TURFGRASS SOIL MANAGEMENT RESEARCH REPORT-1996

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MULCHING LEAVES INTO TURFGRASS STUDIES

The disposal of yard waste to landfills was eliminated as the Solid Waste Management Act became effective March 27, 1995. In 1991 an oak and maple leaf mulching study was initiated at Michigan State University to study the effects of mulching different types of leaves into an existing turfgrass stand. Either maple or oak leaves were mulched into a "Midnight" Kentucky bluegrass turf at the rate of 100 lbs of dry leaves per 1000 sq. ft. (approximately ankle height in depth). Check plots receiving no mulched tree leaves were included. A second variable, nitrogen, was also included in the study. On improved bluegrass varieties, such as "Midnight", proper fertility is a must to maintain the desired stand of grass. Nitrogen was applied at 4 lbs. N per 1000 sq. ft. annually with either a spring or fall emphasis. Spring emphasis applications were applied in April, May, July, and August (1 lb. N per month) while the fall program received nitrogen in June, July, September, and October. A check plot with no nitrogen was included to further examine the impact nitrogen had on the decomposition of the tree leaves. There were three replications of each treatment. Plots measured 4 feet by 12 feet.

In Tables 1 and 2 are the color and quality ratings taken regarding leaf type. The data give an average across nitrogen treatments (thus represents an average of nine plots for each treatment). No statistically significant differences in turfgrass color occurred in 1996. In Table 2 the maple leaf-treated plots had statistically higher quality than the check plots on three dates and higher quality ratings than oak leaf-treated plots on one date. The oak leaf plots had statistically greater quality than the check plot on one date. For interpretation of the statistical probability in these tables, when N.S. appears in the row this means there is no significant difference among the treatment averages. When a number appears such as .02, this means statistics predicts that 98% of the time the same response to the treatments will occur. When .00 appears, this means there is greater than 99% probability the same response will occur. The basis of whether a significant response will occur is based on the 95% level of probability (note LSD@.05), or 95 times out of 100 we can expect the same results.

Table 1.

Oak & Maple Leaf Mulch Study 1996

Initiated 1991

Color Ratings (9 = excellent, 6 and better is acceptable, 1 = dead)

	May 10	June 13	July 2	July 17	Aug 8	Sept 11	Nov 11
No leaves	6.2	5.9	6.1	6.9	7.4	7.1	7.0
Oak	6.6	6.2	6.8	7.1	7.3	7.2	7.2
Maple	6.0	6.3	6.4	7.2	7.5	7.0	7.2
Probability	N.S.#	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
LSD @ .05	.87	.75	1.16	.45	.51	.46	.38

N.S. - No significant difference

Table 2.

Oak & Maple Leaf Mulch Study 1996

Initiated 1991

Quality Ratings (9 = excellent, 6 and better is acceptable, 1 = dead)

	May 10	June 13	July 2	July 17	Aug 8	Sept 11	Nov 11
No leaves	5.3	5.4	4.9 b	6.5	6.7 b	6.0	6.5 b
Oak	5.5	5.4	6.2 a	6.7	6.7 b	6.5	6.9 ab
Maple	5.5	6.0	6.7 a	7.0	7.5 a	6.7	7.2 a
Probability	N.S.	N.S.	.02	N.S.	.00 *	N.S.	.03 *
LSD @ .05	.86	.88	1.18	.50	.46	.63	.48

Means in columns followed by the same letter are not significantly different at the 5% level using the LSD mean separation test.

* Statistical interaction between leaf type and nitrogen program.

In 1995 no weeds grew in any plots treated with maple leaves. In 1996 no herbicides were applied and broad leaf weed counts were made on four dates during the season. The broad leaf weeds were generally dandelion and plantain. One bunch of clover slowly grew into and eventually took over 25% of one of the check plots, but that data is not recorded. In Table 3 are the broad leaf weeds counts per mulching treatment. It is interesting to note that there were no differences in weed counts early in the season while in July and September, differences occurred. The major difference was the lower weed counts in the maple leaf-treated plots compared to the check and oak-treated plots. No explanation for the difference between the oak and maple plots is apparent.

