Tall Fescue Quality As Influenced By Organic and Traditional Fertilizer and Weed Control Programs

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Introduction

Newspapers and other media outlets often report on perceived negative aspects of lawn care. In particular, homeowners often are told to beware of chemicals and fertilizers used by the professional segment of the industry, which are known as Lawn Care Operations or LCO's. Professional LCO services generally involve two or three applications of fertilizer, one pre-emergence herbicide that targets crabgrass, one post-emergence herbicide that targets broadleaf weeds and one insecticide that targets white grubs annually. Herbicides and insecticides are applied by some LCO's on an as needed basis rather than to all lawns. Fungicides are seldom applied, but may be offered as an add-on service. Homeowners can purchase many of the same products that Professional LCO's use.

Due to water quality issues in the Chesapeake Bay, homeowners often are concerned about fertilizers and in particular nitrogen (N) and phosphorous (P). Commonly used N turf fertilizer include synthetic organic fertilizers such as urea, coated urea and methylene ureas, as well as inorganic ammonium-based fertilizers (e.g., monoammonium phosphate, others). There is a multitude of fertilizer products that contain varying amounts of synthetic organic mixed with inorganic N sources. Many organic fertilizers (usually sewage sludge or poultry waste products) provide an excellent N response, but generally are not superior in performance, when compared to synthetic organic N fertilizers. The problem with natural organics is that they usually contain only about 5 to 6% N, whereas traditional fertilizers range from 20 to 46 % N. Hence, more handling is required for natural organics and they are more expensive to use. For example, urea (46% N) contains 23 lbs of actual N in a 50 lb bag; whereas, most organic fertilizers (5 to 6% N) contain about 2.5 to 3.0 lb of actual N in 50 lb. Therefore, it takes from 4 to 9 times as much material by weight to use an organic versus a traditional fertilizer. The additional weight, shipping, handling and storage requirements for organics increases the cost associated with using these products. For example, a home owner would have to buy about eight 50 lb bags of a organic fertilizer (5 to 6% N) to supply the same amount of N found in one 50 lb bag of urea (46% N). A 50 lb bag of urea and most commonly used natural organic fertilizers like Milorganite cost about the same (i.e., $17.00 to $20.00 per 50 lb bag). Thus, natural organics are going to cost substantially more per pound of N to buy and apply.

Media reports suggest that phosphorus (P) in lawn fertilizers may travel to the Chesapeake Bay, where it promotes algal growth. These algae compete with other aquatic life for oxygen in the water and thus contribute to a decline in grasses that keep the Bay healthy for the support of fish, oysters, clams and crabs. Phosphorus, however, is so tightly held by soil that the only way that significant amounts of P in a fertilizer (inorganic or organic) applied to lawns can get to the Bay is if it carried on sediment to a storm sewer or stream, which is highly unlikely to

occur from an established lawn. In fact, reduction of sediment movement is a major advantage of a healthy lawn. Furthermore, the overwhelming source of sediment entering the Bay from urban areas comes from construction sites. Another source point would be if fertilizer were improperly applied and large amounts get onto the driveway or other impervious hard surfaces and is carried into a stream or storm drain after a rain. The aforementioned problem can be averted by avoiding application of P to non-lawn areas by carefully sweeping all fertilizers from hard surfaces back onto the lawn. Also, very heavy rain following the application of a fertilizer could result in some P becoming soluble. Low levels of P could runoff a lawn, but it would take a major rainstorm for this to occur. A light to moderate rain or irrigation following the application of a P fertilizer would preclude soluble P from running off in storm water. Finally, some movement of applied P can occur on soils already high in P. Phosphorus should only be applied as recommended by a soil test.

Another misconception is that the N and P applied from a natural organic fertilizer are much healthier for the plant and soil than traditional fertilizers. Nitrogen must be converted by microbes and the action of water to form inorganic nitrate or ammonium N in order to be taken up by plants. The grass plant cannot distinguish the source of the nitrate or ammonium N, regardless of whether it comes from an organic, synthetic organic or inorganic source. Like organic forms of N, organic forms of P must be converted to a mineral form in soil (i.e., ions like $H_2PO_4^-$ and HPO_4^{2-}) to be taken up by plants. Again, the plant does not distinguish whether the minerals are from an organic or inorganic source. Furthermore, research conducted at the University of Maryland showed that natural organic fertilizers applied over a 7 year period had little or no positive impact on soil microbial activity, soil organic matter or thatch production, when compared to synthetic organic N (Davis and Dernoeden, 2002). Some of the natural organic materials had negative and even deleterious effects, including the once popular Compro® Sewage Sludge from Washington DC, which is no longer commercially available.

Nontraditional nutrient products have received much media attention lately. For example, compost teas are being marketed throughout the Northeastern U.S. for use on lawns and landscape plants. Pogo Organics® (Sunshine, MD) is a local company that markets a compost tea. The organic material used to make Pogo's Compost Tea is shredded yard waste (i.e., leaves, brush, stems, branches, etc). To make Compost Tea, compost is placed in aerated water for 24 hours. Some believe that Compost Tea can be used to maintain a low cost sustainable lawn and that they provide disease suppressive benefits. Dry applications of composts also are of interest, especially to organic gardeners. Leafgro® is a compost product marketed by Maryland Environmental Services (MES; Millersville, MD). According to MES, Leafgro consists of leaves and grass clippings that are composted with yard wastes, then shredded, dried and screened. According to one technical data sheet (A&L Great Lakes Laboratories, Fort Wayne, IN), Leafgro contains about 0.47, 0.14 and 0.31 % N, P, K as measured on a percent wet weight basis, respectively. Leafgro consists of about 30% organic matter, has an 18:1 C:N ratio; and a pH of about 8.0. Leafgro is said to replenish "vital organic matter and beneficial micro-organisms" in the soil. Leafgro is largely used by landscapers as a soil conditioner and is mixed with existing soil when planting trees and shrubs or when establishing lawns. For establishing lawns, it is recommended that Leafgro be spread on bare soil and rototilled to a soil depth of about 4 to 6 inches. There are no recommendations for using

Leafgro on top of established turf. Using any dry compost as a topdress material to established turf over time could lead to a deleterious surface organic layer.

There are other companies that also sell nutrient and humate products for use on lawns. One producer that markets in Maryland is 3 Tier Technologies®, Inc. (Southlake, Texas). The 3 Tier Lawn Care Program involves applying a combination of three products, 5 or 6 times on a 30 day interval from spring to late summer. The 3 Tier products contain humates (i.e., humic and fulvic acids); microbial inoculants (i.e., 5 species and numerous strains of bacteria [*Bacillus* spp.]); very low amounts of nitrogen (usually < 0.02 lb N/1000 ft^2 per application from urea or ammonical N) in combination with equally minute amounts of phosphorus, potassium, manganese and iron. The 3 Tier Technologies products claim to "provide a cost effective tools to cleanse your soils, restore nutritional and microbial balance, increase natural disease and insect suppression, and provide an advanced platform for nutrient delivery whether by foliar or soil applications."

Crabgrass (*Digitaria* spp.) is the most invasive weed in Maryland lawns. If not controlled, crabgrass can dominate a lawn in 2 to 4 years and push the desirable turf out of the stand. Most people who desire a nice looking and functional lawn would agree that crabgrass needs to be controlled to maintain the sustainability of the turfgrass and reduce the potential for soil erosion. Chemical pre-emergence herbicides have been used on lawns since the 1950's. These herbicides are insoluble and bind to soil and do not move in the environment unless as previously described for fertilizer (i.e., on sediments or improper application). Pre-emergence herbicides do not kill seed in soil. The crabgrass plant must first germinate and then pick up the herbicide, usually by roots and sometimes by shoots, to prevent normal root development. There is a large homeowner market for natural weed control products, such as corn gluten meal. Corn gluten meal was shown to be an effective pre-emergence crabgrass herbicide in Iowa, but has had mixed performances in Maryland studies (Dernoeden, 2001). Regardless, corn gluten is the only natural product that has been shown by University researchers to provide a significant level of herbicidal activity on crabgrass as well as several broadleaf weed species. It also contains significant amounts of nitrogen. While there may be other commercially available organic products that claim weed control few other than corn gluten have been shown through research to be safe and effective.

This study involved a turf performance comparison among several different programs ranging from completely organic to completely synthetic. The focus will be on fertilizers and herbicides. The site has no history of any insect pest problems and few disease problems. Hence, insect pests and disease control programs were not factored into the protocols. There were two organic programs as follows: 1) Organic, which employs corn gluten meal and a natural organic fertilizer and 2) Pogo's Compost Tea (2009) or Leafgro (2010). The Synthetic Programs are 1) Professional Lawn Care Operation Program (LCO); 2); Urea Program; and 3) Golf Course Rough Program. The 3 Tier Technology Lawn Care Program bridges both organic and synthetic, but is mostly organic in nature since very low amounts N, P and K are applied. The two Organic Programs, 3 Tier and Urea Programs will have a complete weed control treatment counterpart similar to LCO and Golf Course Rough Programs. The complete weed control program will consist of a single spring application of a pre-emergence herbicide that targets smooth crabgrass (*Digitaria ischaemum*) and a post-emergence herbicide that targets broadleaf weeds (mostly

white clover, *Trifolium repens*). The broadleaf herbicide used was Speedzone (carfentrazone+2,4-D+MCPP+ dicamba; PBI Gordon, Kansas City, MO) and was applied once in May 2009 and 2010. On 21 May 2010, the broadleaf weeds in plots of the Organic + CGM Program received a spot treatment of Ecosense Lawn Weed Killer (Ortho), which contains 1.5% Iron HEDTA. Weed leaves (mostly white clover and some Lespedeza) were wet to run-off with the Iron HEDTA. There were a Weed Control Only (no N) and a No Fertilizer + No Weed Control (hereafter untreated control) Programs. The Weed Control Only involved Drive (quinclorac at 0.75 lb ai/A) applied post-emergence on July 29,2009 to control crabgrass and white clover and Dimension (dithiopyr at 0.38 lb ai/A) applied pre-emergence on 31 March 2010. Tall fescue (*Festuca arundinacea*) is the most highly recommended and widely planted lawn species in Maryland and was the turf species used in this study.

