

Improvement of Loamy Sand with Organic Matter Amendments

James A. Murphy, Ph.D.
Charles Schmid, Ph.D. candidate
59 Dudley Road, New Brunswick, NJ 08901-8520
Dept. of Plant Biology and Pathology, NJAES, Rutgers University

The objectives of this field study was to determine the effect of increasing the organic matter content with several locally available sources on the establishment and survival of a low maintenance turfgrass cover on a loamy sand.

Materials and Methods

The experimental site was located in open field at Jakes Branch County Park in Beachwood NJ, which was vegetated with weeds (largely annual grasses and sedges and some broadleaves) growing on a 6-inch deep layer of loamy sand containing 3.5% soil organic matter (SOM), by weight. The topsoil layer was readily penetrated with a soil probe and displayed no characteristics of severe compaction. Weeds were eliminated with glyphosate.

The treatment structure in this experiment included several controls to determine the effects, if any, caused by changes in soil potassium, pH and bulk density separate from effects caused by organic matter addition. One control received no improvement practices except for a typical N and phosphate fertilizer application at seeding. A second control received a surface application of potassium fertilization and liming based on soil test results. The third control treatment incorporated the application of potassium fertilization and limestone with the tillage method used to incorporate the organic matter amendments. The three organic matter amendment treatments were 357 cubic yards per acre of leaf compost, 485 cubic yards per acre of Scotts Premium Topsoil, and 258 cubic yards per acre of Premier sphagnum peat. These rates were selected based on the goal of increasing organic matter content of the loamy sand to 7% by weight.

Soil treatments were initiated 24 September 2012. A Harley rake was used to loosen and stir the surface inch of topsoil over the entire trial area, simulating conventional soil tillage to prepare landscapes for seeding with turfgrass. This was the extent of the physical preparation of the soil for the N-P and N-P-K-lime treatments. Based on soil test results, potash (0-0-50) was applied at 6.1 pounds per 1,000 square feet to all treatments except the non-amended (OceanGro only) treatment. Similarly, calcitic lime was applied at 32.0 pounds per 1,000 square feet to all treatments except the non-amended and Scotts Topsoil treatments. The Scotts Topsoil treatment was not limed because of the high pH of this amendment.

Each 9- x 9-foot plot was marked to guide the incorporate of amendments in four treatments with tillage. All organic matter amendments were applied in two split applications on 25 September 2012. After the first split rate was applied and raked evenly over the center 6- x 6-ft of each plot, one pass of a Rotadairon[®] tiller was used to incorporate the amendment. Two passes (in opposite directions) of the tiller were used to incorporate amendments after the second split rate was applied. Tillage was limited to the center 6- x 6-ft of each plot. After tillage, soil was hand raked to evenly spread and smooth the soil within each 9 x 9 feet plot.

A layout of the plots at this experimental site is presented in Appendix I of this report.

OceanGro (5-5-0) fertilizer and turfgrass seed were applied to all plots on 25 September 2012. The entire trial received 1 pound of N and available phosphate per 1,000 square feet. The trial at was seeded at 3.1, 3.3, and 2.5 pounds per 1,000 square feet with 'Bullseye' tall fescue, 'Spyder LS' tall fescue, and 'Heron' hard fescue, respectively.

Summary of the fertility and organic matter amendment levels of the six treatments applied to the loamy sand site at Jakes Branch County Park in Beachwood NJ on 24 and 25 September 2012.

#	Soil Fertility			Organic Matter Source	Organic Matter Amendment Rate ^d cu. yd. / acre	Tillage ^e
	5-5-0 ^a	0-0-50 ^b	Lime ^c			
1	yes	no	no	none	0	none
2	yes	yes	yes	none	0	none
3	yes	yes	yes	none	0	Rotadairon [®]
4	yes	yes	yes	Leaf compost	357	Rotadairon [®]
5	yes	yes	yes	Sphagnum peat	258	Rotadairon [®]
6	yes	yes	no	Scotts Topsoil	485	Rotadairon [®]

^a OceanGro (5-5-0) fertilizer applied at 1 pound of N and available phosphate per 1,000 square feet on 25 September 2012.

