

2010 University of Wisconsin Organic Lawn Fertilizer Trial

Doug Soldat, Ph.D.
Department of Soil Science
University of Wisconsin-Madison
djsoldat@wisc.edu; 608-263-3631

Professional and consumer interest in organic turfgrass management is growing rapidly. There are many different organic products on the market but very little data with which to compare products. This trial is an attempt to gather data on the efficacy of a range of organic fertilizers. This information will be useful to turfgrass professionals, consumers, and organic fertilizer companies for promoting their products.

MATERIALS AND METHODS

This research was conducted at the O.J. Noer Turfgrass Research and Education Center in Madison, WI on a Batavia silt loam. The experiment was conducted on a mixture of perennial ryegrass and Kentucky bluegrass mowed weekly or more frequently as needed at a cutting height of 2.5 inches. The plots were irrigated weekly to replace 80% of the evapotranspiration estimated by an on-site weather station. A randomized complete block design with four replications of each treatment was used. The individual plots measured six feet by six feet. The treatments (fertilizer) are listed below and classified into three groups to aid in interpretation of results. A detailed analysis of the forms of nitrogen can be found in Table 1. Fertilizers were applied using hand shakers three times during the growing season (May 6, July 8 and September 2, 2010) to give a total of 3 lbs N/1000 ft². The Scotts product was applied at the labeled rate of 0.8 lbs N/M for a total of 2.4 lbs N/M.

1. Control (no fertilizer)
2. Scotts Turf Builder Applied at Label Rate (29-2-4; 0.8 lbs N/M)
3. Milorganite (6-2-0; 1 lb N/M)
4. Nutripel (5-4-0; 1 lb N/M)
5. Chickity Doo Doo (5-3-2.5; 1 lb N/M)
6. Cold Spring Egg Farm (4-3-2; 1 lb N/M)
7. Healthy Gro (5-2-3; 1 lb N/M)
8. Healthy Gro (2-5-4; 1 lb N/M)
9. Healthy Gro (12-2-12; 1 lb N/M)
10. Sustane (18-1-18 +Fe; 1 lb N/M)
11. Sustane (15-3-9; 1 lb N/M)
12. Sustane (12-4-8; 1 lb N/M)
13. Sustane (8-2-4 A; 1 lb N/M)
14. Sustane (8-2-4 B; 1 lb N/M)
15. Sustane (5-2-4 +Fe; 1 lb N/M)

OMRI-Certified

- Chickity Doo Doo (5-3-2.5; 1 lb N/M)
- Cold Spring Egg Farm (4-3-2; 1 lb N/M)
- Healthy Gro (5-2-3; 1 lb N/M)
- Healthy Gro (2-5-4; 1 lb N/M)
- Sustane (8-2-4 A; 1 lb N/M)
- Sustane (8-2-4 B; 1 lb N/M)

Biosolids

- Milorganite (6-2-0; 1 lb N/M)
- Nutripel (5-4-0; 1 lb N/M)

Organic-based (Augmented w/mineral N)

- Healthy Gro (12-2-12; 1 lb N/M)
- Sustane (18-1-18 + Fe; 1 lb N/M)
- Sustane (15-3-9; 1 lb N/M)
- Sustane (12-4-8; 1 lb N/M)
- Sustane (5-2-4 + Fe; 1 lb N/M)

Both Nutripel and Healthy Gro (12-2-12) were added to the trial in July, and applied for the first time on July 13, 5 days after the other fertilizers were applied for the second time. This should be kept in mind when comparing these fertilizers to others.

During the growing season, several turfgrass and soil parameters were evaluated at various collection intervals. Turfgrass color was evaluated weekly using a reflectance meter (CM-1000, Spectrum Technologies) which measured the amount of green light reflected from the turf. Visual turfgrass quality ratings were also taken on a weekly basis using a 1 – 9 scale where a rating of 9 indicates highest possible turf quality and 6 represents the minimally acceptable turf quality to a (in this case) discerning homeowner. Clippings were collected monthly, dried at 60°C for at least 24 hours, and weighed to determine dry matter production. Soil samples were taken prior to fertilizer application and again at the end of the trial to determine how the various treatments affected soil pH, phosphorus, or potassium levels in the soil. The soil samples were analyzed at the University of Wisconsin Soil and Plant Analysis Laboratory using standard methods for pH and organic matter and the Bray-1 method for P and K. The initial soil tests showed the experimental site to be very uniform, with average Bray-1 P and K of 41.2 ppm and 85.6 ppm, respectively. The pH was 7.1 and organic matter content of 4.3%.

Table 1. Detailed breakdown on the forms of nitrogen in each of the product.

| Fertilizer | Total N | WIN | Ammoniacal + WSN | % Quick Release N |
|------------------------------|-------------|--------------|------------------|-------------------|
| | -----%----- | | | |
| Chickity Doo Doo (5-3-2.5) | 5 | 3 | 2 | 40.0 |
| Cold Spring Egg Farm (4-3-2) | 4 | 3 | 1 | 0.25 |
| Healthy Gro (2-5-4) | 2 | 1.62 | 0.38 | 19.0 |
| Healthy Gro (5-2-3) | 5 | 4.8 | 0.2 | 4.0 |
| Sustane (8-2-4 A*) | 8 | 7.2 | 0.8 | 11.1 |
| Sustane (8-2-4 B) | 8 | 7.2 | 0.8 | 11.1 |
| Milorganite (6-2-0) | 6 | 5.25 | 0.75 | 12.5 |
| Nutripel (5-4-0) | 5 | 4.25 | 0.25 | 5.0 |
| Healthy Gro (12-2-12) | 12 | 6.9 | 5.1 | 42.5 |
| Sustane (5-2-4 +Fe) | 5 | 3.5 | 1.5 | 30.0 |
| Sustane (12-4-8) | 12 | 1.8 | 10.2 | 85.0 |
| Sustane (15-3-9) | 15 | 1 | 14.0** | 93.3 |
| Sustane (18-1-18) | 18 | 15.5 | 2.5 | 86.1 |
| Scotts Turf Builder (29-2-4) | 29 | 0.8 + 6.8*** | 21.4 | 73.8 |

* The difference between 8-2-4 A and B was not apparent on label.

