The Effects of Organic Management Practices
on the Quality and Playability of Athletic Fields, Year Two

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Introduction

The pressure to use organic products in the management of turf is becoming more and more commonplace. The trend has started to reach athletic fields, with the ban of pesticide use in Connecticut on school grounds (pre-K through 8th grade) originally effective July 2009. This legislation has since been delayed until July 2010. While many organic materials have proven equal to their synthetic counterparts, their application to sportfields and the effect on playing surface quality is an area that has not been significantly researched. This was the second year of a study assessing the playability and quality of athletic turf under different organic management regimes, as compared to more traditional maintenance practices using synthetic products.

Materials & Methods

This study was arranged in a random complete block design, with two factors and four replications. The first factor, management regime, contained six levels: 1) Synthetic 2) Organic Manure (Oman) 3) Organic Protein (Opro) 4) Organic Manure + Biologicals (Opro + bio) 5) Organic Protein + Biologicals (Opro + bio) 6) None, or the control. The second factor, overseeding, had only two levels: overseeded or not overseeded.

Prior to initiating any treatments for the 2009 growing season, the study area (originally 'Langara' Kentucky bluegrass) was renovated to simulate spring re-establishment efforts on a typical fall use athletic field. The whole study was core aerated on 30 April in two directions using a Ryan greens aerator with 5/8" tines. Cores were mulched and returned to their respective plots. All plots were then overseeded with 'Langara' Kentucky bluegrass at 2 lbs. per 1000 ft^2, and synthetically managed plots were treated with a granular application of Siduron (Tupersan) at 1.5 lbs. per 1000 ft^2. On 11 May the whole study received a granular application of phosphorus at a rate of 1lb. per 1000 ft^2. Triple super phosphate (0-46-0) was applied to the synthetic plots, while the organic and control plots were treated with Bone Char (0-16-0). Plots were mowed three times per week with a rotary mower at a height of 2 inches.

An organic, pre-emergent herbicide, Safespring (Corn Gluten Meal), was applied to organically maintained plots on 26 May, at a rate of 12 lbs. per 1000 ft^2. This application was delayed 26 days after seeding to allow for sufficient germination, as corn gluten meal has been shown to inhibit germination of new seedlings. Urea (46-0-0) was also applied on 26 May to all synthetic plots to match the 9% nitrogen content of the Safespring. To control broadleaf weed populations, the herbicide Q4 (Quinclorac + Sulfentrazone + 2,4-D + Dicamba) was applied to all synthetic plots on 9 July at a rate of 3 oz. per 1000 ft^2. At the time of application, no commercially available organic, broadleaf herbicide could be located for use.

Fungicide applications began on 25 June. The synthetic plots were treated on 28 day intervals with Headway at 3 oz. per 1000 ft^2. The organic plots received EcoGuard on 14 day intervals at 20 oz. per 1000 ft^2. Both fungicides were applied via a pressurized (40 psi) CO_2 sprayer outfitted with a flat-fan nozzle (8010E), and calibrated to deliver 2 gallons of water per 1000 ft^2. Since there was a small amount of nitrogen (0.14 lbs per 1000 ft^2) in the EcoGuard, urea was also applied to the synthetic plots. The last application was applied on 17 September. These products were lightly watered in after application.

Insecticides to preventively control white grubs were applied on 16 June. The synthetic plots received Merit 0.3G at 2 lbs. per 1000 ft^2 using a handheld shaker, and then watered after application. The organic plots were treated with a parasitic nematode product, Nemasys G

(*Heterorhabditis bacteriophora*), on 28 August, per label instructions based on larval growth stage. The nematodes were applied using the aforementioned CO_2 sprayer at a rate of 37,850 active units per square foot (1.65 billion active units per acre). The plots were watered both pre and post treatment to ensure maximum efficacy.

Fertilizer treatments began on 16 June and were repeated on 21 day intervals with the last treatment being applied on 19 October. Organic protein plots received Safegreen (4-1-3), while Organic manure plots were treated with Cheep Cheep (4-3-3). Both products were applied at a rate of 7.5 lbs. per 1000 ft^2, and then supplemented with Bone Char (0-16-0) to ensure each received equal amounts of phosphorus. The synthetic plots were treated with urea (46-0-0), triple super phosphate (0-46-0), and potassium chloride (0-0-60) at rates which matched that applied by the organic fertilizers. All products were applied using a handheld shaker and were watered-in. The Compost Tea was also applied at the same time as the fertilizer treatments at a rate of 128 oz. per 1000ft^2. It was applied using the CO_2 sprayer and then lightly watered-in. In the first year of this study, the mid-August fertilization regime was substituted with a second application of Safespring, Dimension, and urea. This was not done in 2009 due to the adverse effects these products may have had on germination rates when overseeding during the traffic period. Instead, a nitrogen treatment was applied to mimic the nitrogen content of the Safespring and urea. The synthetic plots were treated with urea at a rate of 2.35 lb. per 1000 ft^2, and the organic plots received Pro Booster (10-0-0) at a rate of 9 lbs. per 1000 ft^2 for the OPro regimes, and 10 lbs. per 1000 ft^2 for the OMan regimes. The overall fertilizer amounts for the season were based on pre-season soil nutrient results, and were targeted at 4 lbs. nitrogen, 4 lbs. phosphorus, and 1 lb. potassium.