^b Soluble potash (0-0-50) applied at 6.1 pounds per 1,000 square feet on 24 September 2012.

^c Calcitic lime applied at 32.0 pounds per 1,000 square feet on 24 September 2012.

^d Amendment rates of each organic matter source were based on increasing organic matter content of the loamy sand to 7% by weight.

^e Tillage plots received 1 pass of a Rotadairon[®] tiller after the first split application of organic amendments and 2 passes of the tiller after the second split application of organic amendments.

Results

Leaf compost and sphagnum peat were the amendments responsible for the delayed establishment of turf on amendment treatments compared to the tillage control treatment on 19 Dec. 2013 (Table 1). And leaf compost delayed establishment more than the sphagnum peat.

By March 2013, organic matter amendments treatments were not different from the tillage control but the Scotts topsoil treatment had better turf cover than the leaf compost and sphagnum peat treatments. The leaf compost plots had less turf cover than the sphagnum peat plots.

Winter annual weeds were a large component of the turf on 10 May 2013. Fertilization of plots with K and lime significantly increased weed cover and incorporation of K and lime reduced weed invasion by 23%. Incorporation of organic matter amendments further reduced weed cover by 11% on average.

Drought stress had damaged turf cover by June 2013 (Table 1). Brown (dead) turf cover ranged from 33 to 54% on treatments that were not amended with organic matter. Turf damage on plots

amended with organic matter range from 5 to 18% of the turf, which was 23% less damage, on average, than the tillage control treatment.

Leaf color during spring (March and May) was not affected application of K and lime; however, tillage without organic matter amendment did improve color to an acceptable level (Table 2). By May, all organic matter amendment treatments improved turf color above the tillage control treatment and the Scotts topsoil treatment had better color than the leaf compost and sphagnum peat treatments.

The substantial drought stress in June keep turf color of plots not amended with organic matter below an acceptable level. All organic matter amendment treatment had better turf color than the tillage control treatment and the Scotts topsoil plots had better color the leaf compost and sphagnum peat plots.

The poor turf quality of plots in May reflect the extensive weed cover; all organic matter amendment treatments had better turf quality than the tillage control treatment in May (Tables 1 and 3). Tillage with organic matter amending improved turf quality compared to no tillage in June when drought stress and damage was evident; however, turf quality was not acceptable (Table 3). Plots amended with organic matter were the only plots to have acceptable quality and plots amended with Scotts topsoil had the best turf quality.

Additional data was collected in 2012 and 2013 is currently being analyzed. Plots were further damaged after the drought stress observation in June 2013. It is unlikely that plots will recover from this damage. It is recommended that the plots be sampled for soil nutrient and organic matter content, after which the weeds should be killed and the trial re-seeded for assessment of establishment and survival into 2014. Soil volumetric water content and bulk density would also be monitored during late 2013 and 2014.

Table 1. Organic matter amendment effects on the establishment of a turfgrass mixture (tall fescue and hard fescue) seeded on 25 September 2012 on loamy sand at Jakes Branch County Park in Beachwood NJ.

#	Soil Treatment	20 Dec. 2012	5 Mar. 2013	10 May 2013	24 Jun. 2013	
		-----	Live Turf Cover (%)	-----	Weed Cover (%)	Brown Turf Cover (%)
1	Control ^a	90	85	39	54	
2	K, Lime Control ^{abc}	91	89	71	50	
3	K, Lime, Tillage Control ^{abcd}	91	90	48	33	
4	K, Lime, Leaf Compost, Tillage ^{abcd}	66	74	43	6	
5	K, Lime, Sphagnum Peat, Tillage ^{abcd}	87	86	33	18	
6	K, Scotts Topsoil, Tillage ^{abd}	95	98	35	5	
<u>Treatment Contrasts</u>						
	1 vs. 2, 3	NS	NS	**	NS	
	2 vs. 3	NS	NS	**	NS	
	3 vs. 4, 5, 6	***	NS	*	*	
	4, 5 vs. 6	***	***	NS	NS	
	4 vs. 5	***	**	NS	NS	
	CV (%)	6.5	6.8	20.7	67.1	

^a OceanGro (5-5-0) fertilizer applied at 1 pound of N and available phosphate per 1,000 square feet on 25 September 2012.

