



Research Services Division

Project Report

1.0 Project Title:

Performance of organic fertilizers and amendments on low- to medium-maintenance Kentucky bluegrass home lawn type turf on poor rootzones

2.0 Sponsor:

Turf Revolution and EasyFlo

3.0 Objective:

The objective of this research project was to determine the performance of the sponsor's fertilizer and organic amendment products on low maintenance Kentucky bluegrass home lawn type turf on a poor quality rootzone.

Data collected included the duration and strength of the color response following applications of the tested products, turf quality, uniformity, and density, and resistance of the turf to disease, weed and drought stress.

4.0 Experimental Design / Methods:

The six treatments consisted of the sponsor's products (Corn Plus 8-1-6 and Alfalfa 5-1-5 fertilizer, and EasyFlo compost product on aerified and unaerified plots) at the recommended rate and program, as well as an industry standard fertilizer product (25-4-10, 60% SCU) at 150 kg actual N ha⁻¹ yr⁻¹ and split over 3 applications (Table 1). An unfertilized check treatment was also included. Aerification of compost treated plots was done with hollow tine coring equipment just prior to the first compost treatment application. Treatments were applied to 2 x 2 m plots of mixed species turf maintained as a low maintenance turf on a poor soil (limited topsoil, low fertility) area at the Guelph Turfgrass Institute (Figure 1). Treatments were replicated five times in a randomized complete block design. Treatments were applied May 26, July 24, and September 15, 2006 (alfalfa, corn gluten meal, and NPK standard) or May 26 and September 15, 2006 (compost).



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Table 1. Treatments

Corn Plus 8-1-6	50 kg N ha ⁻¹ x 3 applications
Alfalfa 5-1-5	50 kg N ha ⁻¹ x 3 applications
EasyFlo compost – aerified prior to first application + NPK	19.5 kg ha ⁻¹ x 2 applications + 50 kg N ha ⁻¹ x 3 applications
EasyFlo compost – not aerified + NPK	19.5 kg ha ⁻¹ x 2 applications + 50 kg N ha ⁻¹ x 3 applications
NPK control (25-4-10, 60% SCU)	50 kg N ha ⁻¹ x 3 applications
Untreated check	



Figure 1. Plot area in low maintenance turf: May 26, 2006 (aerification and first treatment application).

Color response of the turf to treatments was assessed, both visually and using instrumental color (Minolta CR310 full spectrum colorimeter, Spectrum CM1000 chlorophyll meter, and Greenseeker normalized-difference vegetation index [NDVI] meter). Uniformity of the color response was assessed visually. Plots were also rated for turf quality, density and uniformity. Root systems were sampled at the beginning and end of the season to determine treatment effects on total root system biomass. Root system sampling involved collection of soil cores, washing root systems free of soil, drying and measurement of biomass as dry matter. Other stresses were measured as they occurred (disease, weed, drought). Spring greenup will be assessed in April 2007. An anecdotal photographic record of the experiment was kept.

All measurements were analysed by appropriate statistical analyses (general linear models).

5.0 Results:

Visual ratings: Color, quality, uniformity, density. All treatments, including the controls, exhibited acceptable functional features when rated visually once the fertilizer treatments had been applied (Table 2). Generally the fertilized treatments were significantly better than the unfertilized check, but the differences among the fertilized treatments were small. The two compost treatments tended to be a little higher and the Corn Plus treatment slightly lower on dates when differences were significant.

Table 2. Visual ratings of treated plots.

