THE EFFECTS OF MULCHING TREE LEAVES IN KENTUCKY BLUEGRASS

T. A. Nikolai, P.E. Rieke, B.E. Branham, R. N. Calhoun, D.M. Roth and P. Grow
Crop and Soil Sciences Department, M.S.U.

The sights and scents of the fall have always made that season special to me and as a child the burning of tree leaves added to its' magic. My father would rake the leaves to the curb and make several small piles. Upon completion of this task he would strike a match to each one. I loved how those burning leaves smelled and the way the fire and smoke danced as he rotated the leaves with his rake. This task was duplicated by every household in the suburb until a law was passed making the activity illegal. I was young and couldn't conceive that disposing of yard waste in this manner caused pollution, but I understood that it was a dangerous activity among all those homes. Nonetheless, I found myself angry with the government for the first time.

For the following 25 to 30 years we continued to put our yard waste at the curbside, but now it was in plastic garbage bags(preferably thick ply bags to prevent ripping). Wherever that very first plastic bag of leaves my father placed on the curbside went chances are it still sits there and will remain there for years to come. For reasons such as this the disposal of yard waste to landfills was eliminated as the Solid Waste Management Act became effective March 27, 1995. This leaves us with the options of doing nothing, a bad idea for numerous reasons, or composting the tree leaves for mulch. The latter is a great option that requires space, time, and labor which translates to money. What we need is another option, a simpler solution that is less time consuming and more cost effective for grounds, golf courses, and municipalities as well as the individual home owner. For this reason Michigan State University has two studies that examine the effects of mulching tree leaves into an existing turfgrass lawn. Keep in mind the objective is the disposal of leaves thus no observable differences between mulched and non-mulched plots is an acceptable solution.

The first study was initiated in 1990. The experimental design included three different leaf rates. Treatments were no leaves, 50 lbs. (covers shoe top) or 100 lbs. (ankle height) of dry leaves per 1000 sq. ft. Treatments were mulched into 4' x 8' plots in November of each year with a lawn mower. Nitrogen aids in breaking down leaves in the composting process. For this reason two nitrogen fertilization schedules were followed: a spring emphasis (Early) with applications in April, June, July, and September, and a fall emphasis (Late) with applications in June, July, September, and November. Each nitrogen program was applied at either 2 lbs. per 1000 sq. ft. annually (low) or 4 lbs. (high). The nitrogen has been applied as urea. Each treatment was replicated three times.

Turf color and quality ratings for this study are summarized in Tables 1 and 2, respectively. Of the six color ratings (Table 1) taken during the season only one (April 17) displayed statistical significance. On that date the mulched treatments displayed better color than the check plot. The seasonal average was better for mulched plots as well. The turf quality ratings had statistical significance on three of the six dates ratings were taken. These ratings were somewhat variable with both leaf rates outperforming the check on April 17, the Light and check treatments outperformed the High leaf rate on May 22, and the High rate had the highest rating on September 7. The Light rate of leaves ranked statistically higher than the check for the season average.

In Table 3 there is little data of statistical significance which implies there is no difference between treatments. The mulching of tree leaves into the turfgrass has led to concerns about disease incidence of the turf. In 1995 the only observable disease on the plots was pink snow mold and no differences or trends occurred. In past years necrotic ring spot had been observed but there were no differences between check plots and mulched plots. Fairy ring, often affiliated with decaying wood and organic matter, has never been observed on either of the two leaf mulch studies.

The percent organic matter samples taken in April, 1995 showed no effect of the leaf treatments although a tendency occurred were the organic matter content increased as the leaf rate increased in the thatch. Soil samples taken May 30, indicated there were no statistical differences due to treatment on pH, phosphorus, magnesium, or potassium. There appears to be a trend in the data that implies the leaves have increased the amount of potassium, but the lack of statistical strength leads us to conclude that no differences occur. The calcium tests were somewhat higher for the heavy leaf rate.

Turfgrass response to nitrogen is given in Tables 4-6. Color ratings (Table 4) and quality ratings (Table 5) indicate the higher nitrogen rate gave somewhat higher turf color ratings as would be expected, particularly when the nitrogen was applied in the spring. Turf quality ratings (Table 5) gave more consistent results. Plots receiving the higher rate of nitrogen had slightly thinner thatch layers (Table 6). The higher nitrogen rate may encourage more rapid decomposition of the leaf litter which was mulched into the turf. There was no statistically significant data with regard to the soil tests in this study.