** 8.75% urea stabilized with DCD and NBTP

*** 9.3 from methylene urea, technically classified as “other WSN” but behaves like WIN for all intents and purposes

RESULTS

Color and Quality

The results for color and quality were broken into subgroups (biosolids, OMRI, and augmented) to minimize the clutter as much as possible on the figures. In general, color and quality followed the similar trends. The control treatment began the year with quality around 6 (minimally acceptable) and hovered between 4.75 and 6 for the remainder of the year. In my four years of experience using this device, healthy looking lawn-type turf usually has a color rating around 350, an index below 350 is usually indicative of a nitrogen deficiency¹. The non-fertilized control maintained a color index of averaging 300 during the season, while the maximum ratings for some fertilized treatments peaked at 500.

In the biosolids group (Figures 1 and 2), Milorganite began the year much lower than the industry standard Scotts Turf Builder in both color and quality, but by the end of the year Milorganite was only significantly lower than the Scotts fertilizer once over the final five ratings for quality (Fig. 1) and 10 ratings for color (Fig. 2). This response is typical of fertilizers high in organic N, and the increasing response is related to the mineralization of the organic N during the year. Although NutriPel (a product of Chicago's wastewater treatment plants) was added at the second fertilization event, a similar increasing color and quality trend is clear.

As a composite (thick blue line in Fig. 3), the OMRI fertilizers followed the same trend described above, where the turf color and quality was often below that of the Scotts fertilizer at the beginning of the trial, but statistically similar at the end. Cold Spring Egg Farm and Chickity Doo Doo fertilizers were often above average, often not statistically different from the Scotts fertilizer even early in the season (Figs. 3 and 4), especially for Cold Spring Egg Farm. The Sustane 8-2-4 B and Healthy Gro 2-5-4 tended to perform below the OMRI composite average for most of the season in color and quality, although they converged near the average by the end of the season. It will be interesting to see how these products perform compared to others in subsequent years. Fertilizers not mentioned in the text fell performed very similarly to the OMRI composite, lagging behind the Scotts fertilizer early in the season in color and quality, but becoming statistically similar by season's end.

Finally, the quality and color of the augmented fertilizers is shown in Figures 5 and 6. In this case, the early-season gap between the color and quality of the composite augmented fertilizers and the Scotts Turf Builder was smaller than for the OMRI group. This is not surprising as the augmented fertilizers are supplemented with mineral N which works to quickly green up the turf. The small gap in color was essentially eliminated by August, while a few late-season differences were detected for quality. The Sustane 5-2-4 + Fe performed quite well after August, but had a larger gap in color and quality early in the season; this is clearly related to the relatively low amount of quick release N in this product (30%) compared to the others. The top performing fertilizer in this group was the Sustane 15-3-9, which had the greatest percentage of quick release nitrogen, at 93%. Although the Healthy Gro 12-2-12 was a late addition, it reduced the color and quality gap in July and August, and eventually was statistically similar to the Scotts Turf Builder in color and quality for much of the late summer and fall.

¹ This number is dependent on the species of turf; for example, the color index of healthy bentgrass putting greens usually does not exceed 250 or 300.

Clipping Yield

There was not a statistical interaction between clipping collection date and fertilizer treatment, which meant that the season-long averages shown in Table 1 are representative of the entire year. Most fertilized treatments produced significantly more clippings than the non-fertilized control, with the exception of Milorganite, Sustane 8-2-4 B, and Healthy Gro 2-5-4. These three fertilizers had relatively poor color and quality compared to most, especially in the early season. This is likely related to their low soluble N content, and as previously mentioned these three products produced turf that was often statistically similar to Scotts Turf Builder for most of September and early October.

There was more plot to plot variation in clipping yield than color or quality, therefore the least statistical difference (LSD) was greater, meaning that relatively large differences were required for the differences to be classified as statistically significant. Results from the individual clipping collection dates are shown in Figure 7 for the biosolids group, Figure 8 for the OMRI group, and Figure 9 for the augmented group.

Table 1. Average clipping yields as affected by treatment. There was not a significant treatment by date interaction in the statistical model, indicating that the relative rankings of the treatments shown below were consistent across the four sampling dates. Means connected by similar letters are not statistically different according to Fisher's Protected LSD at $\alpha = 0.05$.

| Fertilizer Treatment* | Average Clipping Yield (g/m ²) |
|------------------------------|--------------------------------------------|
| Healthy Gro (5-2-3) | 11.2 A |
| Sustane (15-3-9) | 10.7 AB |
| Scotts Turf Builder (29-2-4) | 10.6 AB |
| Chickity Doo Doo (5-3-2.5) | 10.4 AB |
| Cold Spring Egg Farm (4-3-2) | 9.9 ABC |
| Sustane (5-2-4 +Fe) | 8.9 ABCD |
| Sustane (12-4-8) | 8.7 ABCD |
| Sustane (8-2-4 A) | 8.4 ABCD |
| Sustane (18-1-18) | 8.3 ABCD |
| Healthy Gro (2-5-4) | 7.7 BCD |
| Sustane (8-2-4 B) | 6.8 CDE |
| Milorganite (6-2-0) | 6.7 DE |
| Control | 4.1 E |

* Healthy Gro (12-1-12) and Nutripel (5-4-0) excluded from this analysis, because they were entered in mid-season, which compromised any attempt to average over the season. Yields of these two treatments can be viewed in Figures 7 and 9.

Soil Phosphorus and Potassium

Overall, end-of-study soil test phosphorus and potassium were related to the amount of phosphorus and potassium that was applied over the season (Table 2.) The one interesting anomaly is the Sustane 18-1-18, which did not have a significant effect on soil potassium levels, despite the high potassium analysis. Healthy Gro (2-5-4) raised both phosphorus and potassium levels more than any other, also this fertilizer applied several times more of each nutrient than the others. Because of its analysis, this particular fertilizer may be an excellent choice for a starter fertilizer, or as a component in divot repair mixes on golf courses. The only other fertilizer to significantly increase soil phosphorus over the non-fertilized control included: Cold Spring Egg Farm (4-3-2), Sustane (5-2-5 + Fe), Healthy Gro (5-2-3), and Chickity Doo Doo (5-3-2.5).