Treatment	06/05	06/16	06/26	07/14	08/01	08/16	09/27
Color ¹							
Alfalfa 5-1-5	7.6 bc	7.6 b	7.0 b	8.0	7.7 a	8.0 a	8.0
Corn Plus 8-1-6	7.2 de	8.0 a	8.0 a	8.0	7.0 b	8.0 a	7.8
EasyFlo compost – aerified + NPK	7.5 cd	8.0 a	8.0 a	8.0	8.0 a	7.8 a	7.8
EasyFlo compost – not aerified + NPK	8.0 a	7.8 ab	8.0 a	8.0	8.0 a	8.0 a	7.8
NPK control	7.9 ab	8.0 a	8.0 a	8.0	7.8 a	8.0 a	7.6
Untreated check	7.0 e	7.0 c	8.0 a	8.0	7.0 b	7.2 b	7.4
lsd p=0.05	0.4	0.4	0.0	NS	0.4	0.3	NS
Quality ¹							
Alfalfa 5-1-5	6.0	7.0	7.0 a	6.8	7.5 ab	7.0	7.0
Corn Plus 8-1-6	6.0	7.0	7.0 a	6.6	7.0 c	7.2	7.0
EasyFlo compost – aerified + NPK	6.0	7.2	7.0 a	7.0	7.8 a	7.4	7.0
EasyFlo compost – not aerified + NPK	6.0	7.0	7.0 a	6.8	7.7 a	7.4	7.0
NPK control	6.0	7.1	7.0 a	7.0	7.3 bc	7.2	7.0
Untreated check	6.0	7.0	6.0 b	6.8	7.0 c	7.0	7.0
lsd p=0.05	NS	NS	0.0	NS	0.3	NS	NS
Uniformity ¹							
Alfalfa 5-1-5	6.0	7.0	7.0 a	6.8	7.5 ab	7.0	7.0
Corn Plus 8-1-6	6.0	7.0	7.0 a	6.6	7.0 c	7.2	7.0
EasyFlo compost – aerified + NPK	6.0	7.2	7.0 a	7.0	7.8 a	7.4	7.0
EasyFlo compost – not aerified + NPK	6.0	7.0	7.0 a	6.8	7.7 a	7.4	7.0
NPK control	6.0	7.1	7.0 a	7.0	7.3 bc	7.2	7.0
Untreated check	6.0	7.0	6.0 b	6.8	7.0 c	7.0	7.0
lsd p=0.05	NS	NS	0.0	NS	0.3	NS	NS
Density ¹							
Alfalfa 5-1-5	6.0	7.0	7.0	7.0	7.8 ab	7.0	7.0
Corn Plus 8-1-6	6.0	7.0	7.2	6.8	7.0 c	7.2	7.0
EasyFlo compost – aerified + NPK	6.0	7.2	7.2	7.4	8.0 a	7.4	7.0
EasyFlo compost – not aerified + NPK	6.0	7.0	7.2	7.0	8.0 a	7.4	7.0
NPK control	6.0	7.1	7.2	7.0	7.6 b	7.2	7.0
Untreated check	6.0	7.0	7.0	6.8	7.0 c	7.0	7.0
lsd p=0.05	NS	NS	NS	NS	0.4	NS	NS

¹All visual ratings are on a scale of 0-10, with 10 being best and 6 being acceptable. Means of 5 replicates. Means within columns followed by the same letter are not significantly different (Fisher's protected LSD, p=0.05).

Instrumental color and chlorophyll index data. Patterns in the data observed with the full-spectrum colorimeter and particularly the Spectrum chlorophyll meter and Greenseeker normalized difference vegetation index (NDVI) meter were similar to the visual ratings. Generally, only the lightness and hue angle parameters of the full spectrum color readings are meaningful in turf evaluation. The fertilized treatments tended to be greener and darker than the unfertilized check, but the differences were very small (Table 3). The two chlorophyll meters measure very similar parameters in the turf, namely a ratio of absorbed vs reflected light at a reference wavelength and at a wavelength at which chlorophyll absorbs (in the case of the Spectrum chlorophyll meter, 800 and 740 nm respectively). The patterns of treatment effects on chlorophyll index/NDVI and by inference chlorophyll content and nitrogen fertility status were very similar between the two sets of data (Tables 4 and 5, Figures 2 and 3). All fertilized plots had significantly higher readings than the control, and significant differences developed among the fertilized treatments. Generally, the two compost treatments had the highest index values (although there was an initial decline in the aerified compost treatment, presumably because of the stress of the aerification system. The Corn Plus treatment had the lowest index of the fertilized treatments, and the alfalfa and NPK standard were intermediate.