It occurred to us that different tree leaves could have different effects on the grass. For this reason a second study was initiated in 1991 to examine the effects of two different leaf types. The chosen leaf types (oak and maple) were mulched into 4' x 12' Kentucky bluegrass plots at the rate of 100 lbs of dry leaves per 1000 sq. ft. Check plots received no leaves. Nitrogen was applied at 4 lbs. N per 1000 sq. ft. annually with either a spring or late fall emphasis. Spring emphasis applications were applied in April, May, July, and August while the fall dates were applied 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.

Though few statistical differences occurred the color ratings in Table 7 indicate the plots receiving the oak or maple leaf mulch treatments were equal to or greater than the check plots for all nine color rating dates. The seasonal average indicated leaf mulch was beneficial. Few differences occurred among quality ratings (Table 8) but the mulched plots fared slightly better than the check plots and the maple leaf treatment was significantly better than the check on July 20, August 21, and for the season average.

Weed population data were taken on May 12 and August 22 (Table 9). Shortly after the May 12 data was collected the plots received a broad leaf herbicide treatment. In late August weeds were once again observed on some plots and thus population counts were once again taken. Though there were no strong statistical differences in broadleaf weed counts the maple leaf-treated plots had no weeds. Also, the maple treatment was the only treatment that had no crabgrass on August 22. These data may suggest the use of maple leaf mulch could reduce the incidence of weeds in a healthy turf, but there certainly is not adequate data to make this statement with confidence. We will continue to monitor the weed populations for the upcoming year.

There was no effect of leaf type on soil tests (Table 10). The most current organic matter data for this study was collected in 1993. In 1993 the plots receiving leaves did have a higher percent organic matter in the thatch layer. The maple-treated plots had 16.0% organic matter compared to 10.3% in the check plot. The oak-treated plots had intermediate levels of organic matter (13.2%).

There was a very clear response to nitrogen in turf color and quality (Tables 11 and 12) when considered for the entire season, but on only a few dates were there significant differences.. Although the plots receiving nitrogen had fewer broadleaf weeds for the no leaf and oak leaf treatments(Table 13), the lack of weeds in the maple treated plots caused an interaction that resulted in no significant differences due to nitrogen treatment. The data for crabgrass counts were so clear that significance did occur with the nitrogen treated plots having less crabgrass. The effect of adequate nitrogen fertilization on reducing weed populations has been documented numerous times. There was no significant effect of nitrogen on leaf treatment on soil tests(Table 14) although there was a trend for lower potassium tests with nitrogen applications, a phenomenon frequently observed. Higher nitrogen rates can result in greater leaching of potassium, causing lower soil tests. There was no effect of nitrogen on the organic matter content of the thatch layer.

Since the inception of the first leaf mulch study few differences between mulched and non-mulched plots have been observed. Most differences that have occurred have been slight and usually favor the leaf mulch treatments. We feel confident that disposing of tree leaves in this manner is a viable option and encourage the exercise, but there are still many questions that need to be answered. What is the highest rate of leaves that a given turfgrass stand can have mulched into it? What will be the effect of mulching leaves on shady sites? Would ryegrass or fescue have done as well in the studies? What effect would other tree leaves(such as black walnut) have on the grass if they were mulched into them? Given time the scientific community in conjunction with turf professionals should help answer these questions.

Table 1.

Leaf Mulch Study-1995
Leaf Rates - Color Ratings
9=excellent, 1=dead, and 6 and above is acceptable.

Rate	Apr.17	May 22	June 6	July 5	Aug.4	Sept.7	Season Avg.
Heavy	6.13 a	7.04	7.17	7.71	7.46	7.46	7.16 a
Light	6.13 a	7.04	7.13	7.71	7.42	7.17	7.10 a
None	4.25 b	7.04	6.75	7.58	7.63	7.13	6.73 b
Prob.	0.0000	N.S.	N.S.	N.S.	N.S.	N.S.	0.0002
LSD @.05	0.6111	-----	----	-----	-----	-----	0.1874

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

Table 2.