Table 2. Soil test levels of phosphorus and potassium at the end of the study. Tests were run using the Bray-1 extract.

| Fertilizer Treatment | P ₂ O ₅ applied (lbs/M) | Soil Test Phosphorus | K ₂ O applied (lbs/M) | Soil Test Potassium |
|------------------------------|-----------------------------------------------|----------------------|----------------------------------|---------------------|
| Healthy Gro (2-5-4) | 7.50 | 67.3 A | 6.00 | 118.2 A |
| Cold Spring Egg Farm (4-3-2) | 2.25 | 53.8 B | 1.50 | 93.3 BCDE |
| Sustane (5-2-4 +Fe) | 1.20 | 51.3 BC | 3.75 | 98.3 B |
| Healthy Gro (5-2-3) | 1.20 | 50.3 BCD | 1.80 | 97.0 BC |
| Chickity Doo Doo (5-3-2.5) | 1.80 | 50.0 BCDE | 1.50 | 100.3 B |
| Sustane (8-2-4 B) | 0.75 | 47.3 BCDEF | 1.50 | 98.3 B |
| Nutripel (5-4-0) | 1.60 | 47.0 BCDEF | 0.00 | 87.0 CDE |
| Sustane (8-2-4 A) | 0.75 | 46.0 BCDEF | 1.50 | 96.3 BCD |
| Milorganite (6-2-0) | 1.00 | 44.3 BCDEF | 0.00 | 83.8 E |
| Sustane (18-1-18) | 0.17 | 44.2 BCDEF | 3.00 | 86.0 DE |
| Healthy Gro (12-2-12) | 0.33 | 42.8 DEF | 2.00 | 93.8 BCDE |
| Sustane (15-3-9) | 0.60 | 42.5 DEF | 1.80 | 94.3 BCDE |
| Control | 0.00 | 42.0 EF | 0.00 | 85.3 E |
| Scotts Turf Builder (29-2-4) | 0.17 | 41.0 F | 0.33 | 85.0 E |
| Sustane (12-4-8) | 1.00 | 40.8 F | 2.00 | 90.3 BCDE |

Final Note:

One important source of the differences among the treatments is the variability that can occur from batch to batch with manure-based products. The labeling process requires that the guaranteed analysis be reported, as such it is possible and actually very likely that a product may contain significantly more nitrogen than is stated on the label. A small variation away from the target (i.e. 5.5% N on a label claiming 4.0% N) can create large differences in nitrogen application to the plots. We did not analyze the actual nutrient content of the fertilizers applied, but may do so during winter 2011, and then update this report.

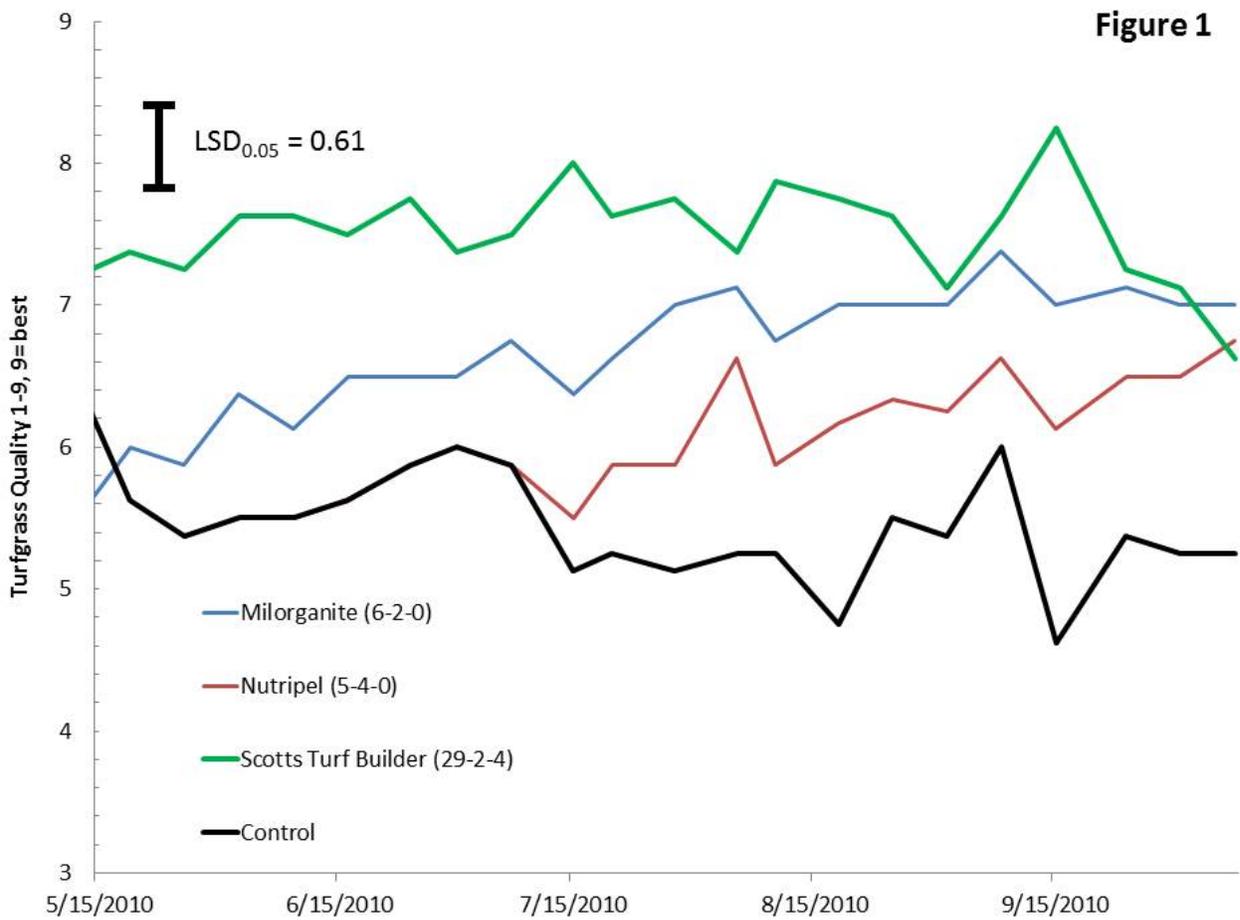


Figure 1. Turfgrass quality as affected by fertilizer treatment and date for the biosolids group of fertilizers compared to Scotts Turf Builder and the non-fertilized control. The LSD_{0.05} indicates the smallest difference that is considered statistically significant at the 95% confidence level.