Table 3.

Oak & Maple Leaf Mulch Study 1996

Initiated 1991

Broad Leaf Weed Counts (Number per plot)

	May 10	June 13	July 2	Sept 20
No leaves	3.8	4.0	4.4 ab	12.4 a
Oak	3.3	4.8	5.4 a	10.3 a
Maple	0.4	0.4	0.3 b	1.4 b
Probability	N.S.	N.S.	.08	.03 *
LSD @ .05	2.61	3.99	3.74	8.10

Means in columns followed by the same letter are not significantly different at the 5% level using the LSD mean separation test.

* Statistical interaction between leaf type and nitrogen program.

Tables 4 and 5 reflect data taken from the same plots regarding nitrogen timing. Plots receiving nitrogen (Table 4) had much higher quality ratings than the check as would be expected. The first ratings taken in May reflect the turf response to the April application for the spring fertilizer program. A rating taken in early April would have had higher ratings for the fall program. The spring of 1996 was again an unusually cold with slow recovery from dormancy when nitrogen was limiting. In this regard the late fall and early spring nitrogen treatments provided quicker green-up than check plots. The latter showed little improvement until into July. Even then, the check plots never achieved an acceptable quality rating during the growing season. Data in Table 5 provides proof that a good turf fertility program is a key factor in an integrated weed control program. Weed numbers continued to increase in the check plot throughout the season while there was no change in plots receiving nitrogen. This applies for both improved and common Kentucky bluegrass cultivars.

Table 4.

Oak & Maple Leaf Mulch Study 1996

Initiated 1991

Quality Ratings (9 = excellent, 6 and better is acceptable, 1 = dead)

	May 10	June 13	July 2	July 17	Aug 8	Sept 11	Nov 11
No Nitrogen	3.6 c	3.5 b	4.2 b	5.5 c	5.6 b	5.6 b	5.4 c
Spring N	6.8 a	6.5 a	6.7 a	7.9 a	7.2 a	6.7 a	7.2 b
Fall N	5.8 b	6.7 a	6.9 a	6.8 b	7.6 a	6.9 a	7.9 a
Probability	.00	.00	.00	.00	.00 *	.00 *	.00 *
LSD @ .05	.86	.88	1.18	.50	.46	.63	.48

Means in columns followed by the same letter are not significantly different at the 5% level using the LSD mean separation test.

* Statistical interaction between leaf type and nitrogen program.

Table 5.

Oak & Maple Leaf Mulch Study 1996

Initiated 1991

Broad Leaf Weed Counts (Number per plot)

	May 10	June 13	July 2	Sept 20
No Nitrogen	7.1 a	8.5 a	9.3 a	20.4 a
Spring N Program	0.2 b	0.3 b	0.1 b	1.8 b
Fall N Program	0.2 b	0.3 b	0.8 b	2.0 b
Probability	.00	.00	.00	.00 *
LSD @ .05	2.61	3.99	3.74	7.10

Means in columns followed by the same letter are not significantly different at the 5% level using the LSD mean separation test.

* Statistical interaction exist between leaf type and nitrogen program.

Three new leaf mulch studies were initiated during the Fall of 1996. One of these is located in a heavy shade area on campus. This study includes either oak or maple leaves applied at several rates, including rates as high as 450 lbs. of leaves per 1000 sq. ft. (Over 12 inches of leaves) either in one application or split over 3 applications at weekly intervals. Another study includes a mowing height variable with plots mowed at either 1.5 inches or 3 inches. Rates of leaves are up to 450 lbs. per 1000 sq. ft. in one or three applications. The objective of this study is to determine the effect of mowing height and heavy leaf rates on turf survival. Samples of leaves have been collected and are being screened to determine particle size of the leaves.