Table 3. Instrumental color readings of treated plots (Minolta CR310 colorimeter).

Treatment	06/14	07/11	08/11
	Lightness ¹		
Alfalfa 5-1-5	42.24 b ⁴	41.82	42.89 b
Corn Plus 8-1-6	42.58 b	41.92	42.46 b
EasyFlo compost – aerified + NPK	42.62 b	41.58	42.72 b
EasyFlo compost – not aerified + NPK	42.48 b	41.91	43.02 ab
NPK control	42.51 b	41.99	42.93 b
Untreated check	43.93 a	42.36	43.59 a
lsd p=0.05	0.93	NS	0.64
	Chroma ²		
Alfalfa 5-1-5	15.77 ab	17.00	15.78 b
Corn Plus 8-1-6	15.26 bc	17.13	14.88 c
EasyFlo compost – aerified + NPK	14.36 c	16.84	15.76 b
EasyFlo compost – not aerified + NPK	15.50 b	16.94	15.81 b
NPK control	15.49 b	17.15	15.97 ab
Untreated check	16.55 a	17.88	16.70 a
lsd p=0.05	0.96	NS	0.75
	Hue angle ³		
Alfalfa 5-1-5	127.54 a	124.00 b	120.48
Corn Plus 8-1-6	125.70 b	123.30 b	119.98
EasyFlo compost – aerified + NPK	126.09 ab	126.38 a	121.39
EasyFlo compost – not aerified + NPK	127.40 ab	123.07 b	122.38
NPK control	126.02 ab	122.89 b	121.18
Untreated check	123.28 c	123.54 b	120.19
lsd p=0.05	1.84	1.78	NS

¹ Lightness 0 (black) to 100 (white).

² Chroma (vividness or color saturation) 0 (grey) to 60 (fully saturated)

³ Hue angle 0 to 360 degrees; in the range observed, lower values are yellower, higher are greener.

⁴ Means of 5 readings x 5 replicates; means within columns followed by the same letter are not significantly different (Fisher's protected LSD, p=0.05)

Table 4. Chlorophyll index in treated plots.

Treatment	05/08	06/05	06/13	06/19	06/26	07/04	07/10	07/14
Alfalfa 5-1-5	242.2 b ¹	338.5 c	398.6 b	381.7 a	407.2 a	447.8 b	293.9 b	363.8 ab
Corn Plus 8-1-6	243.5 b	325.0 d	392.8 b	378.3 a	417.6 a	451.7 ab	282.1 c	358.4 b
EasyFlo compost – aerified + NPK	244.7 b	308.2 e	369.4 c	381.5 a	407.7 a	465.4 a	309.5 a	370.7 a
EasyFlo compost – not aerified + NPK	265.6 a	406.2 a	426.3 a	388.3 a	407.2 a	445.4 b	284.9 bc	369.7 a
NPK control	243.3 b	394.9 b	405.6 ab	362.3 b	383.5 b	422.8 c	275.6 c	363.8 ab
Untreated check	249.3 b	300.5 e	332.7 d	334.3 c	357.6 c	391.5 d	282.7 c	302.3 c
lsd p=0.05	15.9	9.5	22.8	14.3	14.5	17.4	11.1	10.6

