**GEORGIA GOLF ENVIRONMENTAL FOUNDATION**

REPORT SECOND YEAR (January 17, 2017)

# TEMPORAL, CULTURAL, BIOLOGICAL, AND CHEMICAL PRACTICES TO ENHANCE SPRING DEAD SPOT (SDS) CONTROL OF BERMUDAGRASS IN GEORGIA.

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## 1. COMBINATION OF TEMPORAL, CULTURAL, AND CHEMICAL PRACTICES FOR THE CONTROL OF SPRING DEAD SPOT AND EVALUATION OF NEW CHEMISTRIES

### Introduction

Bermudagrass (*Cynodon* sp.) is the single most popular, widely used warm-season grass in Georgia. It is found in most sport fields, lawns, greens, tees, and fairways. It is also extensively produced in sod farms and found in pastures. Spring dead spot (SDS) (caused by *Ophiosphaerella korrae, O. narmari* and *O. herpotricha*) is a persistent and destructive disease of bermudagrass (*Cynodon* sp.) in Georgia. The disease is particularly prevalent and damaging in the northern part of Georgia, especially in the Piedmont physiographic area. However, SDS can be observed throughout the state after harsh winters and in areas where bermudagrass has been exposed to freezing temperatures for extended periods of time. There are 401 golf courses in Georgia with 80% having bermudagrass on greens and 100% using bermudagrass either on tees, fairways, and/or roughs. Anecdotal data estimates that each golf course spends an average of $11,500 a year managing SDS, this translates on an estimated cost of control of US $ 3,600,000 statewide. These estimates do not include data from other turfgrass sectors such as sports fields and lawncare. To date, there is no consistent and efficacious control of the disease. Cultural practices as well as fungicide availability have proven erratic and ineffective at reducing disease. Additionally, inability to identify *Ophiophaerella* infection timing has led to inconsistent control, varying from area to area and from year to year. Furthermore, environmental stewardship, overreliance on chemical control, and increasing concerns about pesticide resistance has led turfgrass managers to examine alternative practices to reduce plant disease.

Four reports have been previously submitted on 03 Nov 2014, June 18, 2015, July 10, 2016 and an interim report on Nov 17, 2016. This report summarizes the field research and results from year 2 of the Spring Dead Spot GGEF grant.

### Materials and Methods

1. **Evaluation of Cultural Practices**
   a. **Effect of Core Aereation**

   Field experimental areas were either core-aerated or not core-aerated (cultural treatment) using 1-inch solid tines immediately prior to fungicide applications in the fall and in the spring (temporal treatment)

2. **Evaluation of Fungicide Treatments applied either in the fall or spring**
   a. **Fall applications**

   Two fungicide trials were conducted on a 7-year-old sward of bermudagrass cv. "TifSport" grown on a clay loam soil (pH 5.8) at the University of Georgia-Griffin campus and on a 15-year-old 319 bermudagrass fairway at Towne Lake Hills Golf Club located in Woodstock GA. Turfgrass cultural practices were similar to those prescribed for maintenance of fairway areas in Georgia. Fertilizer treatments consisted of 1.0 lb nitrogen (10-10-10) per 1000 sq ft applied monthly during the growing season. The turfgrass was maintained at a height of 5/8 in. to 1 in. by mowing twice a week. The bermudagrass area located at the University of Georgia-Griffin campus has been artificially inoculated with an *Ophiosphaerella korrae* grown on an oat/barley/wheat seed

mixture previously soaked in water overnight and then double sterilized in Erlenmeyer flasks. The infected seed was manually placed into the center of the plot and into the soil (@ 3 inches in depth) by pulling a golf course cup cutter plug and/or soil probe, depositing the infested grain in the soil and replacing the plug on top of the grain. The area located at Towne Lake Hill golf club has a history of severe SDS infections.

On both sites, treatments were arranged as plots (4 ft x 6 ft) in a randomized complete block design with four replications. At the University of Georgia-Griffin campus initial application was made on 09 Oct. 2015 and the second application was made on 10 Nov 2015. At the Towne Lake Hills Golf Club site, fungicides applications were made on Oct 06, 2015 and Nov 03, 2015. Fungicides were mixed with water and sprayed in 2.0 gal. water per 1000 sq ft with a hand held, $CO_2$-pressured boom sprayer at 30 psi using XR TeeJet 800 2vs nozzles. Treatments were watered-in after application with 0.1 in. of irrigation. Normal irrigation was applied as per site management. Visual ratings were performed at 14-8 day intervals at green up. Visual estimates of disease severity were made using a modified Horsfall-Barratt rating scale (0 to 11), and then transformed to percent disease severity (0 = 1.17%, 5=37.5%, 11=98.82%) using ARM. Turf Quality was also rated using a percent (0=bad, unsightly quality; 100=excellent quality). Percent of disease severity and quality data were subjected to analysis of variance and means were separated Fisher's Protected LSD test ($P$= 0.05).

**b. Spring applications**

Two fungicide trials were conducted as described in Fall applications section. On both sites, treatments were arranged as plots (4 ft x 6 ft) in a randomized complete block design with four replications. At the University of Georgia-Griffin campus, initial application was made on 24 Mar, 2016 and the second application was made on 20 Apr, 2016. At the Towne Lake Hills Golf Club site, fungicide applications were made on 29 Mar, 2016 and 26 Apr, 2016. Fungicides were mixed with water and sprayed in 2.0-gal water per 1000 sq ft with a hand held, $CO_2$-pressured boom sprayer at 30 psi using XR TeeJet 800 2vs nozzles. Granular formulations were weighed and distributed equally in each replicated plot using a canister with perforated lid. Treatments were watered-in after application with 0.1 in. of irrigation. Normal irrigation was applied as per in-site management. Visual ratings were performed at 14-28 day intervals at green up. Visual estimates of disease severity were made using a modified Horsfall-Barratt rating scale (0 to 11), and then transformed to percent disease severity (0 = 1.17%, 5=37.5%, 11=98.82%) using ARM. Turf Quality was also rated using a percent (0=bad, unsightly quality; 100=excellent quality). Percent of disease severity and quality data were subjected to analysis of variance and means were separated Fisher's Protected LSD test ($P$= 0.05).

**c. Fungicides chemistries**

| Commercial Name | Active Ingredient (s) | Rate/1000 sq ft | Chemical Group | Company |
|---|---|---|---|---|
| 1. Non Treated Control | ------ | ------- | -------- | -------- |
| 2. Torque | tebuconazole | 0.6 fl oz | DMI | BASF |
| 3. Pillar | triticonazole + pyraclostrobin | 3.0 lb | DMI + Strobilurin | Nufarm |
| 4. Headway | propiconazole + azoxystrobin | 3.0 fl oz | DMI + Strobilurin | Syngenta |
| 5. Rubigan | fenarimol | 6.0 fl oz | DMI | Gowan |
| 6. Briskway | difenconazole + azoxystrobin | 0.75 fl oz | DMI + Strobilurin | Syngenta |
| 7. Xzemplar | fluoxapyroxad | 0.26 fl oz | SDHI | BASF |
| 8. Tourney | metconazole | 0.37 oz | DMI | Valent |
| 9. Torque + Revolution | tebuconazole + modified alkylated polyol | 0.6 fl oz + 6.0 fl oz | DMI + polyol | Nufarm, Aquatrols |

In the 2015-2016 field trials an additional, independent fungicide trial was carried using penthiopyrad (Velista)

| Commercial Name | Active Ingredient (s) | Rate/1000 sq ft | Chemical Group | Company |
|---|---|---|---|---|
| 1. Non Treated Control | ------ | ------- | -------- | -------- |
| 2. Velista | penthiopyrad | 0.3 oz | SDHI | Syngenta |
| 3. Velista | penthiopyrad | 0.5 oz | SDHI | Syngenta |

## RESULTS FOR 2015-2016 SEASON

### 1. Evaluation of Cultural Practices

#### a. Effect of Core Aereation

Core aereation (solid tine) cultural practice before fungicide application was statistically ($P$= 0.05) similar to non-core aereation in both, fall and spring. In other words, core aereation did not increased fungicide efficacy in spring or fall applications in any of the sites. Solid tine did not negatively impact fungicide efficacy, and neither promoted disease severity.