II . GOLF SPIKE TRAFFIC STUDY

On July 25, 1996 a study was initiated to evaluate the effects of different golf shoe spikes on green speed. Extra Traction Soft Spikes and Greenspikes, both plastic type spikes, were donated by the respective companies and the Michigan Turfgrass Foundation provided money to purchase three identical pairs of golf shoes. Soft Spikes were placed in one pair of shoes, Greenspikes in another, and metal spikes remained in the third pair. On 17 days of the 22 day study one individual walked the same number of times across each plot (1 foot by 17 feet) wearing the appropriate shoes. Twenty passes were generally made on the day of a stimping event (40 passes on the final day) and on non-data collection days 10 passes were made.

Data are given in Table 6. Numbers reflect the average green speed taken from 18 plots. On all four dates of stimpmeter data collection the metal spikes resulted in statistically slower green speeds than the Greenspikes, and on three of the four dates Soft Spikes were faster than the metal spiked greens. On August 9 the Greenspike-trafficked greens were approximately 3 inches faster than for Soft Spike-treated greens, a difference that would not be noticed by most golfers. Except for the August 16 data the difference between Greenspike and metal spiked greens was greater than 6 inches. Six inches is the length generally regarded as noticeable by most golfers when putting on a green. We hypothesize that the earlier data is more reflective of a real world situation and present the following argument for our hypothesis. The plots were 1 foot wide by 17 feet long with traffic restricted to this area for the duration of the experiment. The golf course superintendent repositions the golf cup in order to spread traffic effects. In this study space limitations restricted traffic to this long narrow plot which resulted in compaction along the traffic path. This may have reduced the differences between metal and non-metal spike effects even further. We have observed that metal spikes cause lifting of bentgrass stolons while the others give no evidence of this effect. New studies will be initiated in 1997. It is clear that the traditional metal spikes cause slower green speeds and result in more injury to the grass than some of the plastic spikes. We have not yet looked at effects if some of the larger non-metal spikes which have become available recently. There have been some reports from the superintendents that these may cause a dimpling effect on greens. It is clear that continued evaluations are necessary.

Table 6.

Metal and Non-metal Spikes Traffic Study

Initiated July 25, 1996

Stimpmeter Readings in feet

	July 25	Aug 2	Aug 9	Aug 16
Metal Spikes	8.81 b	9.33 b	8.81 c	9.73 b
Soft Spikes	9.69 a	10.28 a	9.29 b	10.00 ab
Greenspikes	9.72 a	10.46 a	9.53 a	10.19 a
Probability	.00	.00	.00	.02
LSD @ .05	.30	.22	.24	.32

HIGH POTASSIUM RATE STUDY ON A CREEPING BENTGRASS GREEN

The studies evaluating high annual rates of potash on creeping bentgrass and Kentucky bluegrass that were initiated in 1990 were continued in 1996. There were four replications of six different treatments in the study. Plot size was 5 feet by 7 feet. All applications during the season were made at the rate of 2 lbs. K_2O per 1000 sq. ft. per application. In these studies, soil samples are normally collected during the Fall, but due to arrival of winter weather early in 1995 these samples were taken in May, 1996. The soil test data from the thatch, 0-3, and 3-6 inch depths, are given in Tables 7-9, respectively. As expected there were statistically significant differences for the potassium at all three depths. For the first time there was a reduction in magnesium levels caused by high rates of potassium which was evident in the 3-6 inch depth. As mentioned previously, we do not recommend such high rates of potassium as were utilized in this study. Following soil test recommendations or slightly higher rates should provide adequate levels of potassium. On sands, the potash should be applied regularly throughout the season.

Table 7.

High Potassium Rate Study, Bentgrass

Soil test data in thatch layer (pounds per acre)

Sampled May, 1996

Treatment & Rate	P	K	Ca	Mg	pH
Check Plot	32	201 d	2817	411	7.0
Soil Test Recommend.	32	280 a	2697	382	7.0
4 lbs KCl / M / year	38	256 b	3059	445	7.0
8 lbs KCl / M / year	34	229 c	2556	368	7.0
12 lbs KCl / M / year	34	293 a	2600	372	7.0
12 lbs K2SO4 / M / year	33	297 a	2865	416	7.0
Probability	N.S.	.00	N.S.	N.S.	N.S.
LSD @ .05	5.7	23	407	73	.09