Leaf Mulch Study-1995
Leaf Rates - Quality Ratings
9=excellent, 1=dead, and 6 and above is acceptable.

Rate	Apr.17	May 22	June 6	July 5	Aug.4	Sept.7	Season Avg.
Heavy	5.42 a	6.25 b	6.83	7.17	7.79	7.21 a	6.78 ab
Light	5.79 a	6.83 a	6.79	7.21	7.75	6.79 b	6.86 a
None	4.96 b	6.75 a	6.63	7.04	7.79	6.67 b	6.64 b
Prob.	0.0016	0.0222	N.S.	N.S.	N.S.	0.0295	0.0367
LSD @.05	0.4130	0.4342	-----	-----	-----	0.4078	0.1672

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

Table 3.

Leaf Mulch Study-1995
Leaf Rates - Miscellaneous

	Pink Snow Mold spots/plot	Thatch Thickness in cm	% Organic Matter	pH	# P/Acre	# K/Acre	# Ca/Acre	# Mg/Acre
Rate	Apr.17	April 19						
Heavy	6.67	3.64 cm	17.76	7.40	91.42	153.8	2421 a	416.7
Light	5.33	3.66 cm	16.67	7.38	96.17	80.58	2211 b	412.0
None	5.92	3.43 cm	15.08	7.40	98.17	68.83	2204 b	414.7
Prob.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	0.0021	N.S.
LSD @.05	-----	-----	-----	-----	-----	-----	126.2	-----

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

Table 4.

Leaf Mulch Study-1995
Nitrogen Factor - Color Ratings
9=excellent, 1=dead, and 6 and above is acceptable.

Rate	Apr.17	May 22	June 6	July 5	Aug.4	Sept.7	Season Avg.
Early Light	5.33	6.89 b	6.89 b	7.39 b	7.22 b	7.22	6.72 b
Late Light	5.50	6.83 b	6.61 b	7.33 b	7.00 b	7.22	6.62 b
Early Heavy	5.33	7.67 a	7.61 a	8.00 a	7.83 a	7.44	6.98 a
Late Heavy	5.83	6.78 b	6.94 b	7.94 a	7.94 a	7.11	6.71 b
Prob.	N.S.	0.0001	0.0007	0.0000	0.0034	N.S.	0.0056
LSD @.05	0.7057	0.3484	0.4328	0.2074	0.5452	-----	0.1931

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

Table 5.

Leaf Mulch Study-1995
Nitrogen Factor - Quality Ratings
9=excellent, 1=dead, and 6 and above is acceptable.

Rate	Apr.17	May 22	June 6	July 5	Aug.4	Sept.7	Season Avg.
Early Light	5.39	6.67	6.61 b	6.83 b	7.78	7.06	6.82 c
Late Light	5.44	6.56	6.33 b	6.78 b	7.56	7.06	6.75 c
Early Heavy	5.33	6.89	7.44 b	7.50 a	7.83	6.89	7.32 a
Late Heavy	5.39	6.33	6.61 b	7.44 a	7.94	6.56	7.09 b
Prob.	N.S.	N.S.	0.0004	0.0000	N.S.	N.S.	0.0001
LSD @.05	----	----	0.4658	0.2512	----	----	0.2164

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

Table 6.

Leaf Mulch Study-1995
Nitrogen Factor - Miscellaneous

	Pink Snow Mold Spots/Plot	Thatch Thickness in cm.	% Organic Matter	pH	# P/Acre	# K/Acre	# Ca/Acre	# Mg/Acre
Rate	Apr. 17	Apr. 19						
Early Light	5.78	3.79 a	16.34	7.38	86.56	86.00	2255	419.6
Late Light	5.22	3.67 ab	16.94	7.40	96.56	82.67	2274	424.9
Early Heavy	6.89	3.36 c	16.55	7.40	105.4	154.4	2330	408.0
Late Heavy	6.00	3.50 bc	16.20	7.40	92.44	71.11	2255	405.3
Prob.	N.S.	0.0227	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
LSD @.05	-----	0.2817	-----	-----	-----	-----	-----	-----

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

Table 7.