Traffic simulation was conducted using a Cady Traffic Simulator, a modified walk-behind core cultivation unit. Traffic was applied three times a week beginning 17 August and ending on 4 November. Each traffic event consisted of running the simulator over the whole study in two directions. A total of 34 traffic events were conducted, to match the number of events conducted the previous year. As a second factor in the study, some plots were overseeded during trafficking. These plots received Perennial ryegrass (*Lolium perenne*) at a rate of 6 lbs. per 1000 ft^2 per week starting on 28 August. Overseeding was done with a walk-behind drop spreader prior to trafficking in order to let the simulator work the seed through the canopy and establish the desired seed-soil contact.

Data collected in this study included ratings of turf quality and color. This was done by visual rating using a scale of 1 to 9, where 1 = brown/dead turf; 6 = minimum acceptable color/quality; and 9 = optimum quality or dark green color. Digital image analysis was utilized in assessing turf color and cover. Controlled light conditions were provided through the use of a light box. Images were scanned using Sigma Scan Software using the following threshold values; hue=55-125 and saturation=10-100. The Dark Green Color Index (DGCI) was calculated based on hue, saturation and brightness values. Color, quality, and cover data was collected weekly. Rotational traction was measured using a Canaway traction device. Data was collected every other week from during the traffic period, with three subsamples being taken and averaged on each date. Surface hardness and soil moisture content were measured using a 2.25 kg Clegg Hammer (Clegg, Western Australia) and a Trime-FM TDR 5 cm probe (Mesa Systems Co., Medfield, MA), respectively. Measurements were taken weekly through the duration of traffic application. On each sampling date, three readings were taken per plot and then averaged. Weed count data was obtained for both crabgrass and broadleaf weeds. Counts were done visually beginning on 22 June and proceeding every other week through the beginning of November. Soil physical properties and organic matter contents will also be measured.

Summary of Results

This was the second year of this study. Data from the 2008 season was reported in last year's annual report. The 2009 data is in the process of being evaluated. Any data that has already been analyzed is reported in the following sections.

Color

The first application of fertilizer came on 26 May in the form of corn gluten meal for the organic treatments and urea for the synthetic treatments. The color response was similar to that in that in 2008. The synthetic plots exhibited a faster response to the fertilizer, having significantly higher DGCI values than the organic and control treatments eight days after application (Figure 1). At this point, all organic plots did have darker turf color than the control. Fifteen days after application, there was no longer a statistical difference between the synthetic and organic treatments, and all were still displaying darker green color than the control.