### 2. Evaluation of Fungicide Treatments applied either in the fall or spring

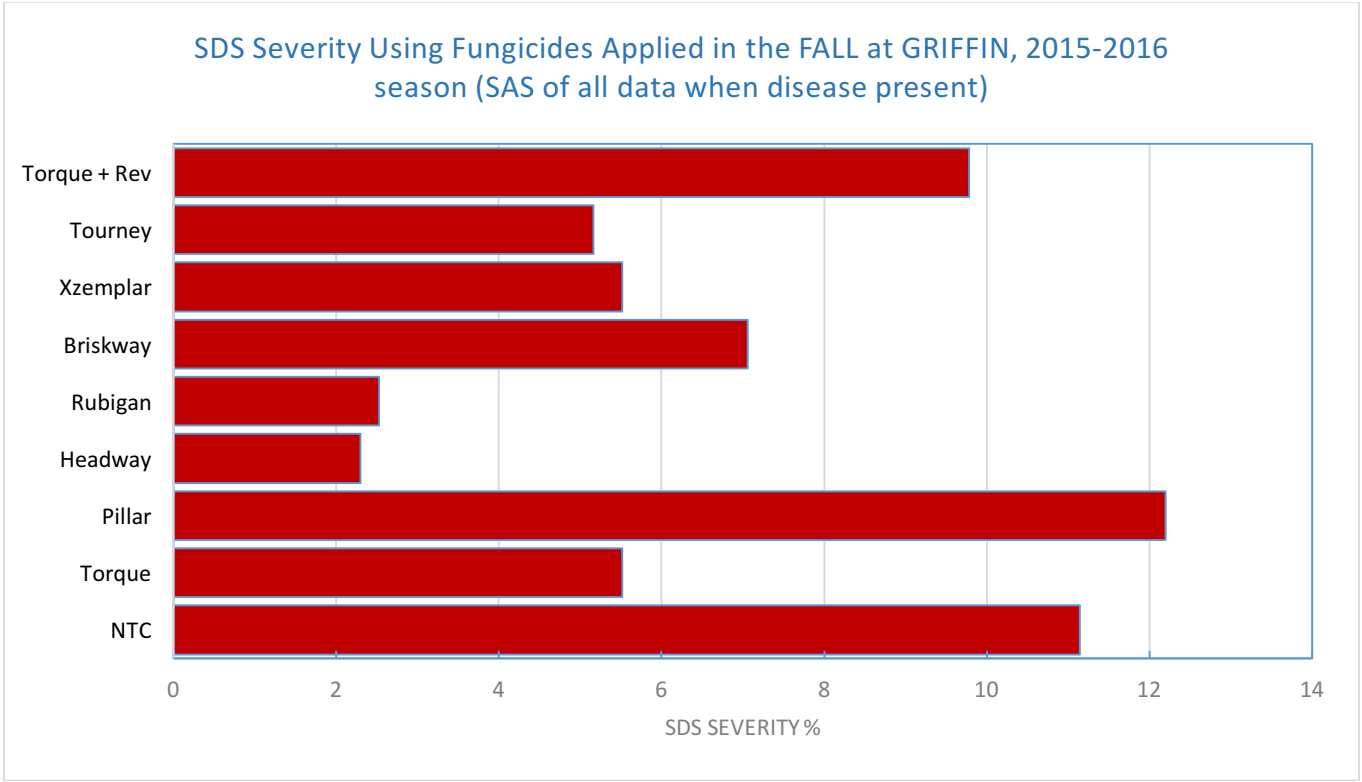
#### a. Fall applications

Efficacy of fungicides applied pre-epidemic (preventive) in the fall on SDS control are summarize in tables 1 and 2.

Table 1. SDS severity and % of SDS reduction using fungicides applied in the FALL at GRIFFIN, 2015-2016 season.

| Treatment | Disease Severity % | % SDS Reduction | Rank |
|---|---|---|---|
| 1. Non Treated Control | 11.14 ab | ----- | ------ |
| 2. Torque 0.6 fl oz | 5.52 bcd | 50.45 | 5 |
| 3. Pillar 3.0 lb | 12.20 a | --- | 8 |
| 4. Headway 3.0 fl oz | 2.30 d | 79.36 | 1 |
| 5. Rubigan 6.0 fl oz | 2.53 d | 77.29 | 2 |
| 6. Briskway 0.75 fl oz | 7.06 bcd | 36.63 | 6 |
| 7. Xzemplar 0.26 fl oz | 5.52 bcd | 50.45 | 4 |
| 8. Tourney 0.37 oz | 5.16 cd | 53.63 | 3 |
| 9. Torque 0.6 fl oz + Revolution 6.0 fl oz | 9.78 abc | 12.79 | 7 |

[z] Within a column, values followed by the same letter are not significantly different according to Fisher's Protected LSD test ($P$= 0.05).