Oak and Maple Leaf Mulch Study-1995
Leaf Type - Color Ratings
9=excellent, 1=dead, and 6 and above is acceptable.

Treatment	Apr.17	Apr.24	May 22	June 6	July 5	July 20	Aug.4	Aug.21	Sept.7	Season Avg.
None	4.78 b	6.00	7.67	7.50 b	6.94	7.28	6.94	7.61	8.17	6.99 b
Oak	6.11 a	6.78	8.39	8.28 a	6.89	7.33	7.56	7.94	8.33	7.51 a
Maple	6.11 a	6.44	8.28	7.83 ab	6.94	7.61	7.44	7.67	8.28	7.40 a
Prob.	0.0001	N.S.	0.089	0.0138	N.S.	N.S.	N.S.	N.S.	N.S.	0.0020
LSD @ 0.05	0.556	----	0.694	0.4952	----	-----	----	0.5479	0.4666	0.2748

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

Table 8.

Oak and Maple Leaf Mulch Study-1995
Leaf Type - Quality Ratings
9=excellent, 1=dead, and 6 and above is acceptable.

Treatment	Apr.24	May 22	June 6	July 5	July 20	Aug.4	Aug.21	Sept.7	Season Avg.
None	5.22	6.94	6.67	6.00	6.39 b	6.39	6.61 b	7.44	6.46 b
Oak	5.78	7.28	7.72	6.17	6.89 ab	6.89	6.39 b	7.56	6.83 ab
Maple	5.94	7.61	7.44	6.39	7.22 a	6.83	7.50 a	7.83	7.10 a
Prob.	N.S.	N.S.	0.0886	N.S.	0.0221	N.S.	0.0204	N.S.	0.0232
LSD @ 0.05	----	----	0.9704	----	0.5715	-----	0.7917	-----	0.4407

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

Table 9.

Oak and Maple Leaf Mulch Study-1995
Leaf Type - Weed Counts

	Dandelion and Plantain Counts / Plot		Crabgrass Counts per Plot	
Treatment	May 12	Aug.22	Aug.22	Season Avg.
None	2.56	2.78	1.44 a	2.26
Oak	1.89	3.33	0.67 ab	1.96
Maple	0	0	0 b	0
Prob.	0.0807	N.S.	0.0440	N.S.
LSD @ 0.05	2.311	-----	1.1111	----

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

Table 10.

Oak and Maple Leaf Mulch Study-1995
Leaf Type - Miscellaneous

Treatment	pH	P	K	Ca	Mg	1993 % OM
None	7.38	22.78	65.00	1930	306.7	10.33 b
Oak	7.42	25.00	76.00	1913	323.6	13.22 ab
Maple	7.48	23.11	72.89	2006	315.6	16.00 a
Prob.	N.S.	N.S.	N.S.	N.S.	N.S.	0.0187
LSD @ 0.05	----	----	----	----	----	3.764

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

Table 11.

Oak and Maple Leaf Mulch Study-1995

Color Ratings

9=excellent, 1=dead, and 6 and above is acceptable.

Treatment	Apr.17	Apr.24	May 22	June 6	July 5	July 20	Aug.4	Aug.21	Sept.7	Season Avg.
No Leaves No Nitrogen	4.17	4.33	5.67	5.33 c	5.17 b	4.83	4.67	6.17	6.83	5.24 c
No Leaves Spring N	4.67	6.67	8.67	9.00 a	7.83 a	9.00	8.17	8.17	8.83	7.89 a
No Leaves Fall N	5.50	7.00	8.67	8.17 a	7.83 a	8.00	8.00	8.50	8.83	7.83 a
Oak Leaves No Nitrogen	6.17	6.17	7.33	7.16 b	5.33 b	4.83	6.33	7.50	7.33	6.46 b
Oak Leaves Spring N	6.00	7.16	8.83	8.67 a	7.67 a	8.83	8.00	8.17	9.00	8.04 a
Oak Leaves Fall N	6.17	7.00	9.00	9.00 a	7.67 a	8.33	8.33	8.17	8.67	8.04 a
Maple Leaves No Nitrogen	5.83	5.17	7.33	6.50 b	5.50 b	5.83	6.17	7.00	7.83	6.35 b
Maple Leaves Spring N	6.17	7.33	8.83	8.83 a	7.50 a	8.83	8.17	8.33	8.50	8.06 a
Maple Leaves Fall N	6.33	6.83	8.67	8.17 a	7.83 a	8.17	8.00	7.67	8.50	7.80 a
Prob.	N.S.	N.S.	N.S.	0.0174	N.S.	N.S.	N.S.	0.0660	N.S.	0.0073
LSD @ 0.05	----	----	----	0.8577	----	----	----	0.9489	----	0.4760

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

Table 12.