Methods. This study was conducted at the University of Maryland Paint Branch Turfgrass Research Facility in College Park. Soil was a Keyport silt loam with a pH of 5.9 and 2.2 %OM. Turf was an October 16, 2007 seeded blend (50:50) of Cochise III and Titanium tall fescue. The site received 1.0 lb N/1000ft^2 from a starter fertilizer (18-24-12) at the time of seeding, but no additional fertilizer was applied prior to the study being initiated in April 2009. Turf was maintained to a height of 2.5 inches and generally was only irrigated to water-in treatments as noted in the Application Diary for 2009 and 2010, which follow the data tables. As noted below, the site was irrigated in early July after turf had become drought dormant. The treatments and application dates also are outlined in the Application Diaries. Granular products were applied by shaker bottle. The 3 Tier products, Dimension 40WSP, Speedzone and Drive 75DF (1% v/v MSO) were applied in 50 gallons of water per acre using a CO_2 powered (35 psi) backpack sprayer equipped with an 8004E flan fan nozzle. In 2009, Compost Tea was prepared by aeration. Between 385 and 400 grams (about 0.85 lb) of compost were placed in a mesh bag and then into 10 liters (about 2.5 gallons) of creek water. Paint Branch Creek water was used since it is not chlorinated. The compost and creek water were aerated for 24 hrs prior to each application. The Compost Tea was applied at a rate of 300 GPA using a garden watering can on 12 occasions between 2 April and 2 September 2009. Because there was little or no response from the Compost Tea in 2009, Leafgro was used as a substitute treatment to these plots in 2010 , however, Compost Tea was applied on two (15 June and 15 July) occasions in 2010. Leafgro was applied at a rate of 80 lb product/ 1000ft^2 on five occasions (total 1.9 lb N/1000ft^2 on a wet wt weight basis) between 31 March and 7 September 2010.

The fertilizers were Oceangro 5-5-0 (Bayville, NJ; $10.00/ 50 lb bag), a composted sewage sludge. Lesco (John Deere Landscapes) was the primary source of synthetic organic fertilizers used are as follows: Lesco SCU 34-0-0; Lescocote 25-3-10 polymer coated urea, and urea 46-0-0. Turflo Plus 20-0-3 (urea and ammonical N; SynaTek, Souderton, PA) was applied once in the LCO program in the summer. The herbicide + fertilizer combinations were Stonewall (Lesco Poly Plus SCU + prodiamine; cost $18.40/bag; Cleveland, OH) and Harrell's 20-0-11 With Dimension (polymer coated urea + dithiopyr; Sylacauga, AL). Espoma Corn Gluten Weed Control (Millville, NJ; $35.00/ 25 lb bag) was the source of corn gluten meal. Corn gluten has a relatively high N (9-0-0) content for an organic product. To ensure uniform smooth crabgrass development the site was broadcast overseeded with 1.4 lb of smooth crabgrass seed/ 1000 ft^2 on March 25, 2009. The seed was collected in late autumn 2008 at the Paint Branch facility. The study area was not overseeded in 2010.

The 3 Tier Program involved six applications of nutrients and humates on a 30 day interval from roughly early April to early September. In 2009, the total amounts of major nutrients applied (i.e., sum of 6 applications) were as follows: N = 0.110 lb N/1000ft^2; 0.053 lb P/1000ft^2 and 0.047 lb K/ 1000ft^2. In 2010, major nutrient total amounts applied were increased as follows: 0.17 lb N/1000ft^2; 0.080 lb P/1000ft^2; and 0.082 lb K/1000ft^2). Minute amounts of manganese, zinc, copper, calcium and purified humic acids also were applied on each occasion.

The rates and dates of all fertilizer and herbicide applications appear in the Treatment Diaries for 2009 and 2010. Briefly, the pre-emergence herbicide Stonewall (prodiamine) was applied at 0.75 lb ai/A in both years. Except for the Golf Course Rough Program (hereater Golf Rough), Dimension treatments were applied at 0.50 and 0.38 lb ai/A in 2009 and 2010, respectively in the 3 Tier + weed control; Organic + Weed Control; Urea + Weed Control; Compost Tea/Leafgro + Weed Control; and Weed Control Only (2010) Programs. In the Golf Rough Program, Dimension was applied at a rate of 0.28 lb ai/A rate in both years. The aforementioned pre-emergence herbicides as well as corn gluten were applied 2 April and 31 March in 2009 and 2010, respectively and were watered-in by irrigation or timely rainfall. Speedzone (1.1 lb ai/A) was applied to the appropriate plots to control broadleaf weeds (mostly white clover and some Lespediza and dandelion) on 19 and 21 May in 2009 and 2010, respectively. On 21 May 2010, the broadleaf weeds in plots of the Organic + CGM Program received a spot application of Ecosense Lawn Weed Killer (Ortho), which contains 1.5% Iron HEDTA. Weed leaves (mostly white clover and Lespedeza) were wet to run-off with the Iron HEDTA. Due to the N contained in corn gluten (9-0-0), these plots received 1.8 lb N/1000 ft^2 in the initial application in both years; whereas all other N treatments (i.e., organic, urea, SCU) were applied at 0.75 lb N/1000 ft^2 on 2 April 2009 and 31 March 2010. Organic (both), LCO, Golf Rough and Urea Programs received another 0.50 lb N in early July and an additional 0.75 lb N in early September of each year. Hence, corn gluten plots received a total of 3.05 lb N per year and the Organic + CGM and Organic + Weed Control (i.e., Oceangro sewage sludge), LCO (mostly SCU), Urea, and Golf Rough (polymer coated urea) received 2.0 lb N/1000 ft^2 per year. Generally, LCO's apply between 2.0 and 3.0 lb N/1000 ft^2 annually, so in this study we were on the low side on N use in these treatments. The 3-Tier tank-mix treatments were applied six times per year as described above and in the Treatment Diaries to provide < 0.2 lb N/1000 ft^2 annually. Compost Tea (no N analysis) and Leafgro (total 1.9 lb N/1000ft^2 on a dry wt basis) were applied as previously described and as shown in the Treatment Diaries. The following treatments served as standards: Untreated control (i.e., No N + Weed Control); N (Urea alone) + No Weed Control; and a No Weed Control treatment. The Weed Control Only Program involved a rescue application of quinclorac (Drive) on 29 July 2009 to control crabgrass and white clover post-emergence, but Dimension and Speedzone were applied to these plots in 2010.

Plots measured 5 by 10 ft and were arranged in a randomized complete block with four replications. Plots were rated visually for color and quality where 0 = entire plot area brown or dead; 7.0 = minimal acceptable color and/or quality; 8.0 = very good summer color and/or quality and 10= optimum green color, density and freedom of weeds. Weeds were visually estimated on a linear 0 to 100% scale where 0= no weeds and 100=entire plot area covered. Percent of plot area brown or dormant from summer stress (i.e., heat and drought induced dormancy or injury) was rated visually on a 0 to 100% scale where 0= entire plot area green and

100= entire plot area brown or dead. Data were subjected to the analysis of variance and significantly different means were separated using Fisher's protected least significant difference (LSD) test , $P \leq 0.05$.

2009 Results

Turf color. Turf color ratings reflect mostly the performance of the N fertilizers; whereas, turf quality ratings take into consideration color, density and the presence or absence of weeds. Hence, color ratings usually are higher than quality ratings. All treatments were initiated on April 2 and additional N was applied on July 8 and September 2, 2009 in LCO, Organic, Urea and Golf Rough Programs. Compost Tea was applied every two weeks and 3 Tier products were applied on roughly a 30 day interval from April to September. The Weed Control Only Program and untreated control did not receive any nutrients at any time. As previously mentioned the site was established in 2007 and received only a starter fertilizer at seeding, but no other nutrients were applied prior to initiating this study. All applications are summarized in the Application Diary following the data tables.

Urea gave the best initial N response on 5 May (Table 1). Turf color associated with LCO, Organic and Golf Rough Programs were similar to the Urea Program at this time. Between 18 May and 1 July, the Organic, Urea and Golf Rough Programs provided generally better turf color than the LCO Program. The Organic + CGM provided better color than Organic + Weed Control on all rating dates between 18 May and 26 June, presumably due to the extra N provided by CGM. Indeed Organic + CGM generally provided better color than all other programs except Golf Rough on most rating dates between 27 May and 26 June. Hence, CGM was an excellent N source as was polymer coated urea in the Golf Rough Program. On nearly all May and June rating dates, little or no enhancement of color was observed in plots treated with 3-Tier (except 18 May) and Compost Tea, when compared to the Weed Control Only Program and the untreated control. Plots treated with 3 Tier + Weed Control exhibited improved color compared to the untreated control on 1 and 15 July, but not on 21 or 3 August. July 1 was the only date in 2009 when Compost Tea improved turf color compared to the control. Programs receiving N on 8 July were LCO, Organic, Urea and Golf Rough. Urea , LCO (SCU) and Organic (Oceangro) Program again gave an equally good initial response on 15 July, which was better than that observed in Golf Rough Program that received polymer coated urea. The July application of N improved turf color for all of the aforementioned Programs on 15 and 21 July and 3 August, but none was superior. Color ratings were suspended on 3 August due to tall fescue foliar browning on all plots in response to wilt stress, which occurred throughout most of July.

A color rating of 7.0 was considered the minimum acceptable, but color ratings of 8.0 or greater would constitute very good color, especially in the summer and is used here as a subjective threshold for comparative purposes. It again is noted that the study area had received no fertilizer in the prior two years to initiating this study. Turf color in the untreated control and Weed Control Only Program achieved ratings below 8.0 on 9 of 10 rating dates. The number of times in the 10 summer rating dates in which programs achieved color ratings above 8.0 were as follows: LCO=7; 3 Tier alone=4; 3 Tier +Weed Control= 6; Organic + CGM=8; Organic + Weed Control=6; Urea alone=7; Urea + Weed Control=9; Compost Tea alone=1; Compost Tea + Weed Control=3; and Golf Rough =8.

On September 2, 2009 all treatments were applied for the last time for the 2009 season. The LCO, Organic, Urea and Golf Rough Programs received 0.75 lb N at this time for a total of 2.0 lb N/ 1000 ft^2 applied between April and September 2009. The Organic + CGM Program delivered a total of 3.0 lb N/ 1000 ft^2. Compost Tea, 3 Tier (about 0.1 lb N/1000 ft^2 total) and Weed Control Only Programs did not receive any significant levels of N at any time in 2009. As was observed following the April and July application of N, Urea had provided the most rapid response as shown by data obtained on 16 September (Table 1). The SCU in the LCO and polymer coated urea in the Golf Rough Programs improved color, but not as rapidly as urea. Tall fescue color in all plots and Programs, however, markedly improved by mid- September in response to cool and wet weather. By 28 September, turf color was equally high (> 9.0) in LCO, Organic, Urea and Golf Rough Programs. Tall fescue color in plots receiving the 3 Tier, Compost Tea, Weed Control Only and untreated control Programs were equal and generally good (i.e., $\geq$ 8.0). This early autumn improvement in tall fescue color in the absence of any significant N input was again observed in 2010.

