 15. Effects of Different Spikes on Traction While Traversing Concrete Pavement.

Spike Treatment	Poor	Fair	Good	Very_Good	Excellent
DJ 8mm (A)*	21%	34%	31%	11%	3%
DUN tl (B)	9%	22%	39%	23%	8%
ETNC dtl (BC)	6%	17%	37%	29%	11%
ETNC dwt (BCD)	5%	15%	36%	32%	13%
FJC ssxt (CD)	5%	14%	36%	32%	13%
FJC bw (CDE)	4%	13%	35%	33%	14%
FJC (CDEF)	4%	13%	34%	34%	14%
FJC* bw (CDEFG)	3%	11%	32%	36%	17%
FJC ssxp (CDEFG)	3%	10%	31%	37%	18%
SJST (DEFG)	3%	10%	31%	37%	19%
AW dnt (DEFG)	3%	9%	30%	38%	20%
ETNC dbw (DEFG)	3%	9%	29%	38%	20%
DJ (EFG)	3%	8%	28%	39%	22%
DJ gs (EFG)	3%	8%	27%	39%	23%
TM (FG)	2%	8%	27%	39%	23%
FJC bf (GH)	2%	8%	26%	40%	25%
DJ gk (GH)	2%	7%	24%	40%	27%
ETNC diff (GH)	2%	7%	24%	40%	27%
NZA (H)	1%	4%	18%	39%	37%

Spike Treatments followed by the same letter are not statistically different to the 5% level using the LSD mean separation test.