Table 8.
High Potassium Rate Study, Bentgrass
Soil test data in the 0 to 3 inch depth (pounds per acre)
Sampled May, 1996

Treatment & Rate	P	K	Ca	Mg	pH
Check Plot	27	75 d	1581 ab	272	7.2
Soil Test Recommend.	26	304 b	1582 ab	258	7.2
4 lbs KCl / M / year	31	201 c	1606 a	265	7.3
8 lbs KCl / M / year	29	285 b	1457 c	242	7.3
12 lbs KCl / M / year	31	378 a	1507 bc	247	7.2
12 lbs K2SO4 / M / year	27	372 a	1507 bc	244	7.2
Probability	N.S.	.00	.03	N.S.	N.S.
LSD @ .05	7.6	40	96	33	.09

Table 9.
High Potassium Rate Study, Bentgrass
Soil test data in the 3 to 6 inch depth (pounds per acre)
Sampled May, 1996

Treatment & Rate	P	K	Ca	Mg	pH
Check Plot	45	50 d	1210	219 a	7.2 b
Soil Test Recommend.	47	318 b	1225	168 bc	7.3 a
4 lbs KCl / M / year	57	211 c	1160	173 b	7.4 a
8 lbs KCl / M / year	55	341 b	1038	157 bc	7.4 a
12 lbs KCl / M / year	54	395 a	1088	160 bc	7.4 a
12 lbs K2SO4 / M / year	52	424 a	1088	131 c	7.4 a
Probability	N.S.	.00	N.S.	.01	.00
LSD @ .05	17	53	173	40	.12

On the morning of September 5 potash treatments were applied for treatments 3, 4, 5, and 6 at the rate of 2 lbs. K20 per 1000 sq. ft.. Treatments were not watered in until early a.m. on September 6. September 5 was an extremely hot and humid day that resulted in significant fertilizer burn. Table 10 gives the burn ratings taken on the afternoon of September 6. All plots treated with KCl had a higher burn potential than K2SO4. It is recognized that no more than 1 lb. of K20 is the maximum that should be applied at one time, particularly on a hot day, but the data confirm the safety in using potassium sulfate under such conditions. Of course, if black layer is a concern on a given turf the use of potassium sulfate would not be recommended. Lower rates of other potash carriers should be utilized. Potassium nitrate would be a good alternative where a black layer condition is present. It is interesting to note that even at 2 lbs. K20 per 1000 sq. ft. that KCl did not result in kill of the turf. Recovery from the burn occurred within a few days

Table 10.
High Potassium Rate Study, Bentgrass
Burn Rating September 6, 1996 (9 = no burn, 6 and above is acceptable, 1 = serious kill)

Treatment & Rate	Burn Rating
Check Plot	9.0 a
Soil Test Recommend.	9.0 a
4 lbs KCl / M / year	3.5 c
8 lbs KCl / M / year	3.5 c
12 lbs KCl / M / year	3.5 c
12 lbs K2SO4 / M / year	8.0 b
Probability	.00
LSD @ .05	.02

IV **LONG TERM TOPDRESSING STUDY**

The long term topdressing study was initiated in 1986 and discontinued in the spring of 1996. Some data were collected in the spring to conclude the study. Topdressing materials utilized were straight sand; 80% sand, 20% peat; and 60% sand, 20% peat, 20% soil. Treatments were applied at the rates of 3 cubic feet of material per 1000 sq. ft. every three weeks; 12 cubic feet of material applied in the spring and fall; 12 cubic feet of sand applied in the spring and fall after operating an aerifier having ½ inch tines and 2 inch by 2 inch spacing; and a check plot that received no topdressing material. Plot size was 4 ft. x 12 ft. The final topdressing application took late summer of 1995. Data in Table 13 reports root weights and some soil physical properties.