Quality: Overall turf quality ratings are of greatest significance since they take into consideration the presence and/or absence of weeds as well as turf color and the effects of summer stresses. All treatments were applied initially on 2 April, with additional N fertilizer applications made to LCO, Organic, Urea and Golf Rough Programs on 8 July. Turf color was the dominating factor during spring, but quality ratings were initiated on 1 July because of the impact of weeds (Table 2). Except for Weed Control Only and Compost Tea all Programs receiving Weed Control exhibited very good (>8.0) quality on 1 July. By 21 July, summer dormancy of the tall fescue in response to wilt became a significant factor affecting quality. Weed cover (described below) and summer dormancy data were the most important elements affecting summer quality ratings in 2009. Most wilt stress occurred during July, but rain in August did not rapidly improve recovery and ratings remained generally high for dormancy on 13 and 23 August (Table 3). The injury took the form of browning of leaves, which impacted quality ratings as discussed below.

On 21 July and 3 August, only LCO and Urea + Weed Control Programs had very good quality, but ratings were statistically similar to 3 Tier + Weed Control (21 July), Organic + Weed Control; and Golf Rough Programs. Plots treated with 3 Tier alone, Compost Tea alone, Weed Control Only and the untreated control had similar low levels of quality on 21 July. On 13 and 23 August, best quality was observed in plots of the Golf Rough Program (7.1). However, Urea + Weed Control (6.6 to 7.1), LCO (13 Aug. only 6.6), Organic + Weed Control (6.6-6.8); Compost Tea + Weed Control (6.6) exhibited a statistically similar level of quality compared to Golf Rough. On the final rating date of summer, poorest quality was associated with the following Programs: 3 Tier alone, Urea alone, Compost Tea alone and the untreated control. Weed Control Only, 3 Tier + Weed Control and Organic + CGM Programs resulted in better quality versus the aforementioned due to the presence of fewer weeds.

Programs associated with the lowest dormancy ratings (12 to 18%) included Organic + CGM; Urea alone; and Golf Rough. However, statistically similar ratings were observed for 3 Tier alone (25 Aug); Organic + Weed Control; Compost Tea alone (13 Aug) and Urea + Weed Control (13 Aug). Programs that had dormancy rating statistically similar to the untreated control on both dates were LCO, 3 Tier (both); Compost Tea (both) and Weed Control Only.

Subjectively, a minimum acceptable level of summer quality was judged to be a rating ≥ 7.0. Golf Rough obtained quality ratings above 7.0 on 5 out of 5 summer rating dates. Urea + Weed Control achieved 4 rating dates above the minimum threshold and LCO, 3 Tier + Weed Control; Organic + CGM; Organic + Weed Control; Compost Tea + Weed Control had 3 dates above the threshold. Weed Control Only had 2 dates above the threshold, but the untreated control, Compost Tea alone and 3 Tier alone Programs had only one date when quality was ≥ 7.0.

As previously noted, all treatments were last applied on 2 September 2009. As usual color ratings were generally higher than quality ratings since the latter took into consideration the presence of weeds. About two weeks after the treatments were last applied, quality was assessed on 16 September (Table 2). Good quality (i.e., > 8.0) was associated with LCO, Organic + Weed Control, Urea + Weed Control, Compost Tea + Weed Control and Golf Rough Programs. Intermediate quality (7.7) was provided by 3 Tier + Weed Control. Plots treated with Organic + CGM and Urea alone and Weed Control Only Programs had poor quality, but ratings were significantly better than 3 Tier alone and the untreated control. Quality improved in all plots by 28 September in response to cool and wet weather. Furthermore, much of the crabgrass present was suppressed by the cool night temperatures and its presence was somewhat masked. While most crabgrass plants at this time remained green in color some plants were senescing and turning brown. On 28 September, excellent quality (> 9.4) was observed in LCO, Organic + Weed Control, Urea + Weed Control and Golf Rough Programs. Good quality (> 8.0) was associated with 3 Tier + Weed Control, Organic + CGM, Urea alone, Compost Tea + Weed Control and Weed Control Only Programs. Plots treated with 3 Tier alone and Compost Tea alone had poor quality equivalent to the untreated control.

Weeds: Weed pressure was a major factor affecting quality. The weed ratings obtained on 1 and 21 July consisted of a composite of all weeds including smooth crabgrass and broadleaf weeds (mostly white clover and some dandelion). On 1 and 21 July all Programs receiving Weed Control except Organic + CGM had provided nearly complete weed control (Table 3). Highest total weed cover was observed in plots treated with Compost Tea alone (5-12%) and other non-herbicide treated Programs ranged from 1 to 4% weed cover. Smooth crabgrass began to tiller and become more invasive and objectionable by late August. On 23 August, broadleaf weed and crabgrass cover were rated separately. Plot is the 3 Tier alone, Organic + CGM, Compost Tea alone and the untreated control Programs had broadleaf weed cover ranging from 4 to 6%. Broadleaf weeds were not as great a factor since smooth crabgrass cover ratings were much higher. Highest smooth crabgrass cover ratings (19 to 28%) were observed in plots treated with 3 Tier alone, Compost Tea alone and the untreated control. Plots treated with Organic + CGM and Urea alone Programs had lower crabgrass cover ratings than the untreated control, but levels were objectionable (12 to 18%). All other Programs had crabgrass cover ratings ranging from 1 to 4%. It should be noted that the Organic + CGM (12% cover) had statistically similar level of crabgrass compared to the Weed Control Only Program (4% cover).

2010 Results

Turf color. Turf color was rated between 15 Jan. and 15 June and again on 6 October 2011. Note that N was not applied until 31 March in 2010. Improved January color ratings therefore reflect N applications last made in September 2009. On 15 January turf color was best in plots treated with all N sources (i.e., SCU, organic, urea and polymer coat urea) (Table 4). Tall fescue plots treated with Compost Tea + Weed Control, 3 Tier + Weed Control and Weed Control Only had color that was better than the untreated control. Plots treated with 3 Tier and Compost Tea Programs alone had color ratings equivalent to the untreated control. These data show that weed control improves turf color, presumably by limiting completion for nutrients by weeds (mostly crabgrass and white clover) in the previous year. Data also showed that white clover (10 to 20% cover in non-herbicide-treated plots) does not promote turf color. That is, the general belief among some gardeners that white clover can produce and liberate N from nodules on roots to benefit turf, probably is not true. On 10 March, best turf color was observed in plots treated with organic N (i.e., Oceangro sewage sludge) + Weed Control, but data were equivalent to other Programs receiving N applications from synthetic sources. Poorest color again was observed in 3 Tier alone, Compost Tea alone and the untreated control. Nitrogen and Leafgro (substituted for Compost Tea in 2010) were applied to the appropriate plots on 31 March, however, vastly improved color was observed among all treatments on 12 April 2010.

April was unusually warm and winter dormancy was broken and active tall fescue growth was occurring about two weeks earlier than normal. Plots receiving N (organic or synthetic organic) on 31 March had perfect or near perfect color ratings (>9.6) on 12 April (Table 4). However, all plots including those in the 3 Tier alone, Compost Tea alone Programs and the untreated control had generally good color (i.e, >8.0). This also was observed in the late summer-early autumn period of 2009. Interestingly, turf color in plots treated with 3 Tier + Weed Control and Leafgro + Weed Control was statistically improved compared to 3 Tier alone and Leafgro alone Programs. This improved color in the absence of supplemental N applications from either urea or sewage sludge was again seen in early autumn 2010 (as well as 2009) in 3 Tier + Weed Control and Leafgro + Weed Control Programs. Hence, data show the importance of controlling weeds for improving tall fescue turf vigor. As stated above, weeds compete with nutrients thus reducing their availability to the tall fescue turf.

The effect of N applied 31 March began to dissipate slightly on 12 May and by 15 June (+ 76 days since N was applied) the color ratings in N-treated plots remained good (8.0 to 8.6), and were significantly higher than those observed in plots treated with 3 Tier, Leafgro and the untreated control. It should again be noted that the Organic + CGM Programs involves more N (1.8 vs. 0.75 lb initially) than the other N Programs (i.e., urea, polymer coated urea, sewage sludge alone or SCU). The Organic+ CGM Program exhibited color as good as any N source, again demonstrating that CGM is a very good N source. After this point in time a drought was underway and color ratings were suspended in summer due to wilting and almost complete browning of the tall fescue canopy. The N sources were applied again on 7 September. On October 6, Programs providing highest color included LCO; Organic + Weed Control; and Urea + Weed Control (Table 4). Tall fescue color ratings from all Weed Control Programs were significantly higher than 3 Tier alone, Leafgro alone and the untreated control on 6 October. There was a significant improvement in turf color in 3 Tier + Weed Control versus 3 Tier alone on 6 October. There was a non-significant trend for improved color in all other Programs + Weed Control versus the No Weed Control Program. The data again support the observation that

tall fescue responds more positively when weed control is practiced, especially where N also is applied.

Quality. Overall turf quality ratings take into consideration color, density and the presence or absence of weeds and environmental stress factors. As such, overall quality is the most important of the two ratings since turf color largely reflects N response from fertilizers. As previously noted, overall quality was rated on a 0 to 10 scale where 0 = entire plot area brown or dead; 7.0 = minimal acceptable color and/or quality; 8.0 = very good summer color and/or quality and 10= optimum green color, density and freedom of weeds. Ratings below 6.0 usually reflect loss of density and/or encroachment of numerous weeds or injury from environmental stress. April and May ratings were most influenced by the application of N to selected plots on 31 March. Very high quality (> 9.0) was observed in the following Programs that included weed control on 12 April and 12 May: LCO (SCU); Organic (Oceangro sewage sludge); Urea and Golf Rough (polymer coated urea) (Table 5). The Organic+ CGM Program (initial N from CGM) lagged behind the other N sources until 15 June. Good quality was observed in plots receiving 3 Tier + Weed Control; Urea alone; Leafgro + Weed Control and Weed Control Only. Poor spring quality (≤ 6.1) was observed in the following Programs: 3 Tier alone; Leafgro alone and the untreated control.

In 2010, June was usually hot and dry and by late June the plot area was almost completely brown as a result of drought dormancy. On 23 June, the study was rated for dormancy by assessing the percent of plot area brown. Lowest dormancy rating was observed in the Golf Rough (polymer coated urea) Program (Table 6). Similarly, during a much less stressful drought stress period in 2009, the Golf Rough Program had the lowest dormancy (i.e., lower % brown area) rating. All other Programs were generally equivalent in terms of drought dormancy. On 28 June, 0.93" of rainfall occurred. During the next two weeks the study site was irrigated frequently to boost green-up. On 13 July, plots were evaluated for percent turf green-up. Lowest green-up (i.e., slowest recovery) was observed in the untreated control. All other Programs generally had an equivalent level of green-up, but numerically highest green-up ratings were associated with the Golf Rough and Urea Programs. The study area did not require irrigation thereafter since there were 10 rain events between 14 July and 22 August, which had deposited 9.3". Turf quality ratings obtained on 15 and 27 June reflect the aforementioned drought stress. Highest quality was associated with the LCO ; Organic + Weed Control; and Urea + Weed Control Programs on both dates. The Weed Control Only Program had higher quality ratings (6.5-7.9) than 3 Tier alone; Leafgro alone and the untreated control (5.1-5.8) on 15 and 27 June, which was the height of the drought.