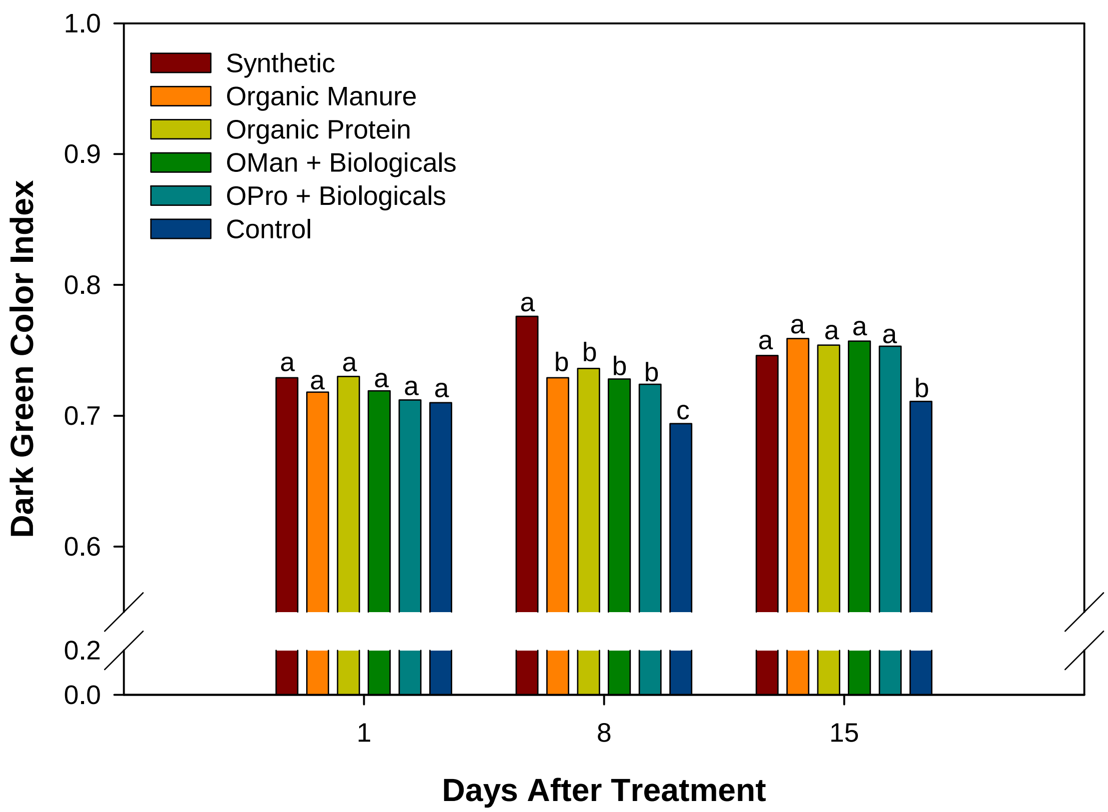

Figure 1. DGCI color values after early season application of Urea and Corn Gluten Meal, 2009

This trend of similar turf color between the organic and synthetic treatments continued through the majority of the summer. Many sampling dates showed no significant difference in visual color ratings or DGCI values between certain organic treatments and the synthetic plots (Table 1). On a number of dates though, the DGCI and color ratings of various organic treatments proved to be statistically greater than those of the synthetic. This was especially apparent in mid to late July. Throughout the mid-summer, all treatments receiving some form of nutrient input demonstrated darker turf color than the control plots, which received no fertility.

Table 1. Effect of management regimes on color and DGCI values during mid-summer, 2009

	Date				
Management	19 June†	2 July	15 July	29 July	12 Aug
			DGCI‡		
Synthetic	0.728 b	0.737 a	0.724 b	0.741 b	0.742 b
Oman	0.742 a	0.738 a	0.769 a	0.759 a	0.753 ab
Opro	0.735 ab	0.739 a	0.763 a	0.762 a	0.762 a
Oman + bio	0.744 a	0.739 a	0.769 a	0.764 a	0.755 ab
Opro + bio	0.735 ab	0.742 a	0.764 a	0.759 a	0.753 ab
None	0.690 c	0.700 b	0.694 c	0.720 c	0.719 c
			Color§		
Synthetic	7.50 a	7.50 a	6.75 b	6.88 b	6.50 b
Oman	7.13 ab	6.75 b	7.25 a	7.38 a	6.63 ab
Opro	6.88 b	7.00 b	7.25 a	7.38 a	6.63 ab
Oman + bio	7.25 ab	7.13 ab	7.50 a	7.25 ab	6.88 a
Opro + bio	6.88 b	7.00 b	7.13 ab	7.25 ab	6.75 ab
None	4.88 c	4.88 c	4.88 c	4.63 c	4.75 c

† Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD (P<0.05)

‡ Dark Green Color Index (DGCI) , the greater the number the darker the color green

§ Color ratings: 1 = brown/dead; 6 = minimum acceptable color; 9 = optimum, dark green color

In August and September, with the onset of traffic simulation, the variation in turf color starts to change. On 19 August, the Opro and OMan+bio treatments were still showing darker turf color than the synthetic plots (Table 2). Additionally, all organic and synthetic treatments were darker than the control. The color differences begin to change on 9 September, with the synthetic plots displaying some of the darkest green color, and the OPro+bio treatment falling off slightly. By 30 September, there was no statistical difference between any of the organic treatments and the synthetic, but all were still darker in color than the control. All organic regimes had lighter green color than the synthetic treatments on 21 October and 6 November.

Table 2. Effect of management regimes on DGCI values during traffic, 2009

	DGCI†				
Management	19 Aug‡	9 Sept	30 Sept	21 Oct	6 Nov
Synthetic	0.731 b	0.771 a	0.765 a	0.699 a	0.735 a
Oman	0.751 ab	0.754 abc	0.754 a	0.663 b	0.704 b
Opro	0.757 a	0.749 bc	0.752 a	0.658 b	0.706 b
Oman + bio	0.753 a	0.763 ab	0.766 a	0.672 b	0.712 b
Opro + bio	0.749 ab	0.740 c	0.745 a	0.654 b	0.705 b
None	0.709 c	0.664 d	0.693 b	0.628 c	0.673 c

† Dark Green Color Index (DGCI) , the greater the number the darker the color green

‡ Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD (P<0.05)

Overseeded treatments displayed darker green turf throughout the entire second year of the study. The overseeding from the 2008 season resulted in significantly greater DGCI values in the spring of 2009 (Table 3). The results were the same during the traffic period as well.