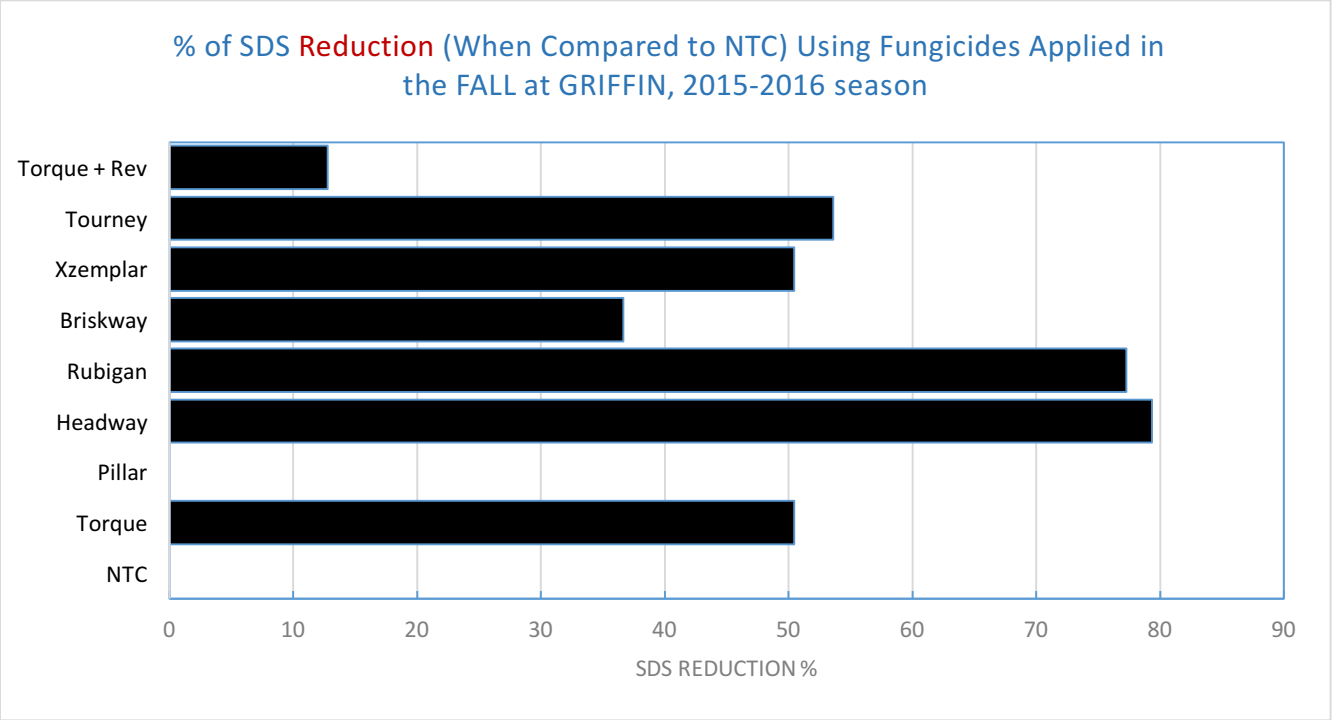
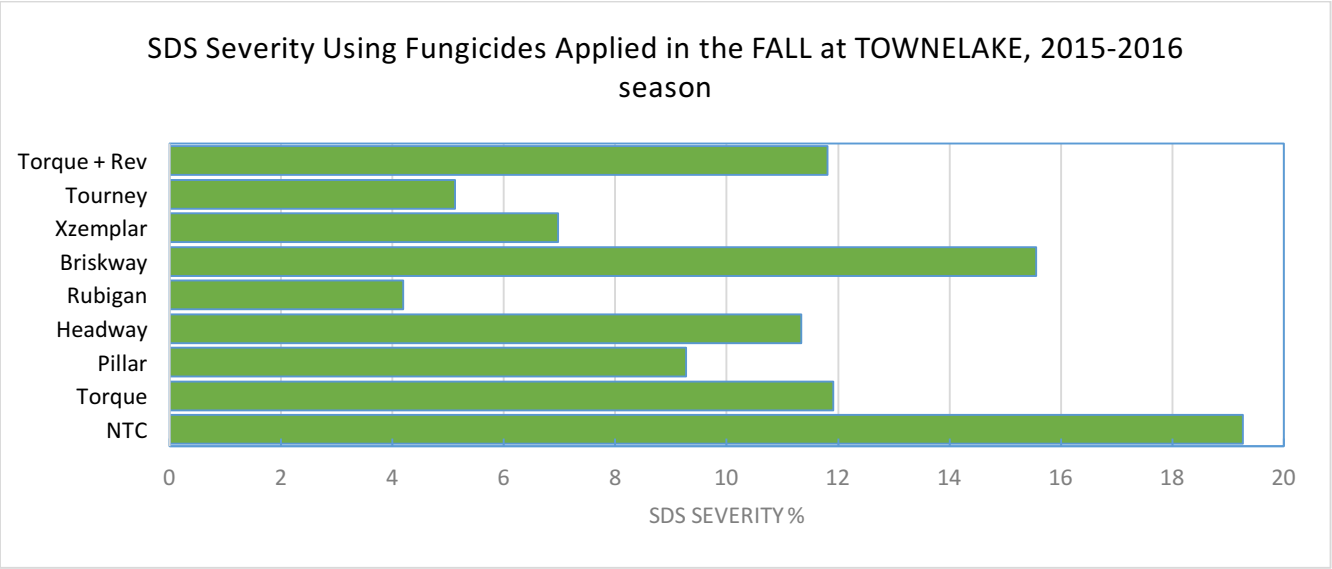
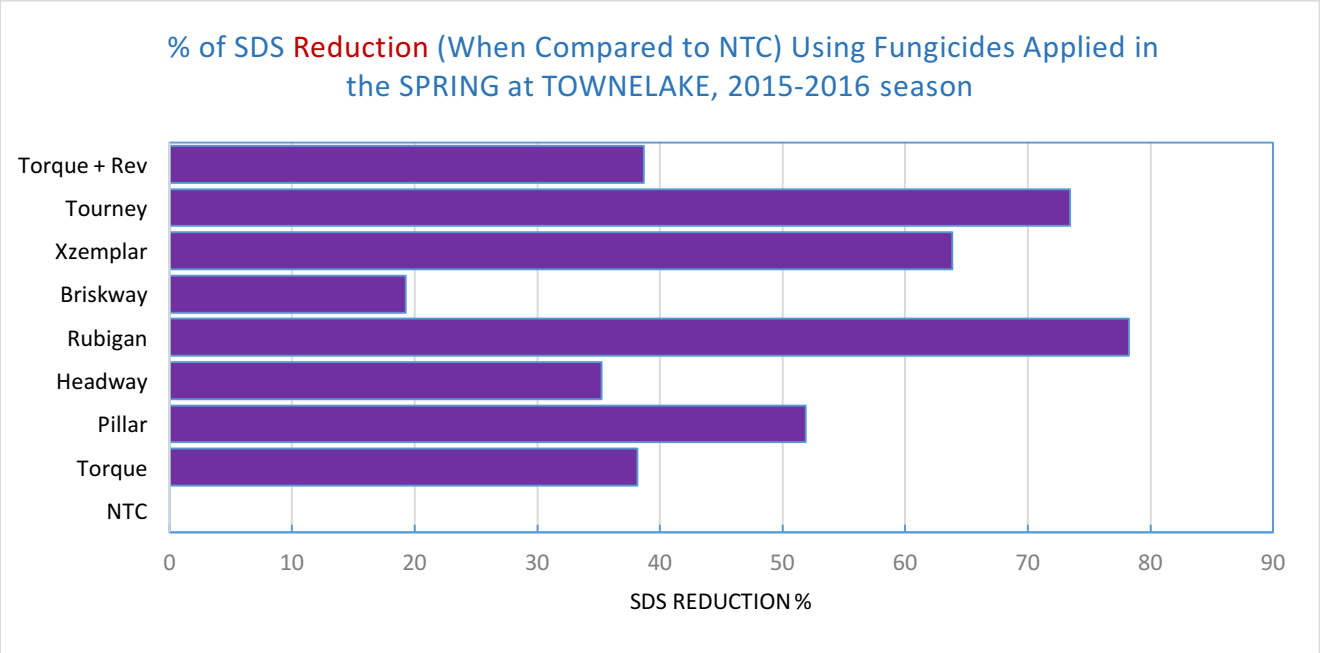



Table 2. SDS severity and % of SDS reduction using fungicides applied in the FALL at TOWNELAKE, 2015-2016 season.

| Treatment | Disease Severity % | % SDS Reduction | Rank |
|---|---|---|---|
| 1. Non Treated Control | 19.26 a | ----- | ------ |
| 2. Torque 0.6 fl oz | 11.91 bc | 38.17 | 6 |
| 3. Pillar 3.0 lb | 9.27 bcd | 51.87 | 4 |
| 4. Headway 3.0 fl oz | 11.34 bcd | 35.26 | 7 |
| 5. Rubigan 6.0 fl oz | 4.19 d | 78.25 | 1 |
| 6. Briskway 0.75 fl oz | 15.55 b | 19.27 | 8 |
| 7. Xzemplar 0.26 fl oz | 6.97 cd | 63.82 | 3 |
| 8. Tourney 0.37 oz | 5.12 cd | 73.42 | 2 |
| 9. Torque 0.6 fl oz + Revolution 6.0 fl oz | 11.81 bc | 38.69 | 5 |

[z] Within a column, values followed by the same letter are not significantly different according to Fisher's Protected LSD test (*P*= 0.05).