As discussed below, frequent rain events in July and August not only stimulated green-up of the tall fescue, but it stimulated crabgrass seedling emergence. During the drought dormancy period only small populations of crabgrass were observed in Programs were no weed control was involved. Thereafter, most Programs experienced major levels of crabgrass encroachment. Hence, the generally low quality ratings obtained 13 August and 9 September reflect loss of tall fescue density from drought and the encroachment and in some cases the domination, by crabgrass. On 13 August, only turf in the LCO; Organic + Weed Control and Urea + Weed Control Programs had quality above 7.0 (i.e., the minimum acceptable level) (Table 5). On 9 September, only the LCO Program was above the minimum and indeed had

improved to a good (i.e., 8.0) quality level. The next best level of tall fescue quality on both 13 August and 9 September (6.4 to 7.2) was observed in the following Programs: 3 Tier + Weed Control; Organic + Weed Control; and Urea + Weed Control

Nitrogen, 3 Tier products and Leafgro were last applied on 9 September 2010. Overall quality data collected 6 October and 2 November were impacted most by the senescing (6 Oct.) and eventually frost-killed crabgrass (2 Nov.). Quality ratings were similar between individual Programs on 9 September and 6 October (Table 5) Hence, the application of N, 3 Tier products and Leafgo alone did not greatly boost quality in any Program. On 2 November, both tall fescue cover and quality data were collected. The tall fescue cover (Table 6) data explain the quality ratings. Some of the tall fescue canopy was likely masked or covered by the dead crabgrass plants, but tall fescue cover (i.e., density) declined greatly in the absence of the use of crabgrass-targeted herbicides. The 3 Tier alone and untreated control plots were inundated with frost-killed crabgrass and tall fescue cover ranged from only 19 to 30%. Tall fescue cover was greater in Leafgro alone (51%) versus 3 Tier alone (30%) and the untreated control (19%). There were no significant differences among all other programs, but lowest (80%) and highest (100%) cover was associated with Organic + CGM and LCO Programs, respectively. Thus, the LCO Program continued to provide for the highest quality at the end of the study. Between, 6 October and 2 November turf quality improved to above the minimum acceptable level (> 7.0) in the following Programs : 3 Tier + Weed Control; Organic + Weed Control; and Urea + Weed Control. Fair quality (> 6.0) was observed in Leafgro + Weed Control and Golf Rough Programs; whereas, poor quality (< 6.0) was observed in the Organic + CGM and Weed Control Only Programs. Extremely poor quality (≤ 3.1) was provided by 3 Tier alone; Leafgro alone and the untreated control.

Weeds and Diseases. Weeds were the dominating factor affecting tall fescue quality in both years although summer drought stress also was important. On 12 April, 12 May and 15 June a composite rating of mostly white clover and some dandelion and Lespedeza were made. Highest broadleaf weed populations (11 to 27% weed cover) were observed on all three dates in the 3 Tier alone; Leafgro alone and the untreated control Programs. There was a trend for higher broadleaf weed populations in the 3 Tier alone and Leafgro (Compost Tee in 2009) alone Programs versus the untreated control. Speedzone was not applied until 21 May 2010, therefore, 12 April and 12 May ratings reflect weed encroachment in plots last treated with Spreedzone on 19 May 2009. As expected, all Programs receiving Speedzone had low (< 1% cover) broadleaf weed levels (Table 7). Surprisingly, relatively low broadleaf weed levels (1.9-5.5%) also were observed in plot receiving the Organic + CGM and Urea alone Programs. Lower broadleaf weed populations in the Organic + CGM Program may be attributed to possible herbicidal effects of the corn gluten. This appears unlikely since Urea alone provided similar results. It is most probable that N from the CGM and urea that improved tall fescue competitiveness against the broadleaf weeds. All Programs that included weed control received Speedzone on 21 May 2010 and these plots were virtually broadleaf weed-free on 15 June. Broadleaf weeds in plots in the Organic + CGM Program were spot-treated with Ecosense Lawn Weed Killer (i.e., 1.5% Iron HEDTA) on 21 May 2010. Field notes state that the Ecosense burned and killed the Lespediza, but only appeared to initially curl leaves of white clover. Some minor injury to the tall fescue was noted in the form of a brownish discoloration of the canopy. Data collected 15 June, however, show that the Ecosense was effective in controlling both white clover and Lespedeza.

In addition to damaging the tall fescue the drought dormancy reduced white clover cover as noted on 27 July and 13 August. On both dates, highest white clover levels were observed in 3Tier alone; Leafgro alone and untreated control Programs. All other Programs had very low (0 to 1.5%) white clover levels.

Crabgrass invasion was the single most important factor in reducing tall fescue quality. Subjectively, crabgrass cover exceeding 5% was considered commercially unacceptable. That is, homeowners who contract for LCO services will note the presence of crabgrass when populations exceed 5% and are likely to complain. Crabgrass cover was first evaluated on 27 July and again 3 Tier alone; Leafgro alone and the untreated control Programs had highest levels (28-45% crabgrass cover) (Table 7). All other Programs had statistically similar crabgrass levels at this time. This included the Organic + CGM Program, when compared to the LCO (Stonewall) and Programs that included Dimension. On 13 August, crabgrass cover ratings had more than doubled in most plots. This was due not only to continued emergence of crabgrass seedlings, but the older plants were now tillered and thus increasing in size and invasiveness. It was evident at this time that crabgrass levels had become unacceptable or near unacceptable (> 5% crabgrass cover) in all but the LCO (prodiamine from Stonewall at 0.75 lb ai/A) Program. Programs receiving Dimension (i.e., 3 Tier + Weed Control; Organic + Weed Control; Urea + Weed Control; Leafgro + Weed Control; Golf Rough (0.28 lb ai/A Dimension); and Weed Control Only) as well as Organic + CGM had equivalent crabgrass levels, ranging from 4 to 18% cover. Weather conditions remained hot and there was timely rainfall in late August and into September. Thus, crabgrass plants continued to increase in size and invasiveness and a more clear separation of crabgrass data in the individual Programs was noted on 9 September. Only the LCO Program (0.75 lb ai/A prodiamine) had limited crabgrass invasion to less than 5% cover , which resulted in good turf quality (rating = 8.0). Highest crabgrass levels (82 to 89% cover) were found in 3 Tier alone and untreated control Programs. Crabgrass cover was reduced compared to the untreated control by the following Programs, but the levels were extremely high (36-51% crabgrass cover): Organic + CGM; Urea alone; Leafgro + Weed Control; Golf Rough; and Weed Control Only. The 3-Tier + Weed Control and Urea + Weed Control Programs had a level of crabgrass statistically equivalent to the LCO Program, but these levels were unacceptable (17 to 24% crabgrass cover). Of interest, the Weed Control Only (i.e., no N applied); Urea only (no herbicide); and Organic + CGM had very similar crabgrass levels (48 to 52% crabgrass cover). However, Urea + Weed Control and Organic + Weed Control Programs reduced crabgrass invasiveness 67 to 75% (13-17% crabgrass cover), when compared to the Weed Control Only Program (51% crabgrass cover). Since all three of the aforementioned Programs received Dimension, these data strongly demonstrate that using N in conjunction with Dimension had greatly improved the level of crabgrass control provided by the herbicide. Furthermore, these data strongly indicated that N alone as used in this study was as effective as CGM in reducing crabgrass.

Diseases. The study site was inundated with snow between 5 February and 1 March 2010. Typhula blight (*Typhula incarnata*) was evident and had blighted about 1 to 6% of the area. There were, however, no apparent Program effects on the disease. Red thread (*Laetisaria fuciformis*) was the only other disease to affect the tall fescue in 2010. Red thread data were variable, but highest levels were observed in plots receiving the Leafgro + Weed Control; Weed Control Only and untreated control Programs (Table 6). Numerically lowest red thread ratings

were associated with Programs involving N applications (i.e., LCO; Organic [both]; urea and Golf Rough). There were, however, no significant differences between the aforementioned and the 3-Tier Programs or Leafgro alone. The latter observation would suggest that some nutritional benefits may have been provided by the 3-Tier Program.

SUMMARY

2009. Programs receiving ≥ 2.0 lb N/ 1000 ft^2 provided generally good color responses. Urea gave the most rapid response following the April, July and September applications. Following the initial application of N on 2 April, CGM (applied once in April and then followed with sewage sludge), and polymer coated urea gave the best color responses in May and June although data did not vary significantly from Oceangro, Urea or the SCU in the LCO Program. Compost Tea and 3 Tier Programs provided little or no improvements in turf color. Weeds and summer wilt stress became significant factors affecting turf quality in July and August. Programs with Weed Control options generally provided for superior quality versus counterpart treatments in which weeds were not controlled. Organic + CGM and Urea alone did reduce crabgrass populations significantly compared to the untreated control, but weed levels were objectionable. No Program impacted broadleaf weed populations in the absence of the application of Speedzone in 2009. Dormancy or turf browning generally was least severe in tall fescue in the Organic + CGM and Golf Rough Programs. Compost Tea alone, 3 Tier alone, Weed Control Only and the untreated control Programs had highest dormancy ratings; whereas, other Programs not previously mentioned were intermediate on their effect on turf dormancy. Best summer quality generally was observed in the Organic + Weed Control, Urea + Weed Control and Golf Rough Programs. However, all Programs that included Weed Control, with the exception of Weed Control Only, generally had summer quality ratings statistically similar to the aforementioned Programs. Compost Tea + Weed Control and 3 Tier + Weed Control generally provided a higher level of quality than the untreated control. However, 3 Tier + Weed Control had improved quality compared to Weed Control Only on three dates in 2009 (1 and 231 July and 16 Sept.); whereas Compost Tea + Weed Control only provided improved control versus Weed Control Only on 1 July 2009. Compost Tea and 3 Tier applied alone provided a level of quality similar to the untreated control. Conversely, Urea alone generally improved quality relative to the untreated control despite the presence of crabgrass. Data showed that effective crabgrass control was essential for improving and maintaining summer tall fescue quality. Despite little or no N being applied to plots in the 3 Tier + Weed Control, Compost Tea + Weed Control and Weed Control Only Programs, turf color and quality rose to a good level (> 8.0) by late September. All Programs containing Stonewall (LCO only) or Dimension provided commercially acceptable (< 5% crabgrass cover) crabgrass control. The Organic + CGM Program provided a statistically equivalent level of crabgrass control compared to the aforementioned Programs involving Stonewall and Dimension, but crabgrass levels were unacceptable. These unacceptable levels of crabgrass resulted in unacceptable quality between 13 August and 16 September in the Organic + CGM Program. The quality of tall fescue in all Programs, except 3 Tier alone and the untreated control, was in the acceptable range by 28 September 2009.