Overall, the synthetic and organic products were very similar in their effect on turf color. The organic fertilizers initially took longer to promote a color response, but they were ultimately able to match the color seen in the synthetically fertilized plots. For the majority of the 2009 season, the color ratings of the organic treatments proved to be equal to or better than that of the synthetic regime. All treatments were consistently darker in color than the control. In addition, overseeding also proved to be an effective means of maintaining adequate turf color.

Table 3. Effect of overseeding on DGCI values, 2009

	DGCI†					
Overseeded	16 May‡	19 June	15 July	19 Aug	16 Sept	15 Oct
Yes	0.737 a	0.734 a	0.757 a	0.754 a	0.742 a	0.740 a
No	0.709 b	0.724 b	0.738 b	0.730 b	0.713 b	0.700 b

† Dark Green Color Index (DGCI), the greater the number the darker the color green

‡ Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD (P<0.05)

Quality

The effect of the management regimes on turf quality showed very little variation during the second year of the study. From the beginning of June through September, the synthetic treatments displayed higher turf quality than both the organic and control treatments (data not shown). Additionally, there were no observed differences between the organic regimes, but all of them had significantly better turf quality than the control plots. During the traffic period, the separation between the synthetic and organic regimes became less clear. On 23 September, there was no statistical difference between the quality of the synthetic treatment and any of the organic treatments (Table 4). All, however, were exhibiting higher quality than the control. This trend continued through the end of the traffic period.

Table 4. Effect of management regimes on turf quality during traffic, 2009

	Quality†				
Management	12 Aug‡	2 Sept	23 Sept	15 Oct	8 Nov
Synthetic	7.38 a	6.50 a	4.75 a	4.50 a	3.00 a
Oman	5.63 b	4.88 b	4.63 a	4.25 ab	3.13 a
Opro	5.63 b	4.75 b	4.63 a	4.13 ab	3.00 a
Oman + bio	5.63 b	5.25 b	4.63 a	4.25 ab	3.00 a
Opro + bio	5.75 b	4.75 b	4.63 a	4.00 b	2.88 a
None	3.63 c	3.25 c	2.63 b	2.63 c	1.88 b
		Number of Traffic Events			
	0	7	16	25	34

† Quality ratings: 1 = dead turf; 6 = minimum acceptable quality; 9 = optimum quality

‡ Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD (P<0.05)

Turf quality ratings were consistently affected by overseeding for the duration of the second year of this study. The overseeding from the previous year resulted in significantly higher turf quality during the spring and early summer 2009 (Table 5). Overseeding during traffic also proved to be beneficial, as overseeded treatments had higher quality ratings on every sampling date.

Table 5. Effect of overseeding on turf quality, 2009

	Quality†						
Overseeded	11 May‡	10 Jun	15 July	12 Aug	9 Sept	15 Oct	8 Nov
Yes	4.83 a	5.50 a	6.08 a	6.08 a	5.67 a	4.79 a	3.75 a
No	3.42 b	3.92 b	5.04 b	5.13 b	4.21 b	3.13 b	1.88 b

† Quality ratings: 1 = dead turf; 6 = minimum acceptable quality; 9 = optimum quality

‡ Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD (P<0.05)

Overall, the synthetic regime showed the highest level of turf quality, closely followed by the organic regimes. Although, once traffic started there was no longer a difference in quality. In addition, all treatments had consistently higher quality ratings than the controls. This indicates that trafficked athletic fields will ultimately lose turf quality with time, but nutrient and pest management, whether it be synthetic or organic in nature, is necessary to maintain the highest quality possible.

The results of overseeding on turf quality are very conclusive. The added pressures of traffic will ultimately result in a loss of turf cover, and thus overall quality. Overseeding during the traffic period not only led to immediate increase in overall quality, but was also effective at increasing the quality in following spring and summer. The quality ratings during the traffic period were below an acceptable level though, so increasing the overseeding rate my be necessary to maintain desired turf conditions.

Percent Cover

The reestablishment of the turf in the spring yielded very few differences between treatments. However, the control plots did exhibit lower turf densities than all other treatments on a number of sampling dates (data not shown). It was not until after the application of corn gluten meal and urea on 26 May, that cover differences become more apparent. One day after initial treatment (DAT), no differences were observed in turf cover between any of the treatments (data not shown). Eight DAT, the synthetic treatments had significantly higher cover than all other treatments (Figure 2). There was no distinction between any of the organics, but all of them had greater densities than the control plots. The separation between synthetic and organics became less apparent 24 DAT, and there was no longer any statistical difference in turf cover between any of the treated plots by 29 DAT. Nonetheless, all regimes had greater turf cover than the controls. This trend in turf cover continued until the application of traffic began (data not shown).It should be noted that the first round of seasonal fertilizer treatments was applied on 16 June, 21 DAT.