Figure 2

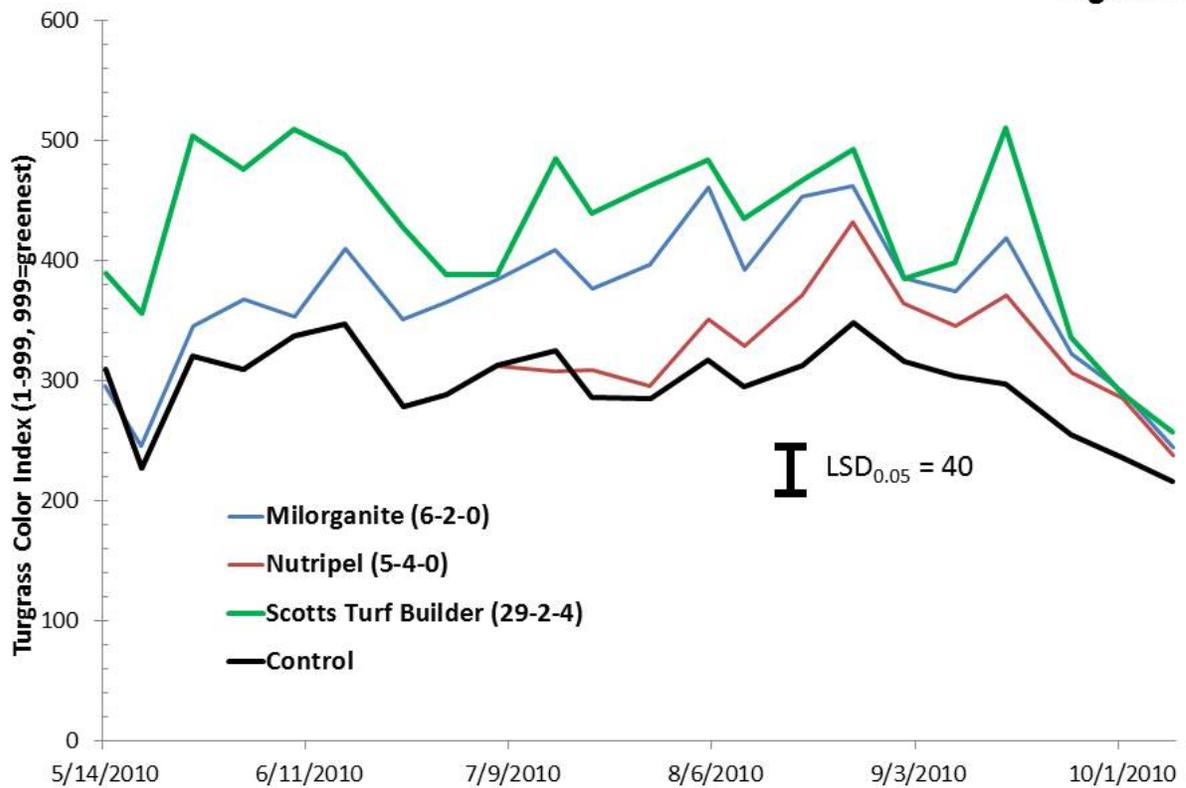


Figure 2. Turfgrass color index as affected by fertilizer treatment and date for the biosolids group of fertilizers compared to Scotts Turf Builder and the non-fertilized control. The $LSD_{0.05}$ indicates the smallest difference that is considered statistically significant at the 95% confidence level. A value of 350 is generally representative of a well-fertilized lawn.