2010. Winter and spring color ratings were equally high among LCO (SCU), Organic (sewage sludge), Urea and Golf Rough (polymer coated urea) Programs. Drought dormancy precluded rating Programs for turf color until autumn. Tall fescue color was generally improved

in Programs involving weed control. There was little indication that any improvement in turf color was accorded by 3 Tier or Leafgro Programs. It is possible that 3Tier and Leafgro may have had a greater impact on turf grown in a sandy soil rather than the silt loam soil in this study. Furthermore, it may take more time for the nutrients in the organic matter in Leafgro (applied 5 times in 2010 only) to be released. The Weed Control Only Program provided higher color ratings versus 3Tier alone or Leafgro alone Programs on the final rating on 6 October. The 3 Tier + Weed Control Program had improved quality compared to Weed Control Only on the last three rating dates in 2010 (9 Sept., 6 Oct, and 2 Nov) indicating that some benefit had been provided by the low levels of nutrients and humic acid that had been applied 12 time over the course of the two year study. As discussed below, the LCO Program had best quality at the end of the study because the rate of prodiamine (i.e., Stonewall) was maintained at the high label rate (0.75 lb ai/A); whereas, the Dimension rate was lowered from 0.50 lb ai/A in 2009 to 0.38 lb ai/A in 2010 (except Golf Rough where Dimension was applied at 0.28 lb ai/A in both years). Hence, it was the superior level of crabgrass control provided in the LCO Program that ultimately provided for the best quality at the end of the study.

The June drought that lead to near complete tall fescue dormancy was the big story in 2010. The Golf Rough Program appeared to delay dormancy in both 2009 and 2010. Following N applications in July 2010, tall fescue in the LCO, Organic + Weed Control (but not Organic + CGM); Urea + Weed Control (but not Urea alone) Programs were most rapid in recovering according to quality ratings obtained on 27 July (Table 5). Thereafter, it was crabgrass encroachment that impacted quality most. On 13 August 2010, the untreated control had 75% crabgrass cover in contrast to the 28% crabgrass cover observed in the untreated control in 23 August 2009. During the ensuing 27 days (i.e., 9 Sept) crabgrass plants had greatly increased in size due to continued high temperatures and good soil moisture from rain. All Programs provided for lower crabgrass cover compared to the untreated control (89% cover). The LCO (Stonewall + SCU; 3% cover = 97% control); Organic + Weed Control (Dimension + sewage sludge ; 13% cover = 85% control), and Urea + Weed Control (Dimension + urea; 17% cover = 81% control) had statistically equivalent levels of crabgrass cover. Poor to very poor crabgrass control was observed in plots treated with Organic + CGM (CGM + sewage sludge; 48% cover = 46% control); Leafgro + Weed Control (36% cover = 60% control); Golf Rough (39% cover = 56% control)); Weed Control Only (Dimension + no N; 51% cover = 43% control) and Urea alone (no herbicide + urea ; 52% cover = 42% control). Crabgrass cover was reduced to commercially acceptable levels in the LCO Program only and thus resulted in the only Program to provide acceptable quality at the end of summer (i.e., Sept. 9). These data showed that the performance of Dimension was improved by using it in conjunction with N (organic or urea) and that N alone from urea was as effective in suppressing crabgrass as corn gluten.

The invasiveness of crabgrass was dramatic in 2010. In late August 2009, the untreated control plots had 28% crabgrass cover and 3 Tier alone (21 %) and Compost Tea alone (19%) plots had been invaded equally. In early September 2010, crabgrass cover ratings in the aforementioned Programs were 82% in 3 Tier alone, 83% in Leafgro alone and 89% in the untreated control. These very high crabgrass populations out-competed and pushed tall fescue out of the stand by November 2010. Hence, tall fescue cover ranged from only 19 to 51% in 3 Tier alone, Leafgro alone and the untreated control Programs. Conversely, where weed control was imposed, tall fescue cover ranged 80 to 100%. As stated previously, the LCO Program was superior because the Stonewall (prodiamine) level was maintained at the high label rate (0.75 lb ai/A). Dimension rate was reduced in the Organic + Weed Control; Urea + Weed Control;

Leafgro + Weed Control ; and Weed Control Programs from 0.50 lb ai/A in 2009 to 0.38 lb ai/A in 2010. The Dimension rate was reduced because previous research conducted at the University of Maryland indicated that once crabgrass was effectively controlled in a site the rate of Dimension could be reduced (to the 0.38 lb rate employed in 2010) without loss of effective crabgrass control (Dernoeden, 2001). This approach failed in 2010 because of several factors – the so called "Perfect Storm." The drought dormancy of tall fescue in late June was followed by 10 rain events in July and August. The rain events stimulated continuous crabgrass emergence at a time that soils were hot and wet, which would speed microbial dissipation of the reduced levels of Dimension. Furthermore, the dormant tall fescue lacked competitiveness with crabgrass plants until late July when dormancy was broken; however, tall fescue density was less than that prior to the drought. High temperature conditions persisted throughout August and into September, which stimulated crabgrass (i.e., C-4 plants) to tiller more aggressively than if conditions had been dry and mild. Despite the failure of Dimension to provide acceptable crabgrass control, tall fescue cover was improved by its use. For example, plots receiving the 3 Tier + Weed Control; Organic + Weed Control; Urea + Weed Control; Leafgro + Weed Control; and Golf Rough (only 0.28 lb ai/A Dimension) had 94 to 98% tall fescue cover prior to winter. With sound fertility and appropriate weed control practices the tall fescue in the aforementioned Programs will improve and likely will once again exhibit good to excellent quality by May 2011. Tall fescue in the Organic + CGM, Urea alone and Weed Control Only Programs (80 to 83% tall fescue cover on 2 Nov.) will require spring overseeding and much more inputs of fertilizer and herbicides to fully recover. Conversely, , tall fescue in the 3 Tier alone, Leafgro alone and the untreated control Programs will not recover functionally or aesthetically, and will require extensive and possibly total renovation.

Key Summary Points

Disclaimer: The findings of this study may only apply to tall fescue turf grown in the transition zone region of Maryland where summer heat stress and crabgrass are major problems. It also is noted that the study was conducted on a silt loam soil and that results may vary in different soil types. The study was conducted for two years and a longer study may have yielded additional information.

- Corn gluten (9-0-0) is a good, but very expensive source of nitrogen.
- Corn gluten can reduce crabgrass invasion under low weed pressure, which probably was due to enhanced turf density promoted by the N in the product.
- Urea (2.0 lb N/1000 ft^2/year) was as effective as corn gluten (20 lb product/1000 ft^2) in reducing crabgrass levels.
- Corn gluten used as recommended did not provide commercially acceptable crabgrass control in either year.
- Little or no improvement in tall fescue quality was provided by 3 Tier products; Compost Tea or Leafgro. Some improvement in tall fescue quality in the 3 Tier + Weed Control compared to the Weed Control Only Program was observed at the end of the study.
- Organic (sewage sludge and CGM) and synthetic organic N sources (urea, polymer coated urea, SCU) generally performed equally in promoting turf color and quality.
- Nitrogen (2.0 lb N/1000ft^2/year) from either organic or synthetic organic sources reduced crabgrass and broadleaf weed populations by promoting turf vigor and density.
- White clover did not release any visible amounts of N or improve tall fescue quality.

- Controlling weeds with one annual application of a pre-emergence herbicide targeting crabgrass and one annual application of a herbicide targeting broadleaf weeds was needed to maintain tall fescue density and quality, even in the absence or presence of nitrogen use.
- Use of nitrogen (organic or synthetic organic) in conjunction with Dimension improved the level of crabgrass control.
- Late spring drought that induced tall fescue dormancy followed by frequent rain events created a "Perfect Storm" for crabgrass encroachment and in some cases dominance in 2010.
- Crabgrass control is required where this weed exists in even initially low populations to maintain long-term functional and aesthetic tall fescue turf.
- Maintaining a high label rate of Stonewall (prodiamine) resulted in effective crabgrass control in both years and provided for the best turf quality among all Programs evaluated at the end of the second study year.
- Reducing the rate of Dimension (dithiopyr; from 0.50 to 0.38 lb ai/A) resulted in unacceptable crabgrass levels in the second study year, but use of the herbicide had reduced crabgrass invasiveness and helped to maintain tall fescue density.
- Plots treated with Compost Tea, Leafgro or 3 Tier products without herbicides (as well as the untreated control) resulted in a turf requiring complete renovation.

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Table 1. Tall Fescue foliar color in response to organic and synthetic organic fertilizer and weed control programs. College Park, MD., 2009.

	Turf color (0-10 scale)					
Program	5 May	18 May	27 May	4 Jun	10 Jun	26 Jun
LCO	9.5 ab***	8.3 cd	8.5 cd	8.0 bcd	8.0 bcd	7.9 cd
3-Tier	8.5 c	8.1 cde	7.8 f	7.7 de	7.7 cde	8.0 bcd
3-Tier + Weed Control*	8.3 c	8.0 cdef	8.0 def	7.7 de	7.6 de	8.2 bc
Organic + CGM**	10.0 a	9.4 a	9.5 a	9.0 a	8.7 a	8.8 a
Organic + Weed Control	9.8 ab	8.5 bc	8.4 cde	8.1 bc	8.1 bc	7.7 cd
Urea	10.0 a	9.1 a	9.0 ab	8.2 b	8.0 bcd	7.7 cd
Urea + Weed Control	10.0 a	9.1 a	8.9 bc	8.2 b	8.2 b	8.0 bcd
Compost Tea (CT)	8.8 c	7.8 def	7.8 f	7.8 cde	7.7 cde	7.6 d
CT + Weed Control	8.8 c	7.8 def	8.0 def	7.8 bcde	7.9 bcde	7.7 cd
Golf Course Rough	9.4 b	8.9 ab	9.3 ab	9.1 a	8.8 a	8.5 ab
Weed Control Only	8.5 c	7.7 ef	7.9 ef	7.7 de	7.7 cde	7.6 d
Untreated	8.3 c	7.6 f	7.6 f	7.6 e	7.5 e	7.7 cd

	Turf color (0-10 scale)					
Program	1 Jul	15 Jul	21 Jul	3 Aug	16 Sep	28 Sep
LCO	7.7 bc	8.9 a	8.2 a	7.9 ab	9.1 b	9.5 ab
3-Tier	7.8 bc	8.0 cd	6.9 e	7.5 bc	7.6 e	8.1 c
3-Tier + Weed Control	8.0 ab	8.6 ab	7.6 bcd	7.2 cd	7.8 de	8.3 c
Organic + CGM	8.0 ab	8.8 ab	7.9 ab	7.9 ab	8.7 bc	9.1 b
Organic + Weed Control	7.8 b	8.4 bc	7.8 abc	7.5 bc	9.1 b	9.4 ab
Urea	7.8 b	9.0 a	7.8 abc	8.2 a	9.0 bc	9.5 ab
Urea + Weed Control	7.7 bc	9.0 a	8.1 ab	8.0 ab	9.5 a	9.8 a
Compost Tea (CT)	7.9 b	7.9 d	7.0 e	7.5 bc	7.5 e	7.9 c
CT + Weed Control	7.8 bc	8.1 cd	7.3 cde	7.5 bc	8.1 d	8.2 c
Golf Course Rough	8.1 a	8.1 cd	7.9 abc	8.1 a	8.6 c	9.5 ab
Weed Control Only	7.6 c	8.0 cd	6.9 e	6.8 d	7.5 e	8.0 c
Untreated	7.6 c	7.8 d	7.1 de	7.0 cd	7.5 e	7.7 c

*Weed control included one application of a preemergence herbicide for crabgrass control and one application of a postemergence herbicide for broadleaf weed control.