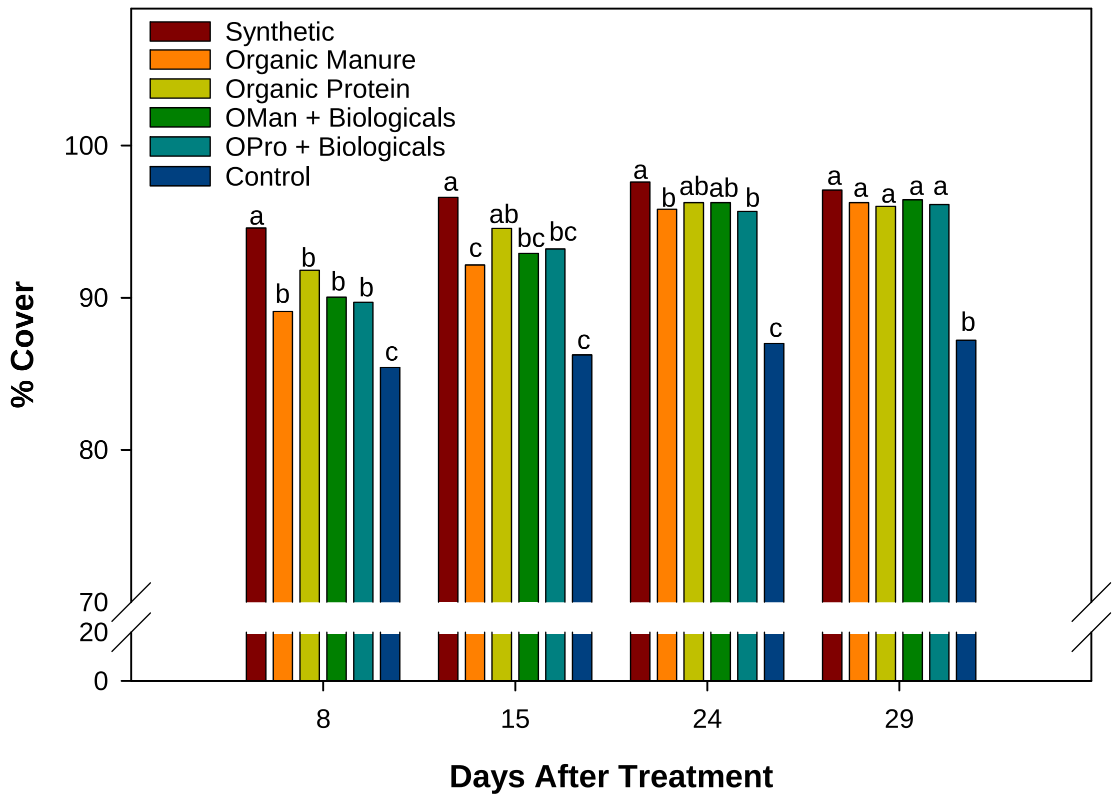

Figure 2. Effect of management regimes on percent turf cover after application of urea and Corn Gluten Meal, 2009

During the traffic period, there was not a lot of difference in turf cover between the treatments. The control treatment consistently had the lowest densities through the entire fall (Table 6). At the onset of traffic, the synthetic and organic regimes were exhibiting very similar cover. On 2 September, most treatments were still very similar, with the Opro+bio regime having less turf cover than some of the other organic regimes. All organic treatments, except Opro+bio, had significantly higher densities than the synthetic treatment on 23 September. Late in the fall, the Opro+bio regime was still showing low densities, being statistically lower than its Opro counterpart on 15 October and 6 November. It should be noted, however, that by the beginning of November, all treatments were well below 50% turf cover.

Table 6. Effect of management regimes on the percent of turf cover during traffic, 2009

Management	Cover†				
	12 Aug‡	2 Sept	23 Sept	15 Oct	6 Nov
	%				
Synthetic	96.13 a	83.39 a	66.14 b	64.48 ab	38.25 ab
Oman	96.01 a	82.38 a	72.27 a	66.49 ab	40.98 ab
Opro	94.93 b	79.71 ab	74.52 a	71.60 a	43.36 a
Oman + bio	95.53 ab	82.69 a	74.53 a	68.19 ab	41.23 ab
Opro + bio	95.58 ab	76.96 b	70.52 ab	62.80 b	35.50 b
None	92.18 c	65.13 c	51.21 c	42.81 c	20.94 c
	Number of Traffic Events				
	0	7	16	25	34

† Percent cover was calculated using Sigma Scan software; # of green pixels compared to total # of pixels

‡ Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD ($P<0.05$)

The effect of overseeding from the 2008 season was clearly depicted in the spring and early summer data from 2009 (Figure 3). Overseeded treatments had significantly greater turf densities than non-overseeded treatments up until the beginning of July. At this point, the turf cover remained relatively constant until the start of traffic in late August. By 2 September, only seven events into the traffic period, the overseeded treatments we showing statistically higher densities than non-overseeded treatments (Table 7). This trend continued for the duration of the traffic period, with the overseeded plots having twice the turf cover at the end of the study.