^b Soluble potash (0-0-50) applied at 6.1 pounds per 1,000 square feet on 24 September 2012.

^c Calcitic lime applied at 32.0 pounds per 1,000 square feet on 24 September 2012.

^d Tilled with 1 pass of a Rotadairon[®] tiller after the first split application of organic amendments and 2 passes of the tiller after the second split application of organic amendments.

Table 2. Organic matter amendment effects on leaf color of a turfgrass mixture (tall fescue and hard fescue) seeded on 25 September 2012 on loamy sand at Jakes Branch County Park in Beachwood NJ.

#	Soil Treatment	5 Mar. 2013	10 May 2013	24 Jun. 2013
----- Color (1 to 9 scale; 9 = dark green, 5 = acceptable) -----				
1	Control ^a	3.8	3.8	3.0
2	K, Lime Control ^{abc}	3.8	3.8	3.5
3	K, Lime, Tillage Control ^{abcd}	5.0	5.0	4.5
4	K, Lime, Leaf Compost, Tillage ^{abcd}	5.0	6.3	6.3
5	K, Lime, Sphagnum Peat, Tillage ^{abcd}	5.5	6.8	6.0
6	K, Scotts Topsoil, Tillage ^{abd}	6.3	7.8	8.0
<u>Treatment Contrasts</u>				
	1 vs. 2, 3	NS	NS	NS
	2 vs. 3	**	**	NS
	3 vs. 4, 5, 6	NS	***	**
	4, 5 vs. 6	**	**	*
	4 vs. 5	NS	NS	NS
	CV (%)	10.8	10.7	20.2

^a OceanGro (5-5-0) fertilizer applied at 1 pound of N and available phosphate per 1,000 square feet on 25 September 2012.

^b Soluble potash (0-0-50) applied at 6.1 pounds per 1,000 square feet on 24 September 2012.

^c Calcitic lime applied at 32.0 pounds per 1,000 square feet on 24 September 2012.

^d Tilled with 1 pass of a Rotadairon[®] tiller after the first split application of organic amendments and 2 passes of the tiller after the second split application of organic amendments.

Table 3. Organic matter amendment effects on turf quality of a turfgrass mixture (tall fescue and hard fescue) seeded on 25 September 2012 on loamy sand at Jakes Branch County Park in Beachwood NJ.

#	Soil Treatment	10 May 2013	24 Jun. 2013
----- Turf Quality (1 to 9 scale; 9 = dark green, 5 = acceptable) -----			
1	Control ^a	4.5	2.5
2	K, Lime Control ^{abc}	3.3	2.0
3	K, Lime, Tillage Control ^{abcd}	4.0	4.0
4	K, Lime, Leaf Compost, Tillage ^{abcd}	5.3	6.5
5	K, Lime, Sphagnum Peat, Tillage ^{abcd}	6.3	6.0
6	K, Scotts Topsoil, Tillage ^{abd}	6.5	7.8
<u>Treatment Contrasts</u>			
	1 vs. 2, 3	NS	NS
	2 vs. 3	NS	***
	3 vs. 4, 5, 6	***	***
	4, 5 vs. 6	NS	**
	4 vs. 5	NS	NS
	CV (%)	14.2	14.9

^a OceanGro (5-5-0) fertilizer applied at 1 pound of N and available phosphate per 1,000 square feet on 25 September 2012.

^b Soluble potash (0-0-50) applied at 6.1 pounds per 1,000 square feet on 24 September 2012.

^c Calcitic lime applied at 32.0 pounds per 1,000 square feet on 24 September 2012.

^d Tilled with 1 pass of a Rotadairon[®] tiller after the first split application of organic amendments and 2 passes of the tiller after the second split application of organic amendments.

Appendix 1. Map of experimental area showing the arrangement of treatments in the amendment trial.