Disease severity data obtained in 2015-2016 is quite variable. At the Griffin site and when fungicides were applied in the fall; Headway 3.0 fl oz and Rubigan 6.0 fl oz provided the most significant SDS suppression followed by Tourney 0.37 oz, Torque 0.6 fl oz, Briskway 0.75 fl oz, and Xzemplar 0.26 fl oz. On this site, Pillar 3 lb and Torque 0.6 fl oz + Revolution 6.0 fl oz did not significantly reduced the SDS incidence when compared to the untreated control.

At the Townelake and when fungicides were applied in the fall; All fungicide treatments provided statistically significant SDS suppression. Additionally, SDS incidence in the non-treated control was considerable higher than that observed at the Griffin site. Rubigan 6.0 fl oz provided the highest SDS suppression with 78% of SDS reduction when compared to the non-treated control. Xzemplar 0.26 fl oz and Tourney 0.37 oz provided 63 and 73% SDS reduction when compared to the non-treated control. Percent of SDS reduction ranged from 51-38 % when Headway 3.0 fl oz, Torque 0.6 fl oz, Pillar 3 lb and Torque 0.6 fl oz + Revolution 6.0 fl oz were applied. On this site Briskway 0.75 fl oz only yielded 19 % of SDS reduction.

As previously stated, penthiopyrad (Velista) was included in the 2015-2016 field trials. Summary of thee data analysis of penthiopyrad is depicted on (Table 3). Two fall applications of Velista 50WG 0.5 oz significantly reduced SDS severity while two applications of Velista 50WG at 0.3 did not significantly reduced SDS severity.

Table 3. Evaluation of penthiopyrad against SDS in Griffin GA.

| | Spring Dead Spot Severity Griffin (%)[z] | | | | | |
|---|---|---|---|---|---|---|
| Treatment and rate/1,000 sq ft | 06 Apr 2016 | 21 Apr 2016 | 28 Apr 2016 | 11 May 2016 | 18 May 2016 | 18 Jun 2016 |
| 1. Non Treated Control | 50.00a | 19.95a | 17.60a | 40.65a | 11.15a | 6.45a |
| 2. Velista 50WG 0.3 oz | 25.78ab | 14.68a | 21.13a | 23.85a | 11.75a | 4.13a |
| 3. Velista 50WG 0.5 oz | 10.55b | 5.28b | 6.45b | 18.55b | 4.40b | 1.76a |

[z] Within a column, values followed by the same letter are not significantly different according to Fisher's Protected LSD test ($P$= 0.05).

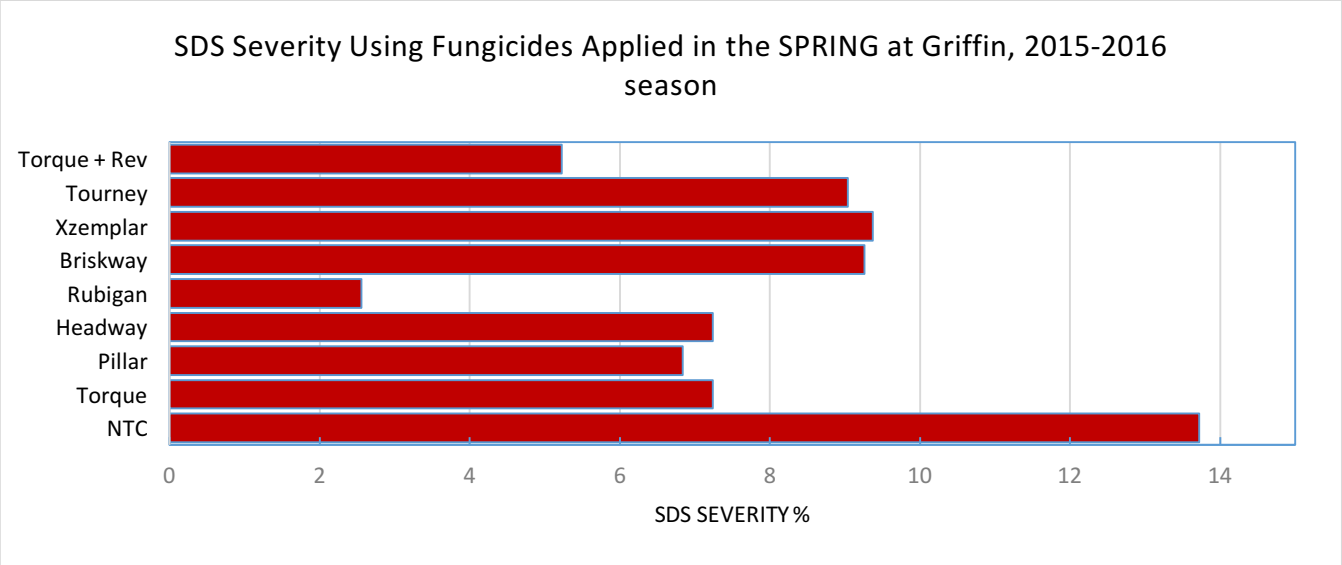
**b. Spring applications**

Efficacy of fungicide applied post-epidemically (curative) in the spring are summarized in table 4 and 6. It is noteworthy to mention that fungicides were applied when symptoms of the disease were present. Therefore, results of spring fungicide applications reflect the amount of recovery from the disease. Fungicide efficacy during the spring time correlated with turfgrass quality (table 5 and 7).

Table 4. SDS severity and % of SDS reduction using fungicides applied in the SPRING at Griffin, 2015-2016 season.

| Treatment | Disease Severity % | % SDS Reduction/Turfgrass Recovery | Rank |
|---|---|---|---|
| 1. Non Treated Control | 13.72 a | --- | |
| 2. Torque 0.6 fl oz | 7.24 bc | 47.06 | 5 |
| 3. Pillar 3.0 lb | 6.84 bc | 50.15 | 3 |
| 4. Headway 3.0 fl oz | 7.24 bc | 47.24 | 4 |
| 5. Rubigan 6.0 fl oz | 2.56 c | 81.35 | 1 |
| 6. Briskway 0.75 fl oz | 9.26 b | 32.51 | 7 |
| 7. Xzemplar 0.26 fl oz | 9.37 b | 31.75 | 8 |
| 8. Tourney 0.37 oz | 9.04 bc | 34.15 | 6 |
| 9. Torque 0.6 fl oz + Revolution 6.0 fl oz | 5.23 bc | 61.89 | 2 |

[z] Within a column, values followed by the same letter are not significantly different according to Fisher's Protected LSD test (*P*= 0.05).