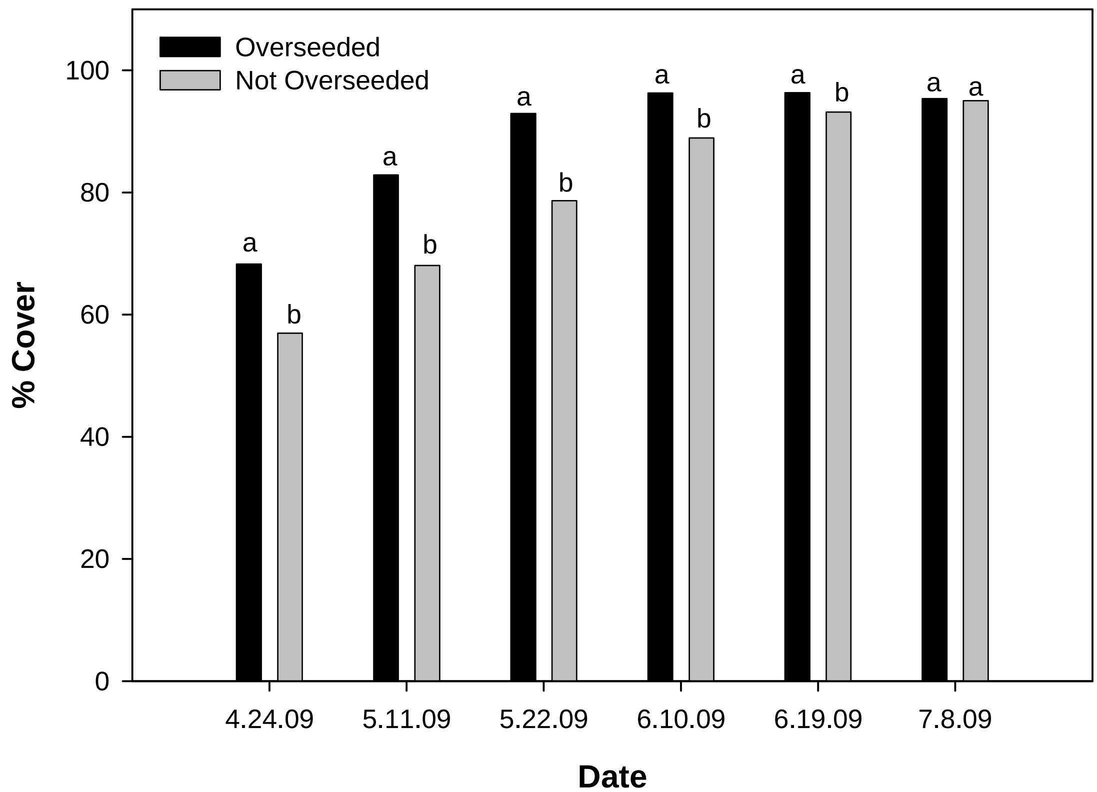

Figure 3. The effect of overseeding on spring and early summer turf cover, 2009

Table 7. Effect of overseeding on percent turf cover during traffic, 2009

	Cover†				
Overseeded	19 Aug‡	2 Sept	23 Sept	15 Oct	6 Nov
			%		
Yes	92.00 a	81.49 a	78.15 a	78.34 a	49.22 a
No	91.97 a	75.26 b	58.24 b	47.12 b	24.20 b
			Number of Traffic Events		
	1	7	16	25	34

† Percent cover was calculated using Sigma Scan software; # of green pixels compared to total # of pixels

‡ Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD ($P<0.05$)

In general, the organic and synthetic management regimes performed similarly in terms of maintaining turf cover, and all consistently outperformed the control treatment. In the spring, the organic treatments had a more delayed response after the first fertilizer applications, but this should be expected with the slower release from the organic fertilizers. During the application of traffic, organic and synthetic regimes performed comparably, while the control treatment had the lowest turf densities. This indicates that maintaining desirable turf cover during traffic requires fertilization inputs, regardless of the source.

Overseeding was also highly beneficial in maintaining turf cover. The overseeding from fall 2008 provided a significant increase in turf cover in spring 2009. Having the seed already in the seed bank come spring, undoubtedly helped increase the recovery rate of the turf stand. Cover data during traffic also showed a significant advantage to overseeding. The weekly overseeding resulted in twice as much density by the end of the study. The turf cover was down around 50%, so higher seeding rates may be required to maintain quality playing conditions.