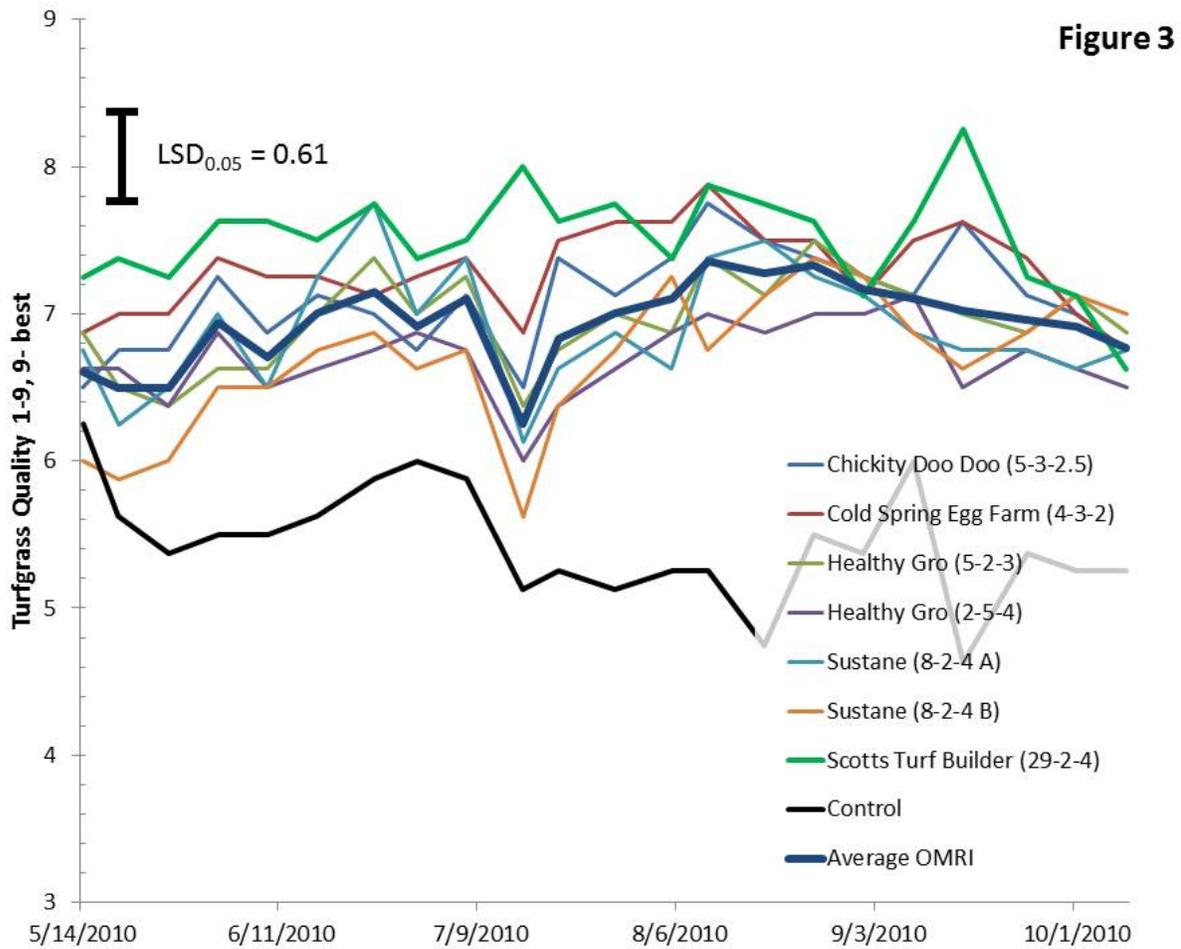


Figure 3. Turfgrass quality as affected by fertilizer treatment and date for the OMRI group of fertilizers compared to Scotts Turf Builder and the non-fertilized control. The thick blue line indicates the average of the OMRI group. The $LSD_{0.05}$ indicates the smallest difference that is considered statistically significant at the 95% confidence level.

Figure 4

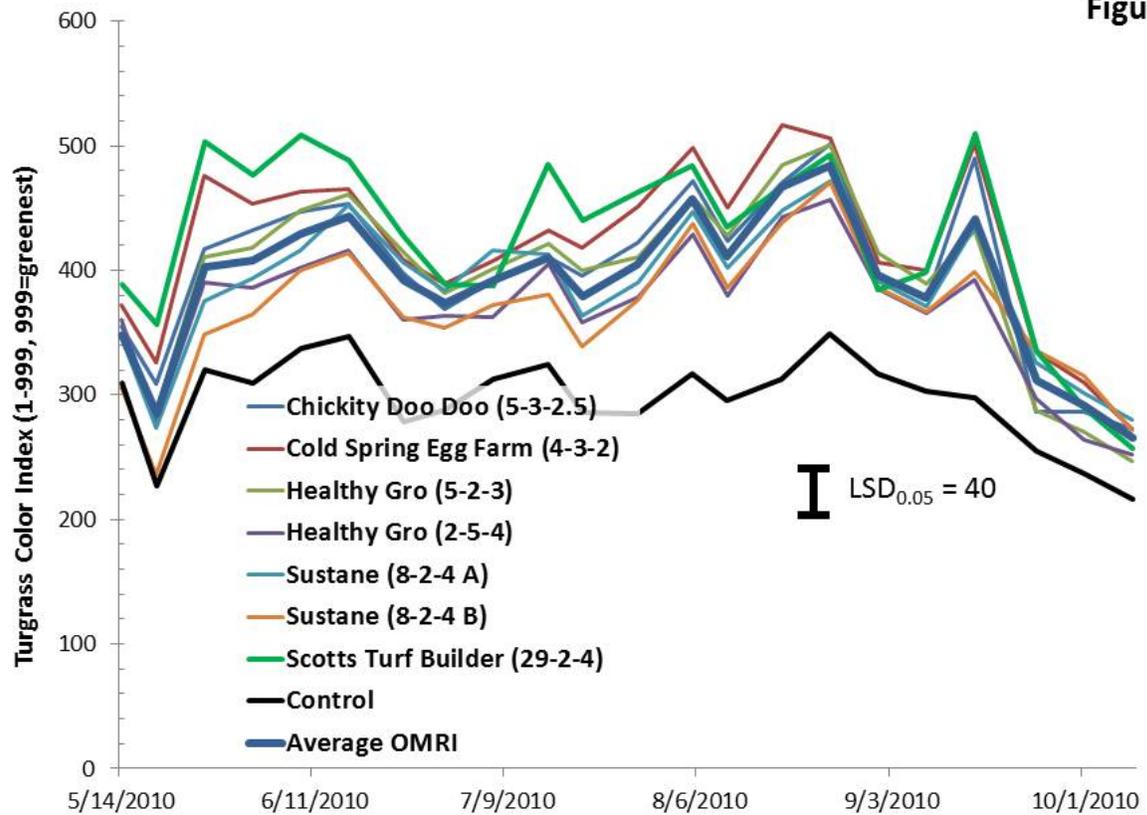


Figure 4. Turfgrass color index as affected by fertilizer treatment and date for the OMRI group of fertilizers compared to Scotts Turf Builder and the non-fertilized control. The thick blue line indicates the average of the OMRI group. The $LSD_{0.05}$ indicates the smallest difference that is considered statistically significant at the 95% confidence level. A value of 350 is generally representative of a well-fertilized lawn.