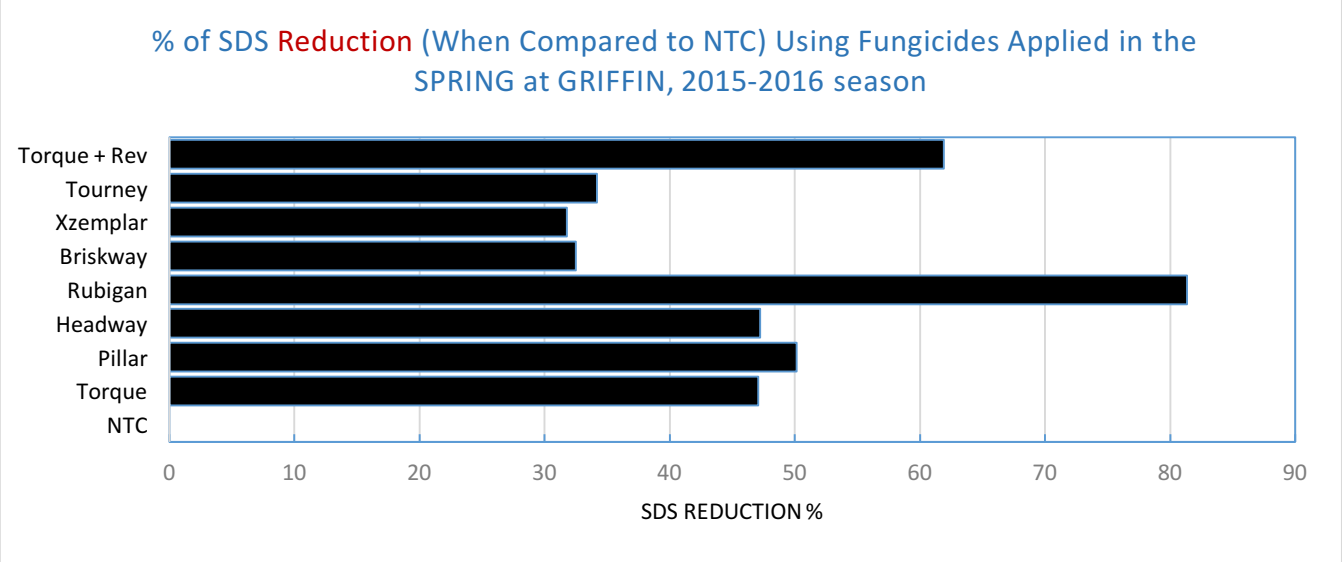




Table 5. Turfgrass quality using fungicides applied in the SPRING at Griffin, 2015-2016 season.

| | Turfgrass Quality at 5/11/2016 |
|---|---|
| 1. Non Treated Control | 84.37 c |

| | |
|---|---|
| 2. Torque 0.6 fl oz | 86.85 bc |
| 3. Pillar 3.0 lb | 87.50 bc |
| 4. Headway 3.0 fl oz | 90.62 ab |
| 5. Rubigan 6.0 fl oz | 92.50 a |
| 6. Briskway 0.75 fl oz | 89.37 ab |
| 7. Xzemplar 0.26 fl oz | 89.37 ab |
| 8. Tourney 0.37 oz | 89.37 ab |
| 9. Torque 0.6 fl oz + Revolution 6.0 fl oz | 90.00 ab |

[z] Within a column, values followed by the same letter are not significantly different according to Fisher's Protected LSD test (*P*= 0.05).

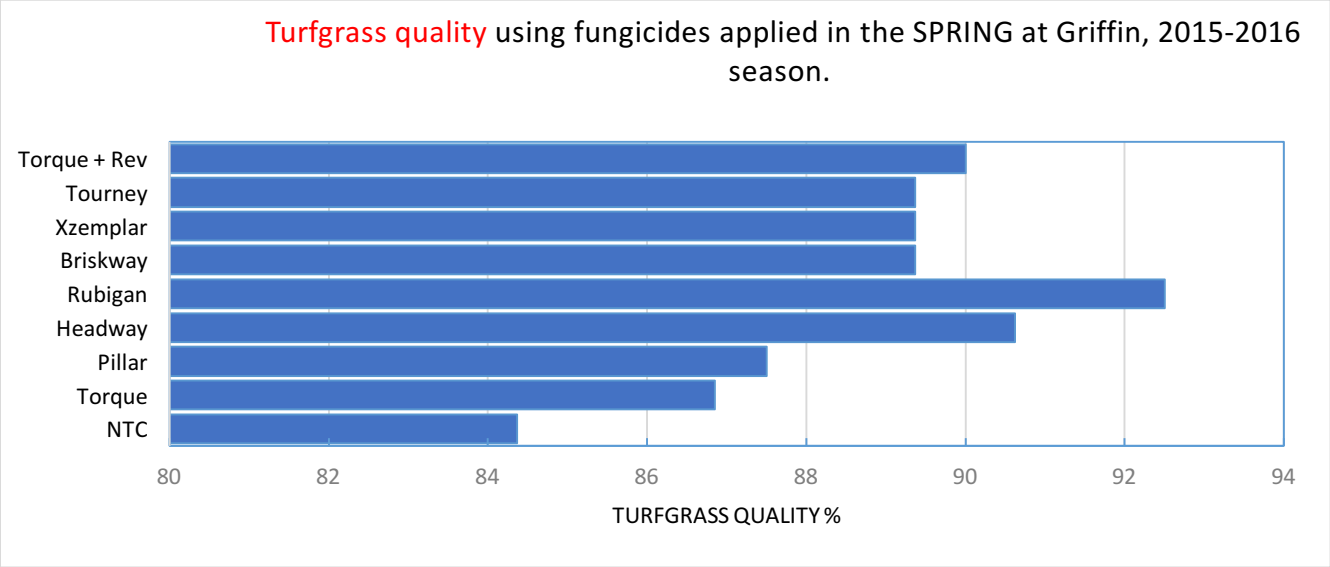
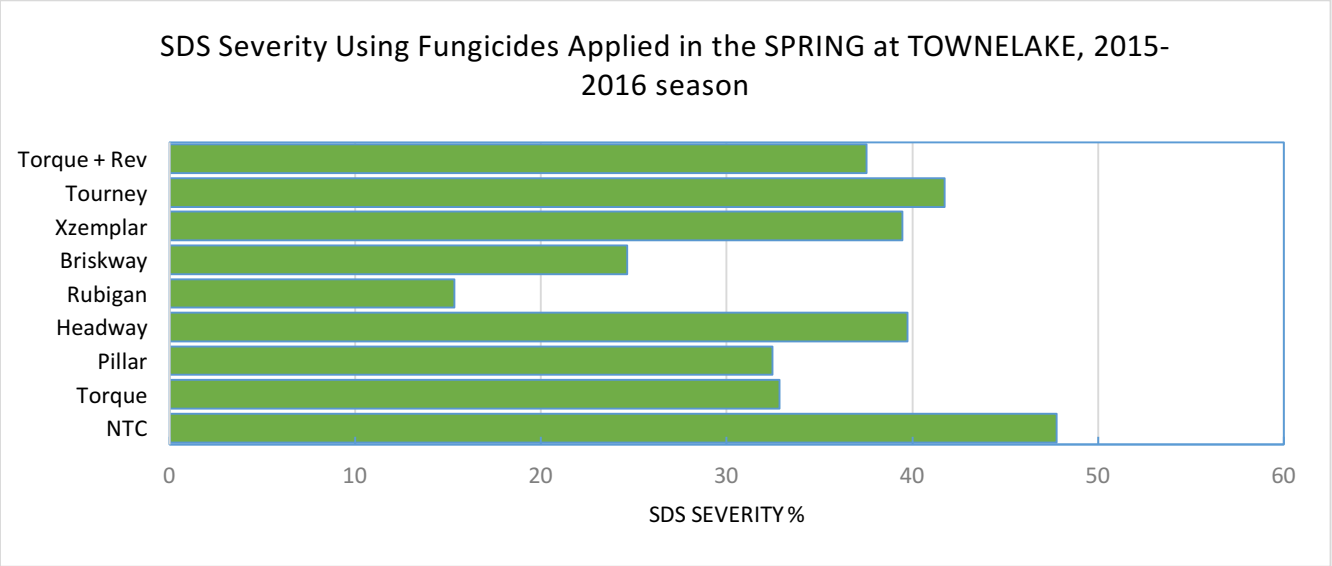