Surface Hardness and Traction

Rotational traction data on 13 August, before the application of traffic, indicates that synthetically managed plots had higher traction values than all organic regimes and the control plots (Table 8). There was also no difference observed between any of the organically managed plots and the control. As the number of traffic events increased, the traction values started showing less separation between treatments. On 21 September there are still some significant difference, with the synthetic and OPro+bio treatments demonstrating some of the highest values. By the end of the study, 9 November, there was no difference between any of the treatments. It should be noted that though there were statistical differences in the rotational traction data, all of values obtained on each sampling date were within an acceptable range. In addition, overseeding practices had no effect on rotational traction.

Table 8. Effect of management regimes on rotational traction during traffic, 2009

	Canaway			
Management	13 Aug†	21 Sept	8 Oct	9 Nov
	N·m			
Synthetic	42.29 a	41.13 ab	38.75 a	35.29 a
Oman	40.42 bc	39.58 bc	38.92 a	36.58 a
Opro	39.33 c	40.13 abc	38.63 a	36.08 a
Oman + bio	40.79 b	39.79 bc	39.29 a	36.04 a
Opro + bio	39.92 bc	41.46 a	37.87 a	36.04 a
None	40.67 bc	39.12 c	40.37 a	36.42 a
	Number of Traffic Events			
	0	15	23	34

† Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD (P<0.05)

Surface hardness values showed very little difference between treatments during the traffic period. There were no significant differences observed between any of the treatments or control until roughly 20 traffic events had been applied (Table 9). On both 5 October and 6 November the control plots had higher surface hardness values than all other treatments. None of the synthetic or organic treatments demonstrated any separation on either of these dates though. Additionally, overseeding had minimal impact on overall surface hardness.

Table 9. Effect of management regimes on surface hardness during traffic with soil moisture as a covariate, 2009

Management	Clegg†			
	13 Aug‡	14 Sept	5 Oct	6 Nov
	gmax			
Synthetic	51.07 a	76.41 a	79.40 b	75.46 b
Oman	49.09 a	73.85 a	78.60 b	78.54 ab
Opro	47.73 a	73.86 a	79.50 b	75.87 b
Oman + bio	48.66 a	73.12 a	78.60 b	76.37 b
Opro + bio	49.89 a	74.67 a	77.50 b	77.72 b
None	50.80 a	75.12 a	85.20 a	81.61 a
	Number of Traffic Events			
	0	12	21	34

† Surface hardness was measured with a Clegg impact hammer

‡ Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD (P<0.05)

In general, the second year of this study yielded very few effects on traction and surface hardness as a result of the different management regimes and overseeding. Rotational traction varied somewhat between treatments during the earlier stages of traffic application, but as the number of events increased, fewer differences were observed. The surface hardness readings had very little variation between treatments over the entire traffic period. The only significant separation was seen in the control plots exhibiting higher values late in the season. Overseeding did not display any consistent effects for either parameter.

Weed Counts

Crabgrass weed count data shows that the synthetic pre-emergent herbicide was superior in reducing the amount of crabgrass when compared to the organically treated and control plots. The synthetic plots had significantly less crabgrass throughout the course of the entire study (Table 10). There was no difference in the amount of crabgrass between any of the organic treatments. In addition, the control plots were yielding similar crabgrass counts to the organic treatments until August and the onset of traffic. On 19 August, both organic biological regimes had significantly less crabgrass than the control plots. By 23 September, all organic treatments had fewer weeds than the control.

Table 10. Effect of pre-emergent herbicides on crabgrass populations†, 2009

	Weed Counts‡					
Management	22 Jun§	22 July	19 Aug	23 Sept	22 Oct	8 Nov
Synthetic	0 c	1 c	1 c	1 c	0 d	0 a
Oman	30 ab	83 ab	77 ab	26 b	1 cd	0 a
Opro	31 ab	84 ab	79 ab	30 b	3 b	0 a
Oman + bio	21 b	74 b	72 b	29 b	2 bc	0 a
Opro + bio	38 a	88 ab	76 b	30 b	2 bc	0 a
None	27 ab	98 a	93 a	57 a	5 a	0 a

† Siduron (Tupersan) was applied on 26 May to synthetic plots, and Safespring (Corn Gluten Meal) was applied on 19 August to organic plots

‡ Counts were made on a whole plot basis

§ Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD (P<0.05)

Overseeding proved to be an effective means of reducing crabgrass populations across all treatments. Overseeded treatments showed significantly less crabgrass than non-overseeded treatments throughout the summer and fall of 2009 (Table 11). Overseeding applications were only done during the traffic period of the study, and didn't begin in 2009 until 28 August. The reduction in crabgrass seen in June, July, and early August was likely due to the overseeding practices of the previous season.