**CGM = Corn gluten meal is an organic preemergence herbicide.

***Means in a column followed by the same letter are not significantly different according to Fisher's protected LSD, $P = 0.05$.

Table 2. Tall fescue quality in response to organic and synthetic organic fertilizer and weed control programs. College Park, MD., 2009.

	Turf quality (0-10 scale)						
Program	1 Jul	21 Jul	3 Aug	13 Aug	23 Aug	16 Sep	28 Sep
LCO	8.3 ab***	8.1 ab	7.9 ab	6.6 ab	6.1 cde	8.4 ab	9.5 a
3-Tier	7.3 def	6.5 f	6.1 ef	5.4 e	5.0 g	5.1 d	6.4 d
3-Tier + Weed Control*	8.5 a	7.7 abc	7.5 bc	6.4 bc	6.0 de	7.7 b	8.4 bc
Organic + CGM**	7.8 bc	7.3 cde	7.1 cd	6.3 bc	5.6 ef	6.4 c	8.0 c
Organic + Weed Control	8.4 a	7.7 abc	7.7 abc	6.6 ab	6.8 ab	8.5 ab	9.4 ab
Urea	7.8 bcd	7.9 abc	6.8 de	6.0 cd	5.4 fg	6.2 c	8.0 c
Urea + Weed Control	8.5 a	8.3 a	8.3 a	7.1 a	6.6 abc	8.7 a	9.8 a
Compost Tea (CT)	7.0 f	6.5 f	6.3 ef	5.5 de	5.0 g	5.3 d	6.4 d
CT + Weed Control	8.2 ab	7.3 cde	7.7 abc	6.6 ab	6.6 abc	8.0 ab	8.3 c
Golf Course Rough	8.4 a	7.5 bcd	8.3 a	7.1 a	7.1 a	8.4 ab	9.5 a
Weed Control Only	7.6 cde	6.6 ef	7.1 cd	6.5 bc	5.8 def	6.6 c	8.0 c
Untreated	7.1 ef	6.8 def	6.0 f	5.4 e	5.0 g	5.1 d	6.4 d

*Weed control included one application of a preemergence herbicide for crabgrass control and one application of a postemergence herbicide for broadleaf weed control.

**CGM = Corn gluten meal is an organic preemergence herbicide.

***Means in a column followed by the same letter are not significantly different according to Fisher's protected LSD, $P = 0.05$.

Table 3. Weed cover and summer dormancy in tall fescue in response to organic and synthetic organic fertilizer and weed control programs. College Park, MD., 2009.

	Weeds†		Brown/dormant		Broadleaf	Crabgrass
Program	1 Jul	21 Jul	13 Aug	23 Aug	13 Aug	23 Aug
	------- % -------		--------- % ----------		--- % ----	--- % ----
LCO	0.0 c***	0.0 c	20.8 abc	26.3 ab	0.0 c	1.3 e
3-Tier	2.8 ab	6.0 b	25.3 ab	18.8 bc	5.3 a	21.3 ab
3-Tier + Weed Control*	0.0 c	0.0 c	29.0 a	29.3 a	0.0 c	0.8 e
Organic + CGM**	2.3 bc	3.3 bc	12.3 c	13.5 c	3.5 abc	11.8 cd
Organic + Weed Control	0.0 c	0.0 c	21.5 abc	13.5 c	0.0 c	1.0 e
Urea	0.5 bc	2.0 bc	12.5 c	12.5 c	0.5 bc	17.8 bc
Urea + Weed Control	0.0 c	0.0 c	13.3 c	18.5 bc	0.0 c	1.2 e
Compost Tea (CT)	4.8 a	12.0 a	17.5 bc	24.3 ab	6.3 a	19.0 abc
CT + Weed Control	0.0 c	0.0 c	24.0 ab	21.5 abc	0.0 c	1.2 e
Golf Course Rough	0.0 c	0.0 c	12.0 c	13.5 c	0.0 c	0.8 e
Weed Control Only	1.8 bc	7.0 ab	18.8 bc	21.3 abc	0.0 c	4.3 de
Untreated	1.9 bc	4.0 bc	27.5 ab	24.5 ab	4.0 ab	27.8 a

*Weed control included one application of a preemergence herbicides for crabgrass control and one application of a postemergence herbicide for broadleaf weed control.

**CGM = Corn gluten meal is an organic preemergence herbicide.

***Means in a column followed by the same letter are not significantly different according to Fisher's protected LSD, $P = 0.05$.

†Composite rating of all weeds present.

Table 4. Tall fescue foliar color in response to organic and synthetic organic fertilizer and weed control programs, College Park, MD 2010.

	Turf color (0 – 10 scale)					
Program	15-Jan	10-Mar	12-Apr	12-May	15-Jun	6-Oct
LCO	7.3ab***	6.5bc	10.0a	9.5a	8.0abc	9.4a
3-Tier	5.8ef	5.6ef	8.1e	8.1cd	7.3de	5.0g
3-Tier + Weed Control*	6.6bcd	6.0de	8.8d	8.4bc	7.6cde	7.3ef
Organic + CGM**	7.5a	6.6ab	9.8ab	9.8a	8.4ab	8.4bc
Organic + Weed Control	7.5a	7.0a	9.8ab	9.3a	8.0abc	8.7abc
Urea	6.5cde	6.3bcd	10.0a	9.6a	8.5a	8.1bcd
Urea + Weed Control	7.0a-d	6.5bc	10.0a	9.9a	8.4ab	8.3ab
LeafGro	5.8ef	5.6ef	8.0e	7.9cd	7.0e	5.5g
LeafGro + Weed Control	6.3de	6.1cd	9.1c	8.8b	7.5cde	7.5de
Golf Course Rough	7.1abc	6.6ab	9.6b	9.6a	8.6a	8.0cde
Weed Control Only	6.3de	6.0de	8.9cd	8.1cd	7.8bcd	6.5f
Untreated	5.3f	5.5f	7.8e	7.5d	7.1de	4.8g

*Weed control included one application of a preemergence herbicide for crabgrass control and one application of a postemergence herbicide for broadleaf weed control.
**CGM = Corn gluten meal is an organic preemergence herbicide
***Means in a column followed by the same letter are not significantly different according to Fisher's protected LSD, $P = 0.05$.

Table 5. Tall fescue quality response to organic and synthetic organic fertilizer and weed control programs, College Park, MD 2010.

	Overall quality (0 – 10 scale)							
Program	12-Apr	12-May	15-Jun	27-Jul	13-Aug	9-Sep	6 Oct	2 Nov
LCO	9.3ab***	9.7a	8.3a-d	7.0ab	7.3a	8.0a	8.4a	9.2a
3-Tier	5.6d	6.1d	5.8e	5.1d	4.0c	4.4e	4.0f	2.3e
3-Tier +Weed Control*	8.9abc	8.5c	7.8cd	6.8bc	6.7ab	6.4bc	5.8c	7.1bc
Organic + CGM**	7.8c	8.3c	8.4abc	6.8bc	5.9b	5.8cd	5.6cd	5.3d
Organic +Weed Control	9.6ab	9.6ab	8.4abc	7.0ab	6.6ab	6.8b	6.5b	7.5b
Urea	9.2ab	8.5c	8.3a-d	6.5bc	5.7b	5.6d	5.0de	5.5cd
Urea + Weed Control	9.9a	10.0a	8.5ab	7.6a	7.2a	6.9b	6.6b	7.8ab
LeafGro	5.9d	6.1d	5.8e	5.3d	4.0c	4.5e	4.1f	3.1e
LeafGro+Weed Control	9.1ab	8.6bc	7.6d	6.2c	6.0b	5.7cd	5.1cd	6.4bcd
Golf Course Rough	9.2ab	9.6a	8.8a	6.8bc	6.2b	5.7cd	5.5cd	6.6bcd
Weed Control Only	8.8bc	8.3c	7.9bcd	6.5bc	5.8b	5.5d	4.4ef	5.3d
Untreated	6.1d	6.1d	5.4e	5.3d	3.4c	4.0e	4.0f	1.5e

*Weed control included one application of a preemergence herbicide for crabgrass control and one application of a postemergence herbicide for broadleaf weed control.

**CGM = Corn gluten meal is an organic preemergence herbicide

***Means in a column followed by the same letter are not significantly different according to Fisher's protected LSD, $P = 0.05$.

Table 6. Red thread, drought dormancy, green-up and final turf cover ratings in tall fescue in response to organic and synthetic organic fertilizer and weed control programs, College Park, MD 2010.

Program	% Red thread 7-Jun	% Brown/ Dormant 23-Jun	% Green-up 13-Jul	% TF cover 2-Nov
LCO	0.9c***	78.3a	69.5ab	100a
3-Tier	4.0bc	75.0ab	62.0abc	30d
3-Tier +Weed Control*	3.5c	81.8a	58.8bc	94ab
Organic + CGM**	0.4c	75.0ab	63.8abc	80b
Organic + Weed Control	0.9c	71.8abc	61.3abc	94ab
Urea	0.5c	77.5a	67.5ab	83ab
Urea + Weed Control	0.5c	62.5bc	70.3a	96ab
LeafGro	3.5c	77.5a	60.0abc	51c
LeafGro + Weed Control	9.3a	68.3abc	63.3abc	94ab
Golf Course Rough	1.0c	58.8c	70.0a	95ab
Weed Control Only	7.3ab	73.3ab	63.3abc	82ab
Untreated	8.5a	75.0ab	55.8c	19d

*Weed control included one application of a preemergence herbicide for crabgrass control and one application of a postemergence herbicide for broadleaf weed control.
**CGM = Corn gluten meal is an organic preemergence herbicide
***Means in a column followed by the same letter are not significantly different according to Fisher's protected LSD, $P = 0.05$.