Treatment	07/24	07/26	07/31	08/08	08/21	08/30	09/05	09/22
Alfalfa 5-1-5	349.0 ab	369.4 a	417.9 c	386.5 b	381.6 a	347.0 ab	320.6 ab	403.2 c
Corn Plus 8-1-6	341.5 abc	354.5 bc	394.8 d	364.2 c	374.4 ab	335.0 c	314.3 b	385.7 d
EasyFlo compost – aerified + NPK	352.9 a	364.1 ab	464.7 a	413.3 a	363.8 b	354.1 a	330.6 a	461.8 a
EasyFlo compost – not aerified + NPK	337.0 bcd	347.7 c	440.5 b	399.7 ab	375.2 ab	341.5 bc	325.4 ab	453.7 a
NPK control	332.9 cd	351.8 c	438.7 b	388.8 b	374.1 ab	356.5 a	323.0 ab	424.4 b
Untreated check	323.3 d	347.2 c	381.4 d	323.5 d	326.4 c	316.2 d	285.6 c	324.3 e
lsd p=0.05	14.4	11.6	14.9	16.7	13.4	11.3	12.4	15.0

¹Chlorophyll index (0-1000), measured with Spectrum CM1000 chlorophyll meter; higher value indicates more absorbance of light at 740 nm and by inference a higher chlorophyll concentration. Means of 10 readings x 5 replicates. Means within columns followed by the same letter are not significantly different (Fisher's protected LSD, p=0.05).

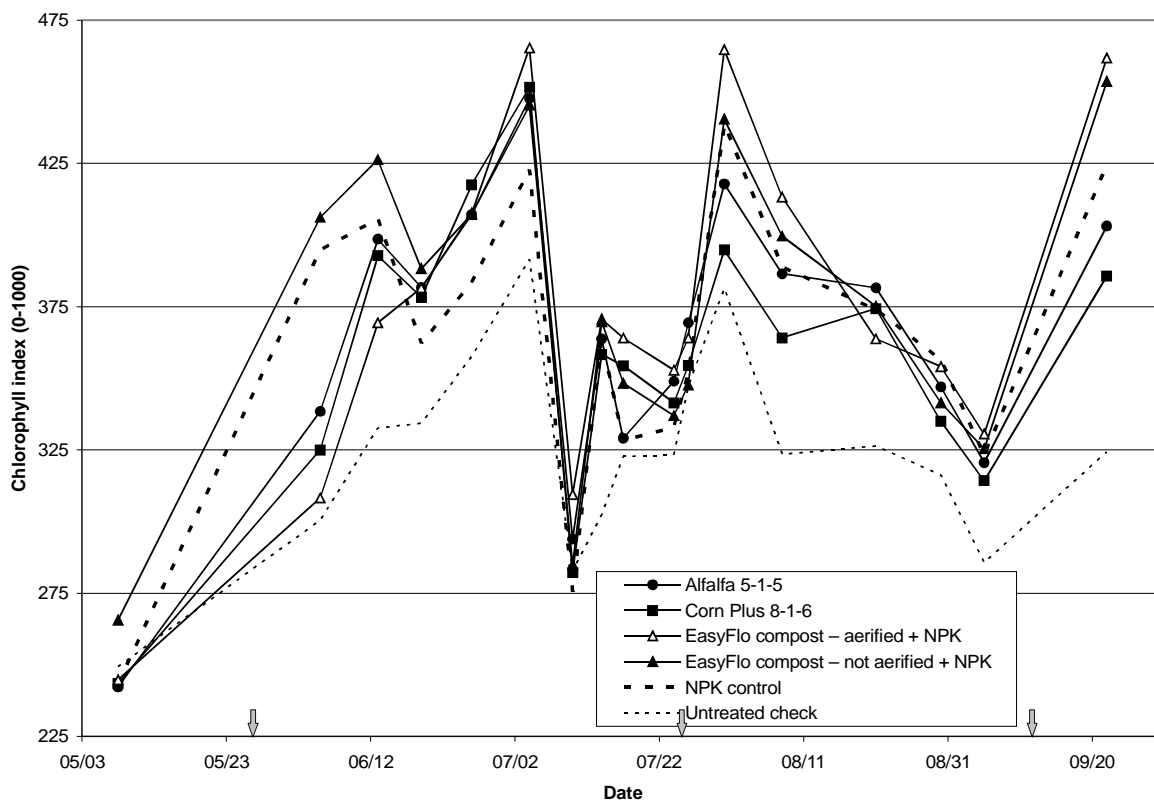


Figure 2. Chlorophyll index readings in treated plots. Grey arrows indicate treatment application dates.