Table 6. SDS severity and % of SDS reduction using fungicides applied in the SPRING at Townelake, 2015-2016 season

| Treatment | Disease Severity % | % SDS Reduction/Turfgrass Recovery | Rank |
|---|---|---|---|
| 1. Non Treated Control | 47.76 a | --- | |
| 2. Torque 0.6 fl oz | 32.84 abc | 31.24 | 4 |
| 3. Pillar 3.0 lb | 32.48 abc | 32.00 | 3 |
| 4. Headway 3.0 fl oz | 39.74 ab | 16.80 | 7 |
| 5. Rubigan 6.0 fl oz | 15.35 c | 67.87 | 1 |
| 6. Briskway 0.75 fl oz | 24.64 bc | 48.41 | 2 |
| 7. Xzemplar 0.26 fl oz | 39.45 ab | 17.40 | 6 |
| 8. Tourney 0.37 oz | 41.73 a | 12.63 | 8 |
| 9. Torque 0.6 fl oz + Revolution 6.0 fl oz | 37.54 ab | 21.40 | 5 |

[z] Within a column, values followed by the same letter are not significantly different according to Fisher's Protected LSD test (*P*= 0.05).



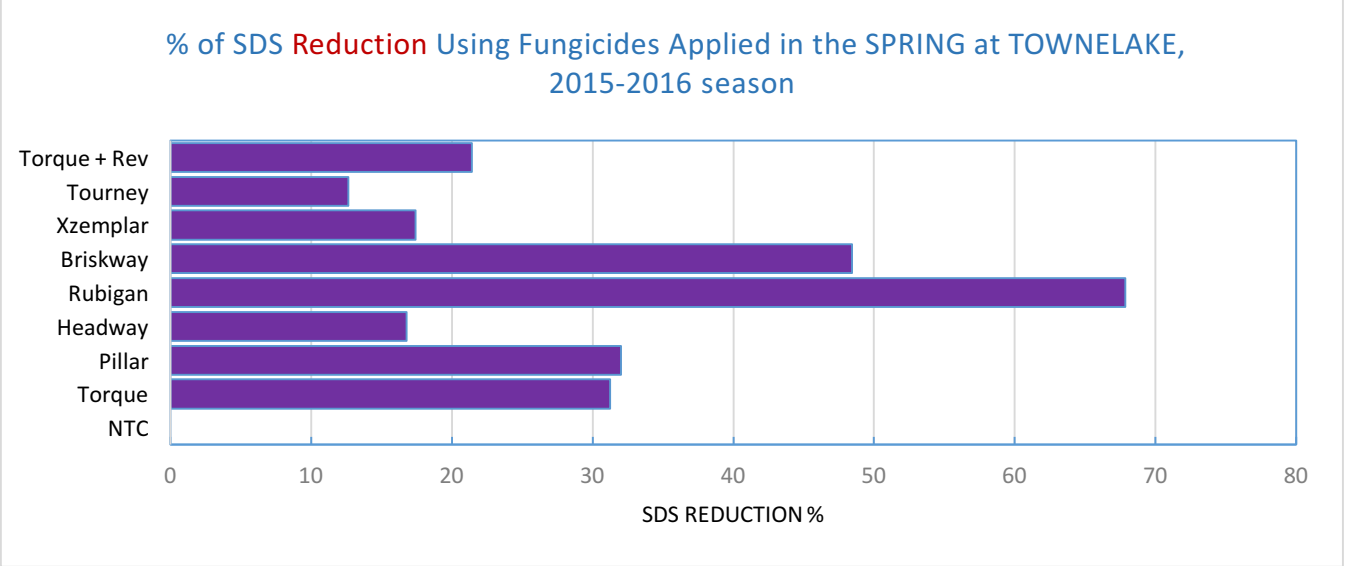
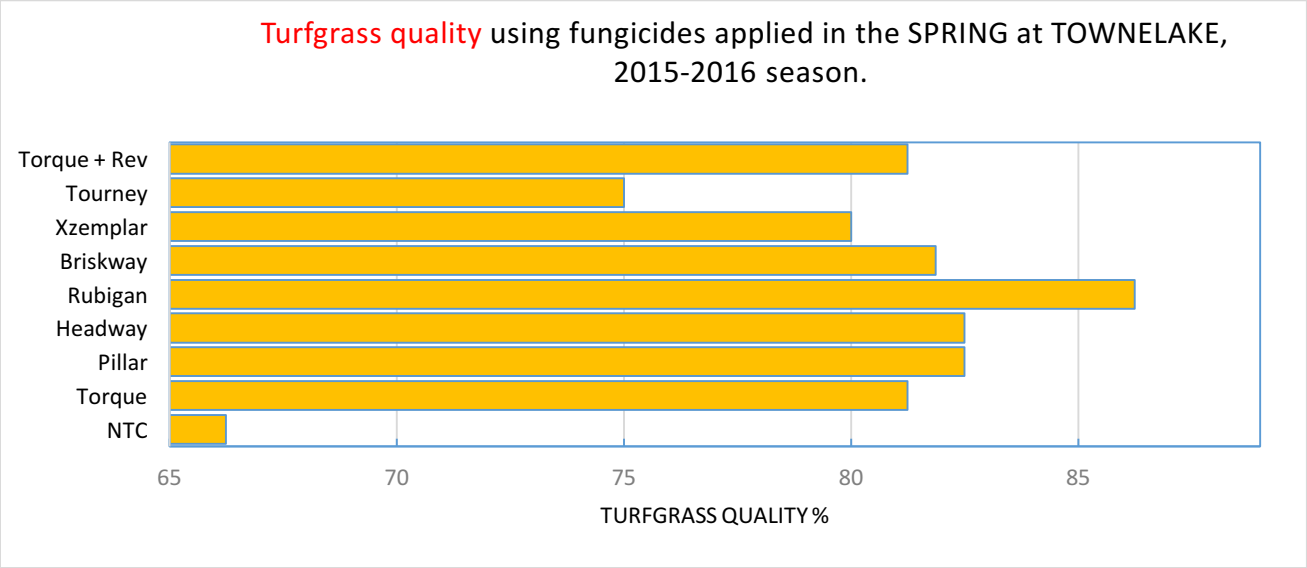




Table 7. Turfgrass quality using fungicides applied in the SPRING at Townelake, 2015-2016 season.

| **Treatment** | Turfgrass Quality at 6/03/2016 |
|---|---|
| 1. Non Treated Control | 66.25 c |
| 2. Torque 0.6 fl oz | 81.25 ab |
| 3. Pillar 3.0 lb | 82.50 ab |
| 4. Headway 3.0 fl oz | 82.50 ab |
| 5. Rubigan 6.0 fl oz | 86.25 a |
| 6. Briskway 0.75 fl oz | 81.87 ab |
| 7. Xzemplar 0.26 fl oz | 80.00 ab |
| 8. Tourney 0.37 oz | 75.00 b |
| 9. Torque 0.6 fl oz + Revolution 6.0 fl oz | 81.25 ab |

[z] Within a column, values followed by the same letter are not significantly different according to Fisher's Protected LSD test (*P*= 0.05).




SDS incidence in the non-treated control was considerably higher in the Townelake experimental site than that observed at the Griffin site.

At the Griffin site and when fungicides were applied in the spring; Rubigan 6.0 fl oz provided the most statistical significant SDS suppression followed by Headway 3.0 fl oz, Tourney 0.37 oz, Torque 0.6 fl oz, Pillar 3 lb and Torque 0.6 fl oz + Revolution 6.0 fl oz. On this site, Briskway 0.75 fl oz, and Xzemplar 0.26 fl oz. provided the lowest SDS reduction when compared to the untreated control with percent disease reduction of 32-31 % respectively. Turfgrass quality inversely correlated to disease incidence.