Figure 5

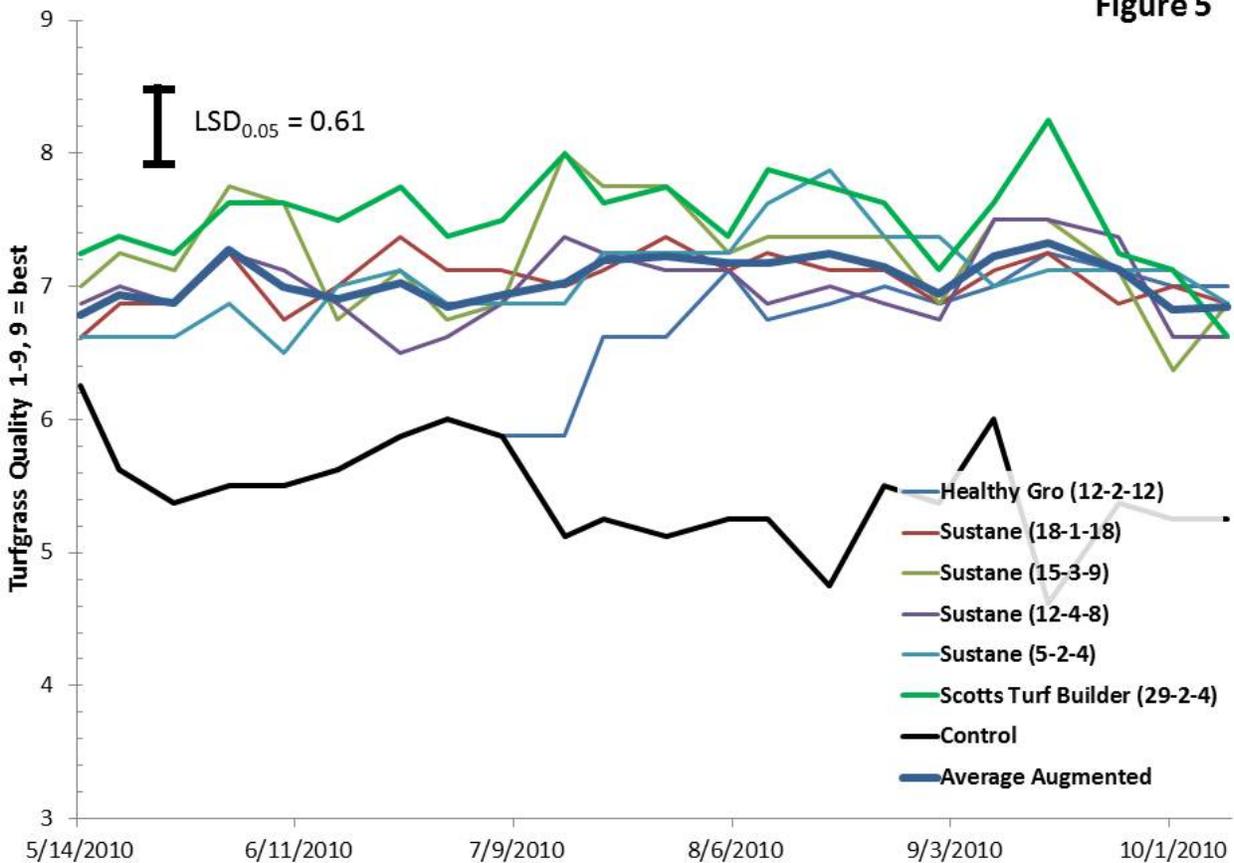


Figure 5. Turfgrass quality as affected by fertilizer treatment and date for the augmented group of fertilizers compared to Scotts Turf Builder and the non-fertilized control. The thick blue line indicates the average of the augmented group. The $LSD_{0.05}$ indicates the smallest difference that is considered statistically significant at the 95% confidence level.