Table 5. Normalized difference vegetation index in treated plots.

Treatment	06/15	06/23	06/29	07/03	07/10	07/19	07/25
Alfalfa 5-1-5	0.9093 b ¹	0.9361 a	0.8866 ab	0.8878 a	0.8540 ab	0.9189 a	0.8856 a
Corn Plus 8-1-6	0.9088 b	0.9328 a	0.8900 a	0.8863 ab	0.8638 a	0.9204 a	0.8868 a
EasyFlo compost – aerified + NPK	0.8932 c	0.9341 a	0.8807 bcd	0.8791 c	0.8647 a	0.9109 a	0.8893 a
EasyFlo compost – not aerified + NPK	0.9148 a	0.9353 a	0.8815 bc	0.8818 bc	0.8625 a	0.9167 a	0.8675 b
NPK control	0.9119 ab	0.9275 ab	0.8770 cd	0.8739 d	0.8451 b	0.9200 a	0.8967 a
Untreated check	0.8900 c	0.9222 b	0.8741 d	0.8719 d	0.8616 a	0.8940 b	0.8650 b
lsd p=0.05	0.0043	0.0090	0.0071	0.0046	0.0149	0.0117	0.0132

Treatment	08/09	08/14	08/22	08/30	09/06	09/20	10/05
Alfalfa 5-1-5	0.8709 b	0.8967 b	0.9046 ab	0.9188 ab	0.9248 a	0.8622 a	0.9085 a
Corn Plus 8-1-6	0.8603 c	0.9075 ab	0.9106 a	0.9119 ab	0.9159 a	0.8272 c	0.9094 a
EasyFlo compost – aerified + NPK	0.8737 b	0.9192 a	0.8884 c	0.9215 a	0.9147 a	0.8616 a	0.9061 ab
EasyFlo compost – not aerified + NPK	0.8808 ab	0.9131 a	0.8946 bc	0.9156 ab	0.9124 a	0.8613 a	0.9067 ab
NPK control	0.8881 a	0.9140 a	0.9079 a	0.9072 bc	0.9169 a	0.8508 b	0.9039 b
Untreated check	0.8507 c	0.9008 b	0.8948 bc	0.8985 c	0.8914 b	0.8311 c	0.8752 c
lsd p=0.05	0.0103	0.0122	0.0121	0.0130	0.0168	0.0062	0.0040

¹NDVI (0-1), measured with Greenseeker meter; higher value indicates more absorbance of light and by inference a higher chlorophyll concentration. Means of 10-20 readings x 5 replicates. Means within columns followed by the same letter are not significantly different (Fisher's protected LSD, p=0.05).