At Townelake, the disease incidence was high; Rubigan 6.0 fl oz and Briskway 0.35 fl oz provided the statistical significant SDS suppression when compared to the non-treated control. Except for Tourney 0.37 oz; all other fungicides provided an SDS reduction ranging from 17 to 32 %. However, the disease present after the application of all fungicide was high and far from reaching an acceptable threshold of turf recovery. Turfgrass quality inversely correlated to disease incidence. Is noteworthy to mention that turfgrass quality was influenced not only by SDS incidence but also by heavy epidemics of dollar spot, bipolaris leaf spot and large patch. Therefore, an added benefit of spring fungicide applications is the control and /or prevention of these other diseases.

**CONCLUSIONS AND DISCUSSION FOR 2015-2016 SEASON**

On average and taking into account all treatments, there was significant disease suppression from year 1 to year 2 (@ 50%)

Overall; data from this year disease suppression by fungicides was variable between sites

Both application times (Fall and Spring) are effective;

On both timings; all SDS labelled fungicides have significant disease suppression

On both timings; “new” chemistries evaluated provided significant disease suppression

Fall applications are guided towards pre-epidemic (preventive) management

In the Fall;

- Still the most efficacious timing for sds management
- Preventative, pre-epidemic
- Use of a DMI (alone-Rubigan, Torque, Tourney). Maybe in combination with strobilurin (Briskway, Headway)

- or a SDHI (Xzemplar, Velista)

Spring applications are guided post-epidemic (curative) management

In the Spring

- Use of a DMI in combination with strobilurin (Briskway, Headway, Pillar).
- Use of fungicides shortens the time to achieve acceptable turf quality for up to 3-4 weeks
- Effect of preventative effect on dollar spot, bipolaris and rhizoctonia

Use of wetting agent did not significantly enhanced fungicide efficacy

Fungicide rate matters (see Velista, Rubigan)

**2. Evaluate the effect of soil fertility-with emphasis of nitrogen source and fungicide alternatives for the control of SDS.**

Two fungicide trials were conducted on a 7-year-old sward of bermudagrass cv. "TifSport" grown on a clay loam soil (pH 5.8) at the University of Georgia-Griffin campus and on a 15-year-old 319 bermudagrass fairway at Towne Lake Hills Golf Club located in Woodstock GA. Area was kept intact to perform the field experiments, therefore no additional fertilizers or pest management was implemented in the area. Both sites had a history of severe SDS infections. On both sites, treatments were arranged as plots (4 ft x 6 ft) in a randomized complete block design with four replications. monthly applications of different sources of nitrogen and bio-fungicides/organic products were performed during the remainder of summer. Treatments consisted of fertilizers with different sources of nitrogen and bio-fungicides/organic products. Liquid products were applied as per manufacturer use instructions. Granular formulations were weighed and distributed equally in each replicated plot using a canister with perforated lid. Ammonium nitrate, calcium nitrate, ammonium sulfate, and 10-10-10 fertilizers at a rate of 1 lb/1000 $ft^2$ and bio-fungicides/organic products were applied monthly starting in May and finalizing in September. Bio-fungicides/organic products consisted of Companion ® at 6 fl oz/1000 $ft^2$, Essential® at 3 oz /1000 $ft^2$, Rhapsody® at 10 fl oz /1000 $ft^2$, and Holganix® at 7 fl oz /1000 $ft^2$. Experimental areas received normal irrigation as per in-site management. Visual ratings were performed at 14-28 day intervals. Visual estimates of disease severity were made using a modified Horsfall-Barratt rating scale (0 to 11), and then transformed to percent disease severity (0 = 1.17%, 5=37.5%, 11=98.82%) using ARM. Turf Quality was also rated using a percent (0=bad, unsightly quality; 100=excellent quality). Percent of disease severity and quality data were subjected to analysis of variance and means were separated Fisher's Protected LSD test ($P$= 0.05).

Table 1. Fertilizers and biological products evaluated

| Commercial Name | Type of Ingredient (s) | Rate/1000 sq ft | Company |
|---|---|---|---|
| 1. Non Treated Control | ------ | ------- | -------- |
| 2. Regalia | Plant Extract | 3.0 oz | Marrone BioInnovations/Engage Agro |
| 3. Essential | Humic acid, Plant extract, sugars, kelp, Organic N | 3.0 oz | |
| 4. Companion | Bacillus subtillis | 6.0 fl oz | Growth Products LTD |
| 5. Holganix | Compost Tea, Endo and Ecto mycorrhizae | 7.0 fl oz | Holganix |
| 6. Ammonium Nitrate 33-0-0 | Fertilizer | 1.0 lb | ---- |
| 7. Calcium Nitrate | Fertilizer | 1.0 lb | ---- |
| 8. Balanced 10-10-10 | Fertilizer | 1.0 lb | ---- |
| 9. Amonium sulfate | Fertilizer | 1.0 lb | ---- |

**RESULTS FOR 2015-2016 SEASON**

In general, SDS incidence was low in both locations. The highest disease severity only reached @ 15 %. No significance statistical SDS suppression was found among treatments and non-treated control. Therefore, the effect of fertilizers and biologicals was best assessed using turfgrass quality/turf recovery ratings. Turfgrass quality, in general was higher at the Griffin location.

Table 2. Turfgrass quality using fertilizers and biological products- Griffin, 2015-2016 season

| Treatment | Average of Turfgrass Quality |
|---|---|
| 1. Non Treated Control | 83.75 b |
| 2. Regalia | 83.75 b |
| 3. Essential | 83.54 b |
| 4. Companion | 82.91 b |
| 5. Holganix | 84.16 ab |
| 6. Ammonium Nitrate 33-0-0 | 84.16 ab |
| 7. Calcium Nitrate | 85.83 a |
| 8. Balanced 10-10-10 | 82.91 b |
| 9. Ammonium sulfate | 84.27 ab |

[z] Within a column, values followed by the same letter are not significantly different according to Fisher's Protected LSD test (*P*= 0.05).