Oak and Maple Leaf Mulch Study-1995

N Factor - Quality Ratings

9=excellent, 1=dead, and 6 and above is acceptable.

Treatment	Apr.24	May 22	June 6	July 5	July 20	Aug.4	Aug.21	Sept.7	Season Avg.
No Leaves No Nitrogen	3.83	4.83	3.00 d	3.83	3.83	3.83	4.67 b	5.50	4.17 d
No Leaves Spring N	5.50	7.83	8.83 a	7.00	8.17	7.67	7.67 a	8.50	7.65 a
No Leaves Fall N	6.33	8.17	8.18 a	7.17	7.17	7.67	7.50 a	8.33	7.56 a
Oak Leaves No Nitrogen	5.17	5.67	6.33 bc	4.17	4.17	5.33	5.00 b	6.00	5.23 c
Oak Leaves Spring N	6.00	7.83	8.33 a	7.17	8.67	7.83	7.50 b	8.33	7.71 a
Oak Leaves Fall N	6.17	8.33	8.50 a	7.17	7.83	7.50	6.67 a	8.33	7.56 a
Maple Leaves No Nitrogen	4.83	6.67	5.83 c	4.83	5.17	5.67	7.33 a	7.67	6.00 b
Maple Leaves Spring N	6.67	8.00	8.50 a	7.00	8.67	7.67	7.83 a	7.83	7.77 a
Maple Leaves Fall N	6.33	8.17	8.00 ab	7.33	7.83	7.17	7.33 a	8.00	7.52 a
Prob.	N.S.	N.S.	0.0196	N.S.	N.S.	N.S.	0.0443	N.S.	0.0154
LSD @ 0.05	----	----	1.681	----	----	----	1.371	----	0.7633

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

Table 13.

Oak and Maple Leaf Mulch Study-1995 N Factor - Weeds			
	Dandelion and Plantain Counts Per Plot		Crabgrass Counts Per Plot
Treatment	May 12	Aug.22	Aug.22
No Leaves No Nitrogen	7.67	7.00	4.00 a
No Leaves Spring N	0	0.67	0 c
No Leaves Fall N	0	0.67	0.33 bc
Oak Leaves No Nitrogen	5.00	9.33	2.00 b
Oak Leaves Spring N	.333	0.33	0 c
Oak Leaves Fall N	.333	0.33	0 c
Maple Leaves No Nitrogen	0	0	0 c
Maple Leaves Spring N	0	0	0 c
Maple Leaves Fall N	0	0	0 c
Prob.	0.0609	N.S.	0.0493
LSD @ 0.05	4.002	----	1.925
Means in columns followed by the same letter are not statistically different at the 5% level using the LSD mean separation test.			

Table 14.

Oak and Maple Leaf Mulch Study-1995 N Factor - Miscellaneous						
Treatment	pH	P	K	Ca	Mg	1993 % OM
No Leaves No Nitrogen	7.50	24.33	95.00	2010	296.0	12.00
No Leaves Spring N	7.33	22.00	50.00	1903	296.0	10.00
No Leaves Fall N	7.30	22.00	50.00	1875	328.0	9.00
Oak Leaves No Nitrogen	7.43	25.67	109.7	1752	341.3	10.00
Oak Leaves Spring N	7.37	22.00	56.33	1954	325.3	15.00
Oak Leaves Fall N	7.47	27.33	62.00	2032	304.0	14.67
Maple Leaves No Nitrogen	7.50	25.67	97.67	2017	301.3	16.00
Maple Leaves Spring N	7.57	22.33	62.00	2045	336.0	13.33
Maple Leaves Fall N	7.37	21.33	59.00	1957	309.3	18.67
Prob.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
LSD @ 0.05	------	----	----	----	----	----