Table 7. Weed cover in tall fescue in response to organic and synthetic organic fertilizer programs weed control, College Park, MD 2010.

	% Weeds			% Clover		% Crabgrass		
Program	12-Apr	12-May	15-Jun	27-Jul	13-Aug	27-Jul	13-Aug	9-Sep
LCO	0.8c***	0.1c	0.0c	0.0c	0.0b	0.0c	1.5b	3.0e
3-Tier	19.0ab	19.5ab	16.0a	10.0ab	15.5a	38.0a	64.5a	82.5a
3-Tier + Weed Control*	0.4c	0.1c	0.0c	0.0c	0.3b	0.3c	5.3b	23.8cde
Organic +CGM**	5.5c	5.3c	0.5c	0.0c	1.0b	7.4bc	18.3b	48.0bc
Organic + Weed Control	0.3c	0.1c	0.0c	0.0c	0.0b	1.3c	4.8b	13.0de
Urea	1.9c	3.0c	1.6bc	1.0c	1.5b	5.8c	18.5b	51.5b
Urea + Weed Control	0.0c	0.0c	0.0c	0.0c	0.0b	0.1c	4.3b	16.8de
LeafGro	22.0a	27.1a	21.8a	13.3a	17.5a	28.0ab	55.8a	83.3a
LeafGro + Weed Control	0.1c	0.3c	0.0c	0.0c	0.0b	1.0c	9.8b	35.8bcd
Golf Course Rough	0.8c	0.1c	0.1c	0.0c	0.0b	2.1c	10.0b	38.8bcd
Weed Control Only	0.0c	0.0c	0.0c	0.0c	0.0b	3.9c	18.3b	51.3b
Untreated	10.0bc	11.3bc	12.3ab	5.3bc	11.5a	44.5a	75.0a	89.3a

*Weed control included one application of a preemergence herbicide for crabgrass control and one application of a postemergence herbicide for broadleaf weed control.

**CGM = Corn gluten meal is an organic preemergence herbicide

***Means in a column followed by the same letter are not significantly different according to Fisher's protected LSD, $P = 0.05$.

Treatment Diary 2009

Treatment 1. LCO Synthetic Organic

Round 1. Applied SCU + Stonewall @ 0.75 lb N and 0.75 lb ai prodiamine on April 2, 2009. Over 0.5 inches of rain fell in +24 hrs of application on 3 April.

Round 2. Speedzone 2.2 EC (1.1 lb ai/A or 60 ml in 6 L) applied May 19.

Round 3. Synatech 20-0-3 at 30 fl oz/1000 sq ft (0.5 lb N/1000 sq ft) @ 204ml in 1L 8 July and watered-in 3-5 hrs.

Round 4. Lesco SCU 34-0-0 at 0.75 lb N/1000ft2 = 50 grm/plot on Sept. 2 and watered-in immediately.

Treatment 2. 3-Tier

Round 1. Applied 61 ml Pre-Mix Blue XL (Establish 5-16-12 @ 1.5 fl oz/1000 ft^2 + Huma-Balance XL w/Bio-Cat Booster @ 3.0 fl oz/1000 ft^2) + 20.4 ml Huma Fe in 2L on April 2, 2009; 0.5" rain on April 3.

Round 2. 20.4 ml Growth 16-4-8 (1.5 fl oz/1000ft2) + 40.8 ml Huma-Balance XL w/Bio-Cat Booster (3.0 fl oz/1000 ft^2) + 20.4 ml Huma-MnFe (1.5 flo oz/1000ft^2) in 2L water and applied May 7, 2009.

Round 3. 20.4 ml Nitro 21-0-0 (1.5 fl oz) + 40.8ml Huma Balance XL w/Bio-Cat Booster (3.0 fl oz) + 20.4 ml Huma MnFe (1.5 fl oz) in 2L and applied June 10; not irrigated due to saturated soils.

Round 4. 20.4 ml Nitro 21-0-0 (1.5 fl oz) + 40.8ml Huma Balance XL w/Bio-Cat Booster (3.0 fl oz) + 20.4 ml Huma MnFe (1.5 fl oz) in 2L on 8 July and watered in3-5 hrs.

Round 5. 20.4 ml Growth 16-4-8 (1.5 fl oz/1000ft2) + 40.8 ml Huma-Balance XL w/Bio-Cat Booster (3.0 fl oz/1000 ft^2) + 20.4 ml Huma-MnFe (1.5 flo oz/1000ft^2) in 2L water and applied August 5, 2009; 0.15" rain + 24hrs.

Round 6. 20.4 ml Maintain 8-16-8 (1.5 oz/1000 ft) plus 40.8 ml Huma-Balance XL w/Bio-Cat Booster (3.0 fl oz/1000 ft^2) + 20.4 ml Huma-MnFe (1.5 flo oz/1000ft^2) in 2L water on Sept. 2 and watered-in immediately.

Treatment 3. 3-Tier + Weed Control

Round 1. Applied 61 ml Pre-Mix Blue XL + 20.4 ml Huma Fe in 2L plus Dimension 40WSP at 0.5 lb ai/A on April 2, 2009.

Round 2. 20.4 ml Growth 16-4-8 (1.5 fl oz/1000ft^2) + 40.8 ml Huma-Balance XL w/Bio-Cat Booster (3.0 fl oz/1000 ft^2) + 20.4 ml Huma-MnFe (1.5 flo oz/1000ft^2) in 2L water and applied May 7,2009. Speedzone 2.2EC (1.1 lb ai/A) applied May 19.

Round 3. 20.4 ml Nitro 21-0-0 (1.5 fl oz) + 40.8ml Huma Balance XL w/Bio-Cat Booster (3.0 fl oz) + 20.4 ml Huma MnFe (1.5 fl oz) in 2L and applied June 10.

Round 4. 20.4 ml Nitro 21-0-0 (1.5 fl oz) + 40.8ml Huma Balance XL w/Bio-Cat Booster (3.0 fl oz) + 20.4 ml Huma MnFe (1.5 fl oz) in 2L on 8 July and watered in 3-5 hrs.

Round 5. 20.4 ml Growth 16-4-8 (1.5 fl oz/1000ft2) + 40.8 ml Huma-Balance XL w/Bio-Cat Booster (3.0 fl oz/1000 ft^2) + 20.4 ml Huma-MnFe (1.5 flo oz/1000ft^2) in 2L water and applied August 5, 2009; 0.15" rain + 24hrs .

Round 6. 20.4 ml Maintain 8-16-8 (1.5 oz/1000 ft) plus 40.8 ml Huma-Balance XL w/Bio-Cat Booster (3.0 fl oz/1000 ft^2) + 20.4 ml Huma-MnFe (1.5 fl oz/1000ft^2) in 2L water on Sept. 2 and watered-in immediately.

Treatment 4. Organic + CGM

Round 1. Applied 20 lb product Corn Gluten per 1000 sq ft on April 2, 2009.

Round 2. Oceangro 5-5-0 at 0.5 lb N/1000 sq ft = 228 grm/plot on 8 July and watered in 3-5 hrs.

Round 3. Oceangro 5-5-0 at 0.75 lb N/1000 sq ft = 340 grm/plot on Sept. 2 and watered-in immediately.

Treatment 5. **Organic + Weed Control**

Round 1. Applied Oceangro Sewage Sludge at 1.0 lb N and Dimension at 0.5 lb ai/A on April 2, 2009.

Round 2. Speedzone 2.2 EC (1.1 lb ai/A or 60 ml in 6 L) applied May 19.

Round 3. Oceangro 5-5-0 at 0.5 lb N/1000 sq ft = 228 grm/plot on 8 July and watered in 3-5 hrs.

Round 4. Oceangro 5-5-0 at 0.75 lb N/1000 sq ft = 340 grm/plot on Sept. 2 and watered-in immediately.

Treatment 6. Urea 46-0-0

Round 1. Applied urea at 1.0 lb N on April 2, 2009.

Round 2. Applied urea at 0.5 lb N/1000 sq ft = 25 gr/plot on 8 July and watered in 3-5hrs.

Round 3. Applied urea at 0.75 lb N/1000 sq ft = 38gr/plot on Sept. 2 and watered-in immediately.

Treatment 7. Urea + Weed Control

Round 1. Applied urea at 1.0 lb N and Dimension at 0.5 lb ai/A on 2 April

Round 2. Speedzone 2.2 EC (1.1 lb ai/A or 60 ml in 6 L) applied May 19.

Round 3. Applied urea at 0.5 lb N/1000 sq ft = 25 gr/plot on 8 July and watered in 3-5 hrs.

Round 4. Applied urea at 0.75 lb N/1000 sq ft = 38gr/plot on Sept. 2 and watered-in immediately.

Treatment 8. Compost Tea [385-400 grams compost aerated for 24 hrs in 10L creek water.

Round 1. Applied 1300 ml of Compost Tea (300 gal/A) on April 2, 2009.

Round 2. Applied 1300ml of Compost Tea on April 17; 1.46 inches rain April 20.

Round 3. Applied 1300 ml of Compost Tea on April 30.

Round 4. Applied 1300 ml of CT on May 14 using new brew system/Paint Branch creek water.
Round 5. Applied 1300ml CT on May 27 using new system and creek water; rain +24hrs.
Round 6. Applied 1300ml CT on June 10 using new system and creek water; rain +24hrs.
Round 7. Applied 1300ml CT on June 24, no rain or irrigation this time-too wet.
Round 8. Applied 1300ml CT on July 8 and watered-in 3-5 hrs.
Round 9. Applied 1300ml CT on July 22; 0.5 inch rain on July 23.
Round 10. Applied 1300ml CT on August 5; 0.15" rain on August 6.
Round 11. Applied 1300ml CT on August 19 and irrigated on August 20.
Round 12. Applied 1300ml CT on Sept. 2 and irrigated immediately.

Treatment 9. Compost Tea [see above] + Weed Control
Round 1. Applied 1300 ml of Compost Tea (300 gal/A) on April 2, 2009 and Dimension at 0.5 lb ai/A on April 2.
Round 2. Applied 1300ml of Compost Tea on April 17; 1.46 in. rain April 20.
Round 3. Applied 1300 ml of Compost Tea on April 30.
Round 4a. Speedzone 2.2 EC (1.1 lb ai/A or 60 ml in 6 L) on May 19.
Round 4b. Applied 1300 ml CT on May 14 using new brew system.
Round 5. Applied 1300ml CT on May 27 using new system and creek water; rain +24hrs.
Round 6. Applied 1300ml CT on June 10 using new system and creek water; rain +24hrs.
Round 7. Applied 1300ml CT on June 24, no rain or irrigation this time.
Round 8. Applied 1300ml CT on July 8 and watered-in 3-5 hrs.
Round 9. Applied 1300ml CT on July 22; 0.5 inch rain on July 23.
Round 10. Applied 1300ml CT on August 5; 0.15" rain on August 6.
Round 11. Applied 1300ml CT on August 19 and irrigated August 20.
Round 12. Applied 1300ml CT on Sept. 2 and irrigated immediately.

