Use Of Detroit Sewage Sludge Compost For Sod Production

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Throughout the large cities of the United States the commonly used methods of sewage sludge disposal (ocean dumping, land filling, and incineration) are being restricted because of specific environmental limitations. An alternative to the present methods used by most cities is the composting of sewage sludge with subsequent application of the compost to agricultural lands. Sod farms, because of their close proximity to metropolitan areas, have been considered ideal sites for land application of sewage sludge compost.

The use of compost in sod production may be of benefit to the sod grower. Typically sewage sludge compost contains sufficient amounts of N and P to partially fulfill the fertilization requirements of turf for sod production (2). Moreover, the large amount of organic matter present in compost (50% by weight, dry solids) can improve soil physical properties by incorporation of the compost (1).

Certain limitations, such as excessive heavy metal availability, may restrict the amount of compost which can be utilized for sod production. The purpose of this study, in part, was to determine if constraints should be placed on the utilization of Detroit sewage sludge compost for sod production. The findings presented herein represent field plot visual observations taken the first growing season following incorporation of Detroit sewage sludge compost.

Materials and Methods

Two sod farms with contrasting soil types (Table 1) served as plot site locations for this study. Compost was applied at rates from 0 to 150 tons/acre (t/a) and was rototilled to a depth of 4 or 8 inches. Treatments were applied in late August (1979) to coincide with the normal field preparation for late summer seeding. Both plot sites were seeded with 45 lbs/acre Kentucky bluegrass the last week in August. Lack of rainfall in the fall together with poor snow cover in the winter of 1979-1980, resulted in poor seed germination and establishment of the turf at both locations. Plots were reseeded May 10 at the Huron Sod Farm and May 27 at the Waltz Green Acres Sod Farm.

Table 1. Soil types present at the 2 sod farm plot locations.

	Sod farm	
	Waltz Green Acres	Huron
Soil Type	Pewamo sandy clay loam	Oakville fine sand
pH (1:1)	6.6	4.9
% Sand	53.1	93.2
% Silt	20.4	4.0
% Clay	26.5	2.8
% Organic Matter	4.0	2.0

Monthly visual observations of percent plot cover began in April of 1980 at the Huron Sod Farm and were discontinued when no significant difference among treatments could be detected. Because of the slower seed germination on the finer-textured soil, visual observations of the percent plot cover at the Waltz Green Acres Sod Farm did not commence until July 1980. Turf color and visual quality ratings at both sites were initiated when sufficient turf plot cover allowed for meaningful visual evaluation of these parameters.

Results

Visual observations of the percent plot cover at the Huron (Table 2) and Waltz Green Acres (Table 3) Sod Farms revealed that incorporation of compost inhibited seedling emergence and sod establishment of Kentucky bluegrass. However, with time the inhibitory effect of the compost diminished. The inhibitory effect of the compost appeared to be more pronounced at the Waltz Green Acres Sod Farm than at the Huron Sod Farm.

Initially, the inhibitory effect of compost on sod formation was minimized on treatments where the compost had been incorporated to a depth of 8 inches. At the time of the first evaluation at both locations, turf cover was significantly higher with the 8 inch depth of incorporation for the 75 t/a compost application rate. At the Waltz Green Acres sod farm, turf cover was significantly higher for the 8 inch depth for the 37.5 t/a compost rate as well. By the second evaluation, depth of incorporation had no effect on percent turf cover at either sod farm. The third evaluation at each sod farm revealed that no significant difference in turf cover existed among all treatments.

Table 2. Effect of compost on the rate of development of Kentucky bluegrass sod at the Huron Sod Farm plots.

Treatment compost	Treatment incorporation	4/23/80	5/24/80	6/23/80	7/24/80	8/25/80
tons/ac.	inches	-------------------% plot cover*				-------------------
0	4	56.3 ab+	76.3 abc	75.0 a	77.5 a	85.0 a
0	8	60.0 a	81.3 a	80.0 a	77.5 a	91.3 a
37.5	4	47.5 bcd	73.8 bc	77.5 a	78.8 a	93.8 a
75.0	4	33.8 e	67.5 d	70.0 a	75.0 a	87.5 a
37.5	8	50.0 bc	78.8 ab	80.0 a	82.5 a	96.3 a
75.0	8	45.0 cd	72.5 bcd	77.5 a	82.5 a	95.0 a
112.5	8	38.8 de	71.3 cd	75.0 a	83.8 a	97.5 a

+Treatment means having the same letter within a column are not significantly different at the 5% level by Duncan's New Multiple Range Test.

*Percent cover ragings are visual estimates made on a 1 to 100 scale with 100 equal to maximum turfgrass cover, 0 equal to bare ground.

Table 3. Effect of compost on the rate of development of Kentucky bluegrass sod at the Waltz Green Acres Sod Farm plots.