Table 11. Effect of overseeding on crabgrass populations†,‡, 2009

	Weed Counts§					
Overseeded	22 Jun[z]	22 July	19 Aug	23 Sept	22 Oct	8 Nov
Yes	9 b	51 b	55 b	20 b	2 b	0 a
No	41 a	92 a	78 a	38 a	3 a	0 a

† Overseeded plots received Perennial ryegrass (*Lolium perenne*) at a rate of 6 lbs. per 1000 ft^2 per week starting on 28 August.

‡ Siduron (Tupersan) was applied on 26 May to synthetic plots, and Safespring (Corn Gluten Meal) was applied on 19 August to organic plots

§ Counts were made on a whole plot basis

¶ Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD (P<0.05)

Broadleaf weed control was only done on the synthetic treatments, as an organic broadleaf herbicide could not be found at the time of this study. After being applied on 9 July, the synthetic product, Q4, was very effective at reducing the amount of broadleaf weeds. The synthetic treatments exhibited the lowest weed counts throughout the whole study (Table 12). The organic regimes showed no separations, but all had less broadleaf weeds than the control plots. Additionally, overseeded treatments had significantly fewer weeds than non-overseeded treatments for the majority of the study (Table 13). As with the crabgrass results, much of this reduction can be attributed to the overseeding practices in the first year of this study. No difference was observed between overseeded and non-overseeded plots after 22 October.

Table 12. Effect of management regimes on broadleaf weed populations†, 2009

	Weed Counts‡					
Management	22 Jun§	22 July	19 Aug	23 Sept	22 Oct	8 Nov
Synthetic	15 c	4 c	1 c	0 c	1 c	0 c
Oman	49 ab	26 b	13 b	22 b	16 b	4 ab
Opro	42 b	22 b	11 b	17 b	10 b	2 bc
Oman + bio	47 b	24 b	13 b	19 b	13 b	4 ab
Opro + bio	44 b	24 b	13 b	18 b	11 b	2 bc
None	58 a	40 a	26 a	33 a	23 a	7 a

† A broad spectrum herbicide (Q4) was applied to synthetic plots on 9 July. Organic plots did not receive a broadleaf herbicide

‡ Counts were made on a whole plot basis

§ Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD (P<0.05)

Table 13. Effect of overseeding on broadleaf weed populations†,‡, 2009

	Weed Counts§					
Overseeded	22 Jun¶	22 July	19 Aug	23 Sept	22 Oct	8 Nov
Yes	27 b	20 b	11 b	16 b	10 a	2 a
No	57 a	26 a	14 a	20 a	14 a	4 a

† Overseeded plots received Perennial ryegrass (*Lolium perenne*) at a rate of 6 lbs. per 1000 ft^2 per week starting on 28 August.

‡ A broad spectrum herbicide (Q4) was applied to synthetic plots on 9 July. Organic plots did not receive a broadleaf herbicide

§ Counts were made on a whole plot basis

¶ Means in a column followed by the same letter are not significantly different according to Fisher's Protected LSD (P<0.05)

Overall, the synthetic weed control products used were superior to their organic counterparts. The corn gluten meal application for control of crabgrass was only minimally effective, with no significant reduction, as compared to the controls, seen until late summer when traffic was started. While there was no organic broadleaf product used, all organic regimes had fewer broadleaf weeds than the control treatments. This is most likely due to the nutrient advantage that the organic treatments received, which would help develop a denser turfgrass canopy for naturally competing with broadleaf weeds. Overseeding was the best 'organic' approach to weed control observed in this study. The overseeding practices of the first year were clearly visibly in the reduction of both crabgrass and broadleaf weeds, and continued overseeding during traffic is a recommended practice.

Conclusions

Data from the second year of this study showed that in regards to turf color, the organic and synthetic management regimes yielded very similar results. For the majority of the year, the organic regimes yielded turf color that was equal to or better than the synthetic regime. It was not until late in the fall that the synthetic treatments displayed significantly darker turf color. In terms of traction and surface hardness, no individual management regime stood out from the others, and all provided acceptable ranges for each parameter. Overseeding did not have any consistent effect on either parameter. Weed count data suggests that the synthetic pre-emergent herbicide, Siduron, was significantly more effective at preventing crabgrass infestation than the organic product, corn gluten meal. The application of overseed during traffic was greatly beneficial in reducing the crabgrass and broadleaf weed populations. Also, in regards to percent turf cover, the organic and synthetic treatments performed very similarly. More importantly, overseeding proved to be an effective means of increasing turf cover and quality during traffic. In general, some form of fertility management, whether synthetic or organic, proved to consistently provide better results than no fertility management at all.