Treatment 10. Golf Course Rough
Round 1. Applied 83.7 grms/plot of Harrell's Polyon Urea (26-0-12) with Dimension 0.17G to deliver 1.0 lb N/1000 ft^2 and 0.28 lb ai dithiopyr/A on April 23 and was water-in on April 24. No crabgrass yet.
Round 2. Speedzone 2.2 EC (1.1 lb ai/A or 60 ml in 6 L) on May 19.
Round 3. Polycoat urea 25-3-10 @ 0.5 lb N/1000 sq ft = 45 grms/plot on 8 July and watered in 3-5 hrs.
Round 4. Polycoat urea 25-3-10 @ 0.75 lb N/1000 sq ft = 68 grm/plot on Sept. 2 and watered-in immediately.

Treatment 11. Weed Control Only – No Fertilizer
Round 1. Applied Drive at 0.75 lb ai/A to control crabgrass and white clover on July 29, 2009. Good soil moisture.

Treatment 12. Untreated – no fertilizer or weed control

Treatment Diary 2010

Treatment 1. LCO - Synthetic Program

Round 1. Applied SCU + Stonewall @ 0.75 lb N and 0.75 lb ai prodiamine on March 31, 2010. Irrigated +48 hrs..

Round 2. Speedzone 2.2 EC (1.1 lb ai/A or 70 ml in 7 L) applied May 21, 2010.

Round 3. Synatech 20-0-3 at 30 fl oz/1000 sq ft (0.5 lb N/1000 sq ft) @ 204ml in 1L July 1 and watered-in + 3 hrs.

Round 4. . Lesco SCU 34-0-0 at 0.75 lb N/1000ft2 = 50 grm/plot on Sept. 7, 2010. Area irrigated + 5hrs.

Treatment 2. 3-Tier

Round 1. Tank mix Blue XL @ 6.0 oz /1000 ft2 (82ml in 2L) + Huma-MnFe @2.25 oz/1000ft^2 (31ml in 2L). Applied March 31, 2010; irrigated +48 hrs.

Round 2. Tank-mix Growth XL @ 6.0 fl. oz/1000 ft2 (82 ml in 2L) + Huma MnFe @ 2.25 fl oz/1000 ft^2 (31 ml in 2L) on May 5, 2010; irrigation +24hrs.

Round 3. Tank-mix Green-Grow XL (6.0 oz/1000 ft2 = 82ml in 2L) + Huma-MnFe (2.25 oz/1000ft2 = 31 ml in 2L) on June 2, 2010. Irrigated 24hrs.

Round 4. Tank-mix Green-Grow XL (6.0 oz/1000 ft2 = 82ml in 2L) + Huma-MnFe (2.25 oz/1000ft2 = 31 ml in 2L) on July 1, 2010 and watered-in + 3 hrs.

Round 5. Tank-mix Growth XL @ 6.0 fl. oz/1000 ft2 (82 ml in 2L) + Huma MnFe @ 2.25 fl oz/1000 ft^2 (31 ml in 2L) on August 2, 2010; 0.38" rain +36hrs.

Round 6. Tank-mix Growth XL @ 6.0 fl. oz/1000 ft2 (82 ml in 2L) + Huma MnFe @ 2.25 fl oz/1000 ft^2 (31 ml in 2L) on Sept. 7, 2010. . Area irrigated + 5hrs.

Treatment 3. 3-Tier + Weed Control

Round 1. . Tank mix Blue XL @ 6.0 oz /1000 ft2 (82ml in 2L) + Huma-MnFe @2.25 oz/1000ft^2 (31ml in 2L) and Dimension 40WSP at 0.38 lb ai/1000 ft2. .Applied March 31, 2010; irrigated +48 hrs.

Round 2. Tank-mix Growth XL @ 6.0 fl. oz/1000 ft2 (82 ml in 2L) + Huma MnFe @ 2.25 fl oz/1000 ft2 (31 ml in 2L) on May 5, 2010; irrigation +24hrs.

Round 3A Speedzone 2.2 EC (1.1 lb ai/A or 70 ml in 7 L) applied May 21, 2010.

Round 3B Tank-mix Green-Grow XL (6.0 oz/1000 ft2 = 82ml in 2L) + Huma-MnFe (2.25 oz/1000ft2 = 31 ml in 2L) on June 2, 2010. Irrigated 24hrs.

Round 4. Tank-mix Green-Grow XL (6.0 oz/1000 ft2 = 82ml in 2L) + Huma-MnFe (2.25 oz/1000ft2 = 31 ml in 2L) on July 1,20101 and watered-in + 3 hrs.

Round 5. Tank-mix Growth XL @ 6.0 fl. oz/1000 ft2 (82 ml in 2L) + Huma MnFe @ 2.25 fl oz/1000 ft^2 (31 ml in 2L) on August 2, 2010; 0.38" rain+36 hrs.

Round 6. Tank-mix Growth XL @ 6.0 fl. oz/1000 ft2 (82 ml in 2L) + Huma MnFe @ 2.25 fl oz/1000 ft^2 (31 ml in 2L) on Sept. 7, 2010. . Area irrigated + 5hrs.

Treatment 4. Organic + CGM

Round 1.Applied 20 lb product Corn Gluten per 1000 sq ft (454 gr/plot) on March 31, 2010. Irrigation + 48 hrs.

Round 2. Broadleaf weeds (mostly white clover) were spot-treated with Ecosense Lawn Weed Killer (Ortho), which is 1.5% Iron HEDTA, on May 21, 2010. Weed leaves were wet to run-off
Round 3. Oceangro 5-5-0 at 0.5 lb N/1000 sq ft = 228 grm/plot on July 1, 20101 and watered-in + 3 hrs.
Round 4. . Oceangro 5-5-0 at 0.75 lb N/1000 sq ft = 340 grm/plot on Sept. 7, 2010. . Area irrigated + 5hrs.

Treatment 5. **Organic + Weed Control**
Round 1.Applied Oceangro Sewage Sludge at 1.0 lb N (454 gr/plot) and Dimension at 0.38 lb ai/A on March 31, 2010; irrigation + 48 hrs.
Round 2. Speedzone 2.2 EC (1.1 lb ai/A or 70 ml in 7 L) applied May 21, 2010.
Round 3. Oceangro 5-5-0 at 0.5 lb N/1000 sq ft = 228 grm/plot on July 1, 2010 and watered-in + 3 hrs.
Round 4. . Oceangro 5-5-0 at 0.75 lb N/1000 sq ft = 340 grm/plot on Sept. 7, 2010. . Area irrigated + 5hrs.

Treatment 6. Urea 46-0-0
Round 1. Applied urea at 1.0 lb N (49 gr/plot) on March 31, 2010; irrigation +48 hrs.
Round 2. Applied urea at 0.5 lb N/1000 sq ft = 25 gr/plot on July 1, 2010 and watered in + 3hrs.
Round 3. Applied urea at 0.75 lb N/1000 sq ft = 38gr/plot on Sept.7, 2010. . Area irrigated + 5hrs.

Treatment 7. Urea + Weed Control
Round 1.Applied urea at 1.0 lb N and Dimension at 0.38 lb ai/A on 31 March 2010; irrigation + 48 hrs.
Round 2. Speedzone 2.2 EC (1.1 lb ai/A or 70 ml in 7 L) applied May 21, 2010.
Round 3. Applied urea at 0.5 lb N/1000 sq ft = 25 gr/plot on July 1 and watered in 3hrs. . Area irrigated + 5hrs.
Round 4. Applied urea at 0.75 lb N/1000 sq ft = 38gr/plot on Sept. 7, 2010. Area irrigated + 5hrs.

Treatment 8. Leafgro and Compost Tea (CT)
Round 1. LeafGro applied at 80 lb/1000 ft2 (1818 gr/plot) on 31 March 2010; irrigation + 48hrs.
Round 2. LeafGro applied at 80 lb/1000 ft2 (1818 gr/plot) on May 5, 2010;
Round 3. LeafGro applied at 80 lb/1000ft2 on June 2 and irrigated +24hrs.
Round 4. Applied 1300ml CT on June 15 using new system and creek water
Round 5. LeafGro applied at 80 lb/1000 ft2 (1818 gr/plot) on July 1, 2010.
Round 6. Applied 1300ml CT on July 15, 2010 and watered-in 3 hrs.
Round 7. LeafGro applied at 80 lb/1000 ft2 (1818 gr/plot) on Sept. 7, 2010. Area irrigated + 5hrs.

Treatment 9. Leafgro and Compost Tea + Weed Control

Round 1. LeafGro applied at 80 lb/1000 ft2 (1818 gr/plot) and Dimension at 0.38 lb ai/A on 31 March 2010; irrigation +48hrs.
Round 2. LeafGro applied at 80 lb/1000 ft2 (1818 gr/plot) on May 5, 2010; irrigation +24hrs.
Round 3. Speedzone 2.2 EC (1.1 lb ai/A or 70 ml in 7 L) applied May 21, 2010.
Round 3b. . LeafGro applied at 80 lb/1000ft2 on June 2 and irrigated +24hr
Round 4. Applied 1300 ml CT on June 15 using new brew system.
Round 5. LeafGro applied at 80 lb/1000 ft2 (1818 gr/plot) on July 1, 20101 and watered-in + 3 hrs. .
Round 6. Applied 1300ml CT on July 15, 2010 and watered-in 3-5 hrs.
Round 7. LeafGro applied at 80 lb/1000 ft2 (1818 gr/plot) on Sept. 7, 2010. . Area irrigated + 5hrs.

Treatment 10. Golf Course Rough
Round 1. Applied 83.7 grms/plot of Harrell's Polyon Urea (26-0-12) with Dimension 0.17G to deliver 1.0 lb N/1000 ft2 and 0.28 lb ai dithiopyr/A on March 31, 2010; irrigation +48hrs.
Round 2. Speedzone 2.2 EC (1.1 lb ai/A or 70 ml in 7 L) applied May 21, 2010.
Round 3. Polycoat urea 25-3-10 @ 0.5 lb N/1000 sq ft = 45 grms/plot on July 1, 2010 and watered in 3 hrs.
Round 4. Polycoat urea 25-3-10 @ 0.75 lb N/1000 sq ft = 68 grm/plot on Sept. 7, 2010. . Area irrigated + 5hrs.

Treatment 11. Weed Control Only - No fertilizer
Round 1. Applied Dimension at 0.38 lb ai/A on March 31, 2010; irrigation +48hrs.
Round 2. Speedzone 2.2 EC (1.1 lb ai/A or 70 ml in 7 L) applied May 21, 2010.

Treatment 12. Untreated – No Fertilizer or Weed Control.