Treatment compost	incorporation	7/24/80	8/26/80	9/23/80	10/23/80
tons/ac.	inches	-----------------% plot cover*			-------------------
0	4	55.0 a	82.5 a	91.3 a	95.0 a
0	8	56.3 a	78.8 a	88.8 a	90.0 a
37.5	4	26.3 bc	71.3 ab	85.0 a	91.3 a
75.0	4	16.3 c	61.3 bc	83.8 a	87.5 a
37.5	8	46.3 a	72.5 a	83.8 a	83.8 a
75.0	8	28.8 b	62.5 bc	90.0 a	91.3 a
150.0	8	18.8 bc	52.0 c	82.0 a	92.5 a

Treatment means having the same letter within a column are not significantly different at the 5% level by Duncan's New Multiple Range Test.

*Percent cover ratings are visual estimates made on a 0 to 100 scale with 100 equal to maximum turfgrass cover, 0 equal to bare ground.

Table 4. Effect of compost on the color of Kentucky bluegrass sod during the 1980 growing season at the Huron Sod Farm plots.

Treatment compost	incorporation	6/23/80	7/24/80	8/25/80	9/23/80	10/23/80
tons/ac.	inches	-----------------color rating*				--------------------
0	4	7.3 a	8.3 a	8.0 a	8.0 a	6.5 a
0	8	6.0 bc	8.0 a	7.8 a	7.5 a	6.0 a
37.5	4	6.5 ab	6.0 b	5.8 b	5.5 bc	4.8 b
75.0	4	5.0 c	6.5 b	5.0 bc	5.3 bc	4.8 b
37.5	8	5.8 bc	6.0 b	5.0 bc	5.8b	5.0 b
75.0	8	5.3 bc	5.5 b	4.8 c	5.0 bc	4.5 b
112.5	8	5.5 bc	6.3 b	4.3 c	4.3 c	4.0 b

Treatment means having the same letter within a column are not significantly different at the 5% level by Duncan's New Multiple Range Test.

*Color ratings are visual estimates made on 1 to 9 scale with 6 being the minimum acceptable color, 1 being completely brown turf, and 9 being the maximum dark green color attainable.

Observation on November 27, 1979 revealed that a hydrophobic soil condition had developed on plots amended with compost. Lack of sufficient rainfall in the fall, following treatment application allowed the compost-amended soils to dry out. The dry conditions promoted the development of the hydrophobic condition. The hydrophobic soil condition was likely responsible for the greater delay in bluegrass seed emergence observed on the compost-amended plots. The presence of supplemental irrigation at the time of seeding together with the application of a wetting agent should insure that compost-amended soils do not develop a hydrophobic soil condition. In this study neither supplemental irrigation nor application of a wetting agent took place following seeding.

Color ratings were made on a 1 to 9 scale, with 1 equal to a completely brown turf, 3 a yellow turf, 6 an acceptable green turf, 9 a very dark green turf. Color ratings at the Huron Sod Farm (Table 4) revealed that the presence of compost resulted in a reduction in green color of the turf. Yellowing of the turf in the compost-treated plots was greatest in the months of August and September and was least noticeable in the month of June.

From August until the end of the color evaluations in October, all compost treatments had color ratings which were unacceptable (below 6). The two check treatments had acceptable color throughout this period. With the exception of the month of June, both check treatments were judged to have significantly darker green color than all compost treatments throughout the entire growing season. Nitrogen immobilization caused by the presence of wood chips in the compost may have been responsible for the chlorotic color of the turf. Because of insufficient turf cover, color ratings at the Waltz Green Acres Sod Farm did not begin until October of 1980. At this site, no significant difference in turf color was found among all treatments, possibly because of greater nitrogen availability in this soil which had 4.0% organic matter.

Turfgrass quality ratings were based on turf density, color, uniformity and verdure. The aspect of color was deemphasized in an attempt to avoid repeating information already given in the color ratings. Quality ratings commenced at the Huron Sod Farm in July of 1980 while at the Waltz Green Acres Sod Farm quality ratings did not begin until September of 1980. Quality ratings at both sod farms revealed that no significant differences existed among the various treatments, throughout the 1980 growing season.

Seed germination of Manhattan perennial ryegrass was substantially reduced under high irrigation conditions in the greenhouse at a 75% (by volume compost rate on both soils. Under low irrigation conditions, 50 and 75% compost resulted in a substantial reduction in ryegrass seed germination on the Oakville soil.

Compost had no significant effect on sod shear strengths in the field (Table 5), but did result in increased dry matter production (Table 6). Increasing rates of composted sludge increased organic matter content of the soil (Table 5) and significantly increased soil pH and soil tests for potassium (K), calcium (Ca) and magnesium (Mg) on both soils (Tables 7 and 8). There was no effect on phosphorus (P) soil tests, however.

Based on our research, we believe that application of Detroit sewage sludge compost to mineral soils does not appear to adversely affect sod growth. The value of the compost as slow release fertilizer and as a soil amendment was readily apparent in this study.