It is interesting that plots which received topdressing every 3 weeks had higher root weights in the 1-3 inch depth compared to the untreated check and the plot which was aerified spring and fall, then topdressed. We know from earlier cultivation research that when removing the soil cores on relatively uncompacted greens that root weights can sometimes be decreased. The plots were aerified in the fall, but not in the spring of 1996. The check plot had by far the poorest rooting, likely a result of the heavy thatch that developed. Since the check received no cultivation or topdressing, it is not surprising a significant thatch layer developed. Grass roots will grow where there is the least resistance to root penetration, a perfect condition in the thatch layer. The check plot had the least rooting in the 3-6 inch depth as well.

The air-filled pores represent the largest pores in the soil, or macropores. Topdressed plots had the highest amount of macropores in contrast to the check plot which had the lowest air-filled pores, as would be expected. The underlying soil is a loamy sand to sandy loam while the topdressing materials ranged from straight sand to a loamy sand. As topdressing accumulated to a depth of about 2 inches in 10 years, less of the underlying soil would be included in the soil samples that were collected to a depth of 3 inches. One of the objectives of topdressing is often to change the soil in the root zone of older greens. These data substantiate that soil conditions can be changed with a long-term topdressing program. Total pore space values reflected the same trend. It was surprising that the plots that were aerified and topdressed tended to have lower pore space values than plots which were topdressed only. Bulk density numbers were consistent with treatment. Sand topdressed plots had the highest bulk densities. This is expected since sand is the heaviest soil component. Again, the aerified plots had a higher bulk density than expected, but this is consistent with the lower pore spaces observed for these plots. There is no ready explanation for this result. The check plot had a high bulk density since there had been no topdressing or cultivation treatments to impact on pore space.

Table 11.

Long Term Topdressing Study - 1996

Initiated 1986. Sampled May 21

Topdressing material & frequency	**Root weight, grams 1-3"**	**3-6" depth**	**Air Filled Pores %**	**Total Pores %**	**Bulk Density gm/cc**
Sand every 3 weeks	1.69 a	.42 a	27.2 ab	49.3 ab	1.34 b
Sand spring & fall	1.39 ab	.32 ab	22.6 abc	46.9 bc	1.35 ab
80 sand : 20 peat every three weeks	1.34 ab	.31 ab	24.0 ab	50.4 a	1.27 c
80 sand : 20 peat spring & fall	1.63 a	.41 a	29.2 a	50.2 a	1.26 c
60 sand : 20 peat: 20 soil; every three weeks	1.19 abc	.30 b	22.5 abc	50.4 a	1.26 c
60 sand : 20 peat: 20 soil; spring & fall	1.28 ab	.28 b	21.2 bc	49.2 ab	1.27 c
Check Plot no topdressing	0.58 c	.15 c	16.1 c	44.9 c	1.41 a
Sand; aerified spring & fall	0.79 bc	.29 b	23.4 ab	47.3 bc	1.40 a
Probability	.02	.00	.05	.00	.00
LSD @ .05	.063	.119	7.16	2.67	.055

*Both topdressing frequencies totaled 24 cubic feet per year.

MANAGEMENT OF SOD GROWING ON SUBSOIL

The project to evaluate management practices to maintain sod grown on compacted subsoils was initiated during summer, 1996. There are nine blocks in this study with three irrigation treatments and three replications. Kentucky bluegrass sod was laid on these plots in 1995. Treatments include nitrogen rates of 0, 2, 4, and 6 lbs. per 1000 sq. ft. annually; core cultivation treatments applied 0, 1, or 3 times annually; organic nitrogen or urea as the nitrogen source; and composted yard waste as a source of organic matter. The 3 irrigation treatments are none, daily, or irrigation on the appearance of wilt. Limited data were collected in 1996. The most obvious result is the rather rapid loss of turf color when no nitrogen was applied. This was expected as the subsoil has essentially no organic matter that could serve as a source of nitrogen for the sod.

A companion study on native soil was established in 1996 as well. This project is being supported by the TruGreen/ChemLawn Corporation. The objective is to evaluate the effect of various lawn care management practices on the biological life of the soil. An initial report on this is presented elsewhere in these proceedings (Ravenscroft). Both of these studies will continue for several years to determine the long-term effects of turf maintenance practices.