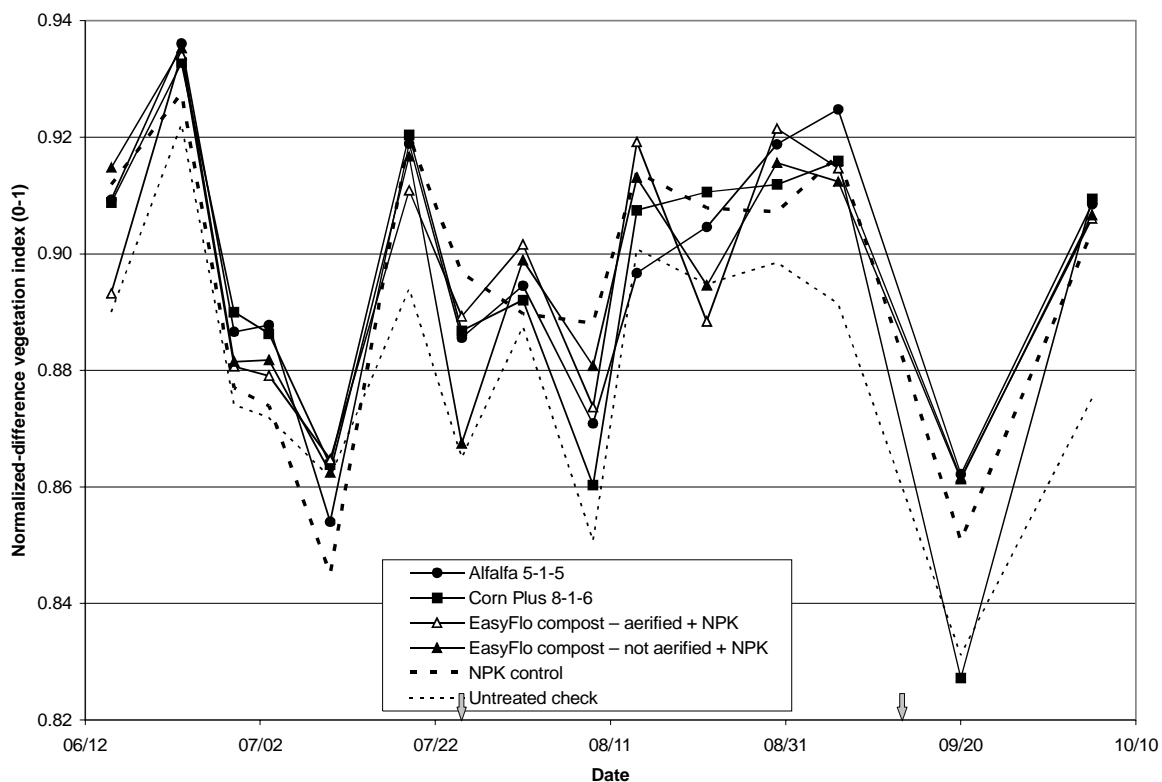


Figure 3. Normalized difference vegetation index readings in treated plots. Grey arrows indicate treatment application dates. Black arrows are clipping collection dates.

Root system size estimated by tissue dry weight. There were not any strong patterns in the root system data (Table 6). Most of the fertilized treatments had less root tissue than the unfertilized check, although the aerified compost treatment had the same amount of growth.

Table 6. Root system size estimated by shoot dry matter before and after experiment.

Treatment	05/10	11/20
Alfalfa 5-1-5	0.21 ¹	0.52 b
Corn Plus 8-1-6	0.18	0.54 b
EasyFlo compost – aerified + NPK	0.19	0.84 a
EasyFlo compost – not aerified + NPK	0.20	0.50 b
NPK control	0.17	0.55 b
Untreated check	0.17	0.91 a
lsd p=0.05	NS	0.23

¹ Mean root tissue (grams dry weight) collected from 2 cm dia x 15 cm deep soil cores. Means of 5 cores x 5 replicates. Means within columns followed by the same letter are not significantly different (Fisher’s protected LSD, p=0.05).

6.0 Conclusions:

All fertilized treatments provided significant improvement in nitrogen status over the unfertilized control throughout the season (16 weeks plus), even though the differences in visual ratings of performance (color, quality, uniformity, and density) were small and the unfertilized plot never fell below and adequate rating. The instrumental color and chlorophyll index indicated that there was significant turfgrass response to all five fertilizer treatments. Among the experimental treatments, most were as good as or better than the standard NPK treatment on most dates, with the exception of the Corn Plus treatment which fell below the standard on a few dates. The best performance came from the compost+NPK treatments (except for the early dates in the aerified compost+NPK treatment, which required a few weeks to recover from the aerification stress).