Sincere appreciation is expressed to Bill Reinhold and Len Zilka of Huron Sod Farms and the Chant brothers of the Waltz Green Acres Sod Farm for giving us space on their farms to conduct the research and for their cooperation with us.

Literature Cited

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Table 5. Sod shear strength and percent soil organic matter determined on the Pewamo and Oakville soils.

Treatment		Oakville		Pewamo	
compost	incorporation	organic matter	sod strength	organic matter	sod strength
mt/ha	cm	%	kg	%	kg
0	10	1.8 c*	44.7 a	5.7 d	48.3 a
0	20	2.0 c	47.0 a	5.7 d	49.8 a
84	10	3.4 b	40.5 a	7.3 cd	51.6 a
168	10	4.2 a	50.1 a	9.4 b	64.3 a
84	20	3.0 b	42.5 a	6.5 d	51.0 a
168	20	3.4 b	46.7 a	8.4 bc	56.6 a
252	20	4.5 a	50.9 a	---	----
336	20	---	----	11.3 a	61.8 a

*Treatment means having the same letter within a column are not significantly different at the 5% level by Duncan's New Multiple Range Test.

Table 6. Dry clipping weights of Kentucky bluegrass harvested from the two sod farms in the summer of 1981.*

Treatment compost	Treatment incorporation	Huron Oakville fine sand	Waltz Pewamo sandy clay
mt/ha	cm	grams/plot	
0	10	56.5 b[+]	9.5 c
0	20	57.6 b	8.5 c
84	10	62.5 b	27.1 b
168	10	58.7 b	56.8 a
84	20	77.1 ab	28.5 b
168	20	111.5 a	40.2 b
252	20	87.5 ab	----
336	20	----	71.0 a

[+]Treatment means having the same letter within a column are not significantly different at the 5% level by Duncan's New Multiple Range Test.

*Date of harvest, July 29, for Pewamo soil, September 6, for Oakville soil.

Table 7. Extractable macroelement and pH levels of an Oakville fine sand soil amended with various compost treatments on August 21. 1979 and sampled July 21, 1980 and September 19, 1981.

Treatment compost	Treatment incorporation	pH	P	K	Ca	Mg
				1980 samples		
mt/ha	cm			ppm		
0	10	5.2 c[+]	420 a	110 d	430 d	43 b
0	20	5.3 c	420 a	130 cd	500 d	55 b
84	10	6.6 ab	470 a	170 ab	1330 b	118 a
168	10	6.7 a	470 a	190 a	1500 ab	105 a
84	20	6.3 b	520 a	150 bc	1100 c	120 a
168	20	6.6 a	470 a	170 ab	1500 ab	115 a
252	20	6.7 a	580 a	190 a	1580 a	108 a
				1981 samples		
0	10	5.9 b[+]	470 a	60 c	600 d	93 b
0	20	5.9 b	470 a	80 bc	650 d	100 b
84	10	6.9 a	420 a	110 a	1450 bc	187 a
168	10	7.0 a	500 a	120 a	1820 a	200 a
84	20	6.9 a	480 a	100 ab	1300 c	179 a
168	20	7.0 a	470 a	110 a	1620 ab	184 a
252	20	7.2 a	500 a	120 a	1650 ab	181 a

[+]Treatment means having the same letter within a column are not significantly different at the 5% level by Duncan's New Multiple Range Test. Macroelement comparisons among the two years were not analyzed.

Table 8. Extractable macroelement and pH levels of a Pewamo sandy clay loam soil amended with various compost treatments on August 22, 1979 and sampled July 7, 1980 and August 21, 1981.

Treatment compost	Treatment incorporation	pH	P	K	Ca	Mg
		1980 samples				
mt/ha	cm	ppm				
0	10	6.6 b[+]	180 b	280 c	4460 c	770 a
0	20	6.6 b	180 b	270 c	4520 c	830 a
84	10	6.9 a	250 a	310 c	4930 abc	740 a
168	10	6.9 a	310 a	410 b	5150 ab	700 a
84	20	6.9 a	250 ab	300 c	4720 bc	715 a
168	20	7.0 a	260 a	350 bc	4930 abc	760 a
336	20	7.0 a	310 a	500 a	5360 a	690 a
		1981 samples				
0	10	6.3 c[+]	150 d	280 b	4430 d	790 a
0	20	6.6 b	150 d	250 b	4610 d	810 a
84	10	6.7 ab	250 bc	300 b	5260 bc	790 a
168	10	6.8 a	310 ab	370 ab	5690 ab	810 a
84	20	6.8 a	220 cd	270 b	4810 cd	740 a
168	20	6.9 a	260 bc	310 b	5170 bc	770 a
336	20	6.9 a	350 a	440 a	6110 a	760 a

[+]Treatment means having the same letter within a column are not significantly different at the 5% level by Duncan's New Multiple Range Test. Macroelement comparisons among the two years were not analyzed.