Figure 6

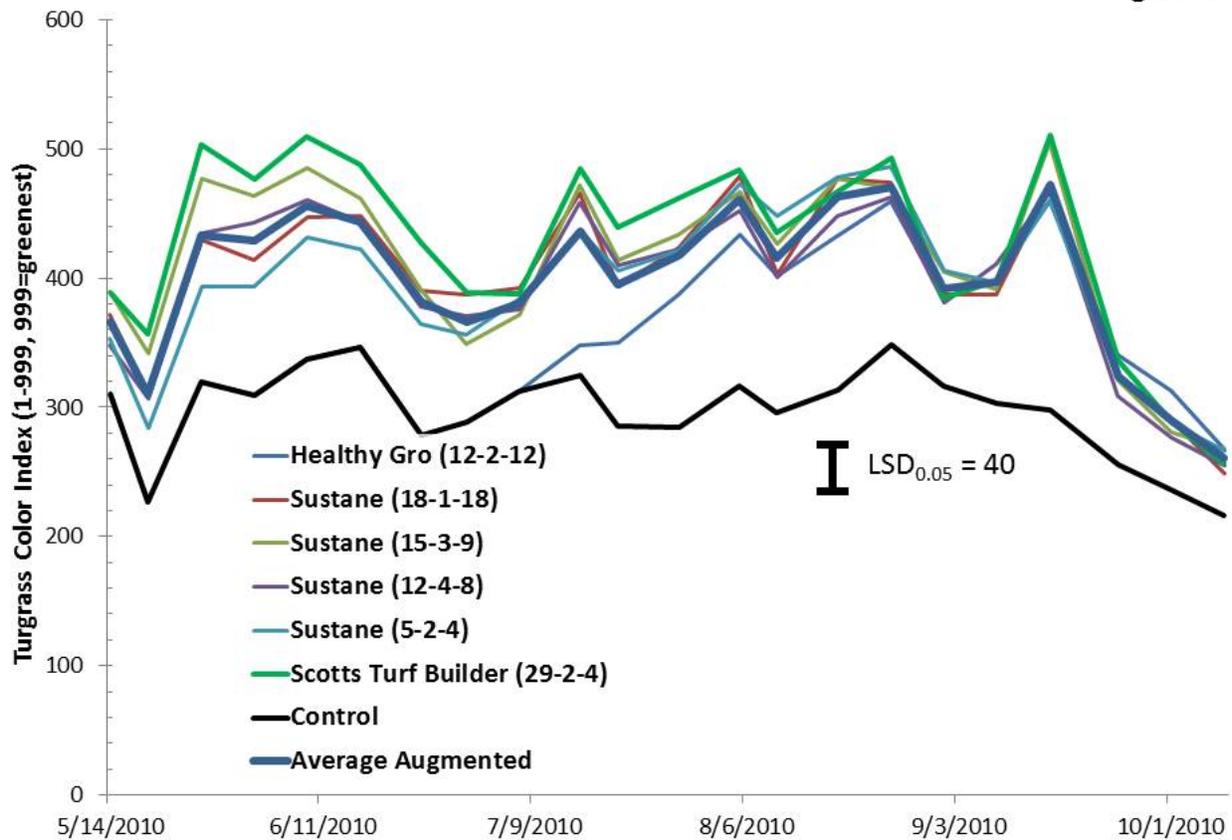


Figure 6. Turfgrass color index as affected by fertilizer treatment and date for the augmented group of fertilizers compared to Scotts Turf Builder and the non-fertilized control. The thick blue line indicates the average of the augmented group. The $LSD_{0.05}$ indicates the smallest difference that is considered statistically significant at the 95% confidence level. A value of 350 is generally representative of a well-fertilized lawn.

Figure 7

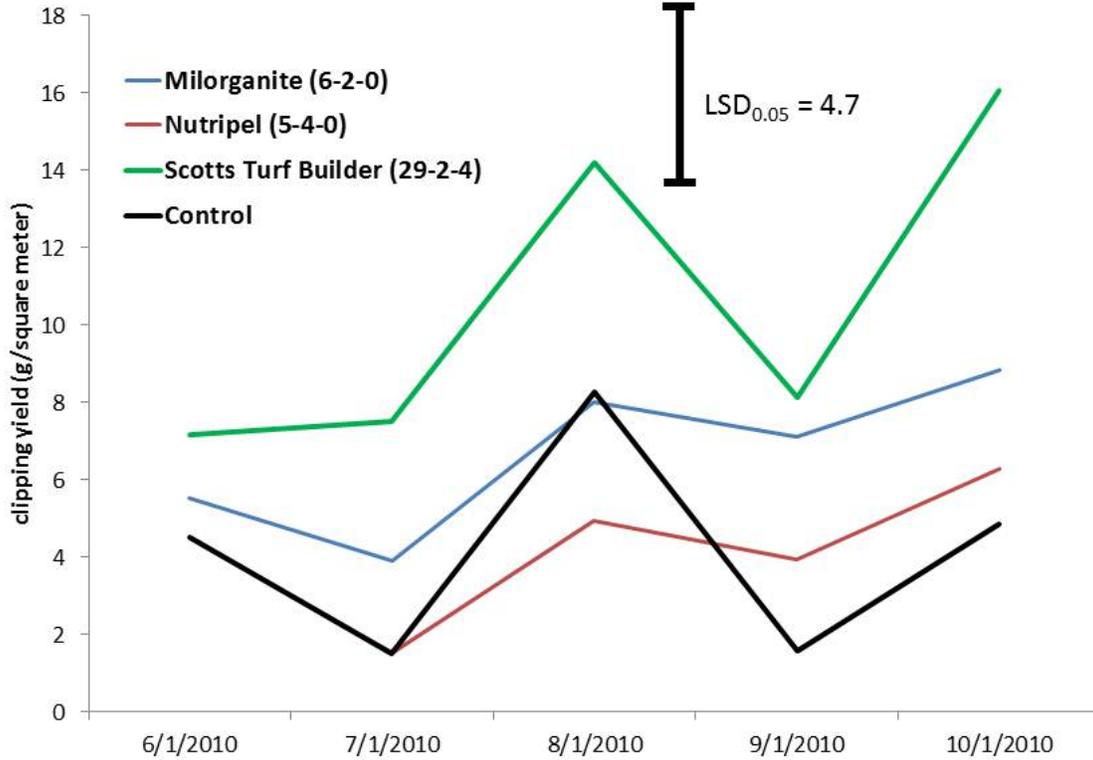


Figure 7. Clipping yield as affected by fertilizer treatment and date for the biosolids group of fertilizers compared to Scotts Turf Builder and the non-fertilized control. The $LSD_{0.05}$ indicates the smallest difference that is considered statistically significant at the 95% confidence level.