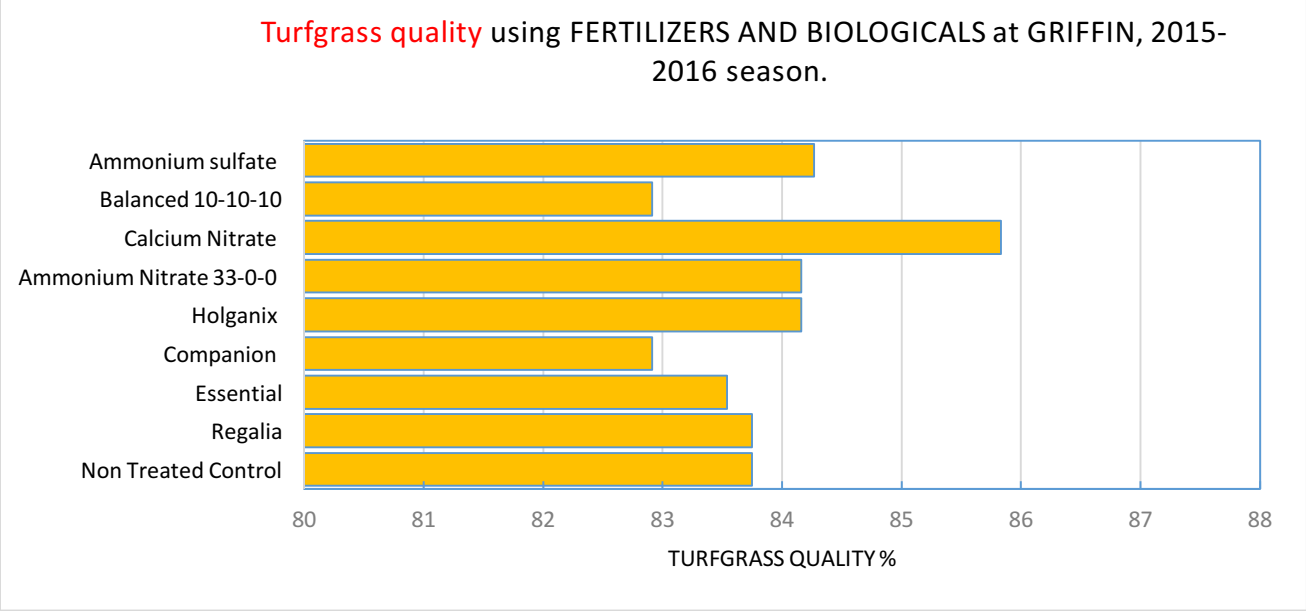
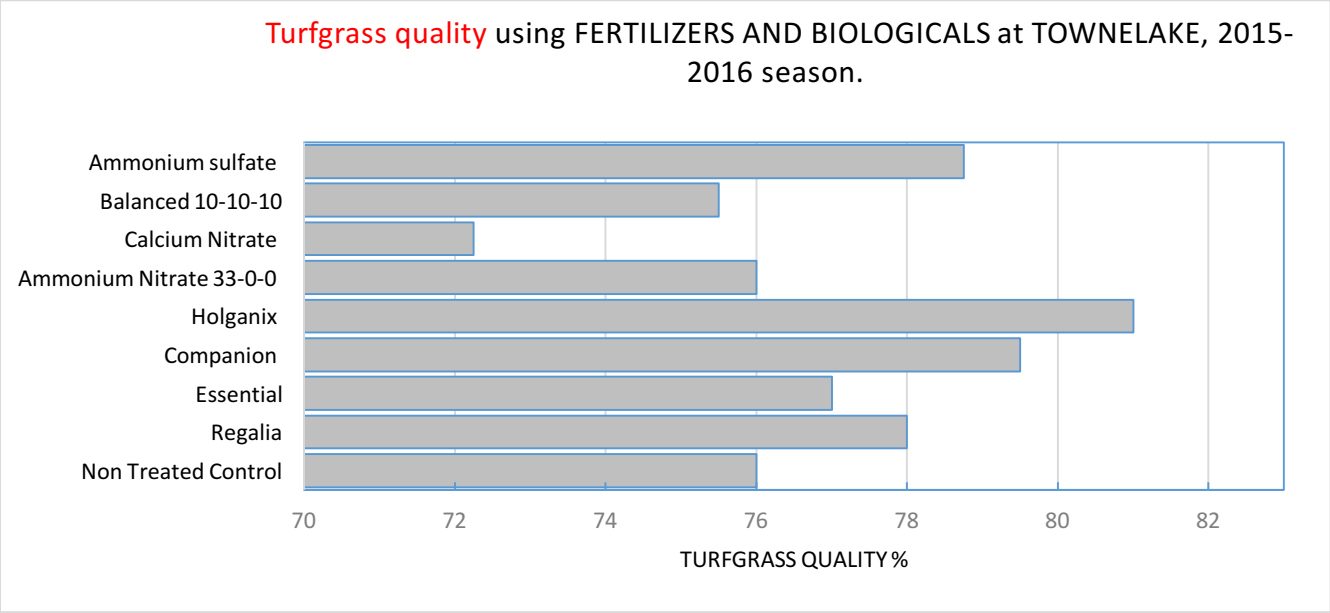



Table 3. Turfgrass quality using fertilizers and biological products- Townelake, 2015-2016 season

| Treatment | Average of Turfgrass Quality |
|---|---|
| 1. Non Treated Control | 76.00 bc |
| 2. Regalia | 78.00 ab |
| 3. Essential | 77.00 ab |
| 4. Companion | 79.50 ab |
| 5. Holganix | 81.00 a |
| 6. Ammonium Nitrate 33-0-0 | 76.00 bc |
| 7. Calcium Nitrate | 72.25 c |
| 8. Balanced 10-10-10 | 75.50 bc |
| 9. Ammonium sulfate | 78.75 ab |

[z] Within a column, values followed by the same letter are not significantly different according to Fisher's Protected LSD test (*P*= 0.05).




At the Griffin site, monthly applications of Calcium nitrate, Ammonium nitrate, and Holganix provided the highest turf quality/turf recovery. While at the Townelake; Holganix, Companion, Ammonium sulfate, Essential and Regalia provided the highest turf quality/turf recovery.

Table 4. Rankings of fertilizers and biological products based on turfgrass quality- Griffin, 2015-2016 season

| Ranking Turfgrass Quality/Recovery Griffin Site |
|---|
| 1. Calcium Nitrate |
| 2. Ammonium Nitrate 33-0-0 |
| 3. Holganix |
| 4. Ammonium sulfate |
| 5. Companion |
| 6. Regalia |
| 7. Essential |
| 8. NTC |
| 9. Balanced 10-10-10 |

Table 5. Rankings of fertilizers and biological products based on turfgrass quality- Townelake, 2015-2016 season

| Ranking Turfgrass Quality/Recovery Townelake site |
|---|
| 1. Holganix |
| 2. Companion |
| 3. Ammonium sulfate |
| 4. Regalia |
| 5. Essential |
| 6. Ammonium Nitrate |
| 7. NTC |
| 8. 10-10-10 |
| 9. Calcium nitrate |

**Outputs for 2015-2016 season**

1. Publication of SDS GGEF-funded research results at the UGA College of Agricultural and Environmental Sciences Impact Statements web page. (available early January 2017 at http://apps.caes.uga.edu/impactstatements/ )

2. Presentation of SDS research results at the 2016 Turfgrass Research and Extension Field Day. Griffin GA. August 4, 2016. Public acknowledgment for Georgia Golf Environmental Fund. 600 people reached.

3. Publication of SDS research results at Martinez-Espinoza, A.D. Waltz, C., and Raymer P. 2016. Turfgrass Research and Extension Field Day, 2016. University of Georgia-Extension, Special Bulletin. http://extension.uga.edu/publications/detail.cfm?number=AP117-1. Page 26-27. Prominent acknowledgment for Georgia Golf Environmental Fund.

4. Signage and demonstration of SDS trial at 2016 Turfgrass Research and Extension Field Day. Prominent display of acknowledgement to GGEF.

5. Seminar presentation. Update on Ongoing Turfgrass Research on Spring Dead Spot (SDS) Control of Bermudagrass in Georgia. Georgia Golf Environmental Foundation Seminar (GGCSA). Jan 06, 2016. Griffin, GA.

6. Seminar presentation. Defending Georgia's Turf: Latest Research on Fungicides and Bermudagrass Disease Control. GCSAA Bermudagrass Forum. Sept 14, 2015. St. Simons Is. GA.

7. Seminar presentation. 2015. Temporal, Cultural, Biological, and Chemical Practices to Enhance Spring Dead Spot (SDS) Control of Bermudagrass in Georgia Update. Georgia Golf Environmental Foundation Seminar (GGCSA). Jan 14, 2015. Griffin, GA.