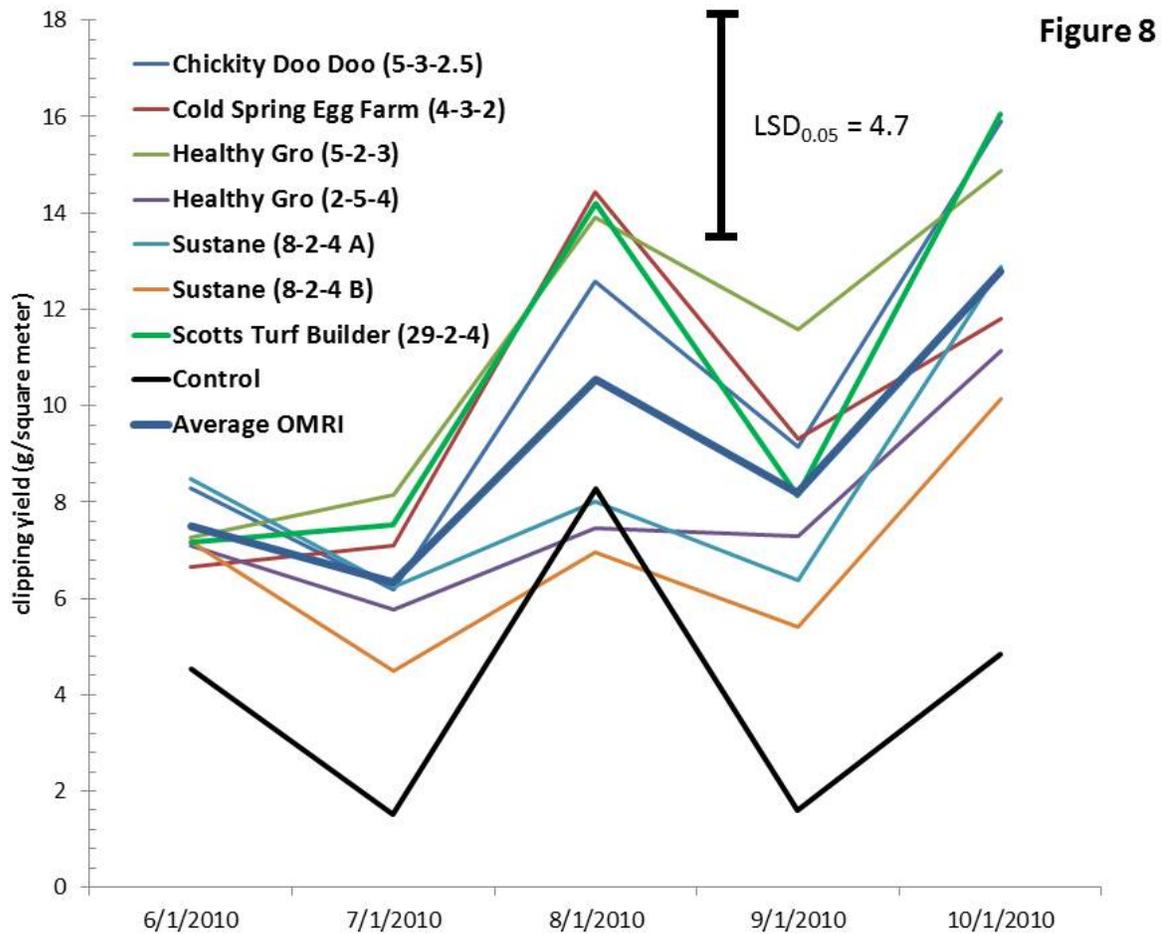


Figure 8. Clipping yield as affected by fertilizer treatment and date for the OMRI group of fertilizers compared to Scotts Turf Builder and the non-fertilized control. The thick blue line indicates the average of the OMRI group. The $LSD_{0.05}$ indicates the smallest difference that is considered statistically significant at the 95% confidence level.

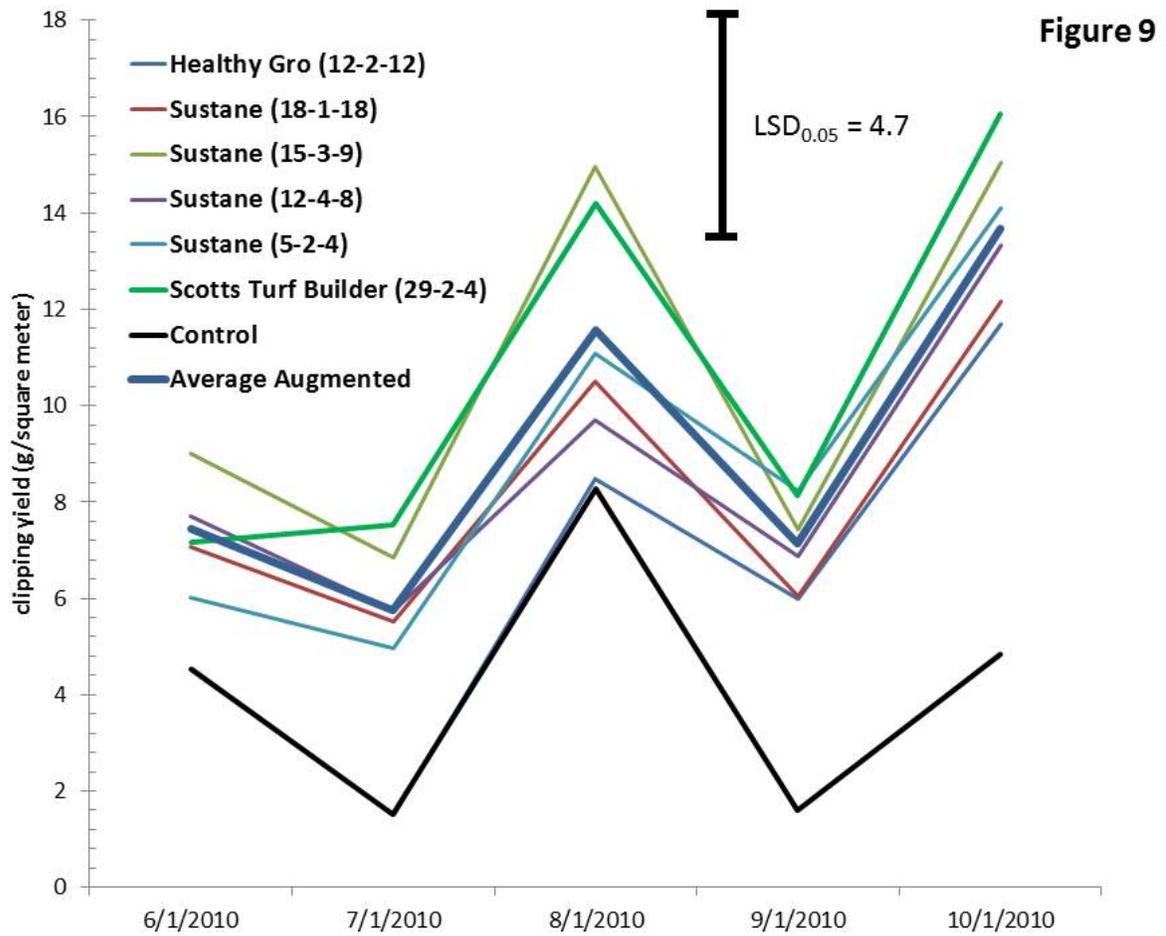


Figure 9. Clipping yield as affected by fertilizer treatment and date for the OMRI group of fertilizers compared to Scotts Turf Builder and the non-fertilized control. The thick blue line indicates the average of the OMRI group. The $LSD_{0.05}$ indicates the smallest difference that is considered statistically significant at the 95% confidence level.