University of Connecticut

College of Agriculture, Health and Natural Resources

2020 Annual Turfgrass Research Report

UCONN | COLLEGE OF AGRICULTURE, HEALTH AND NATURAL RESOURCES

PLANT SCIENCE AND LANDSCAPE ARCHITECTURE

Cover photo: Weed infestations during turf establishment are a common challenge for turf managers, particularly for sites where herbicides are not an option. Research by graduate student Tyler Seidel and Jason Henderson looks at how seeding rate, species selection and mowing regime during establishment influence weed populations. (Photo credit: Tyler Seidel, UCONN)

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PLANT SCIENCE AND LANDSCAPE ARCHITECTURE

2020 Annual Turfgrass Research Report Summary

University of Connecticut
College of Agriculture, Health and Natural Resources
Department of Plant Science and Landscape Architecture
Storrs, Connecticut

The University of Connecticut's Annual Turfgrass Research Report is published to provide timely dissemination of current research findings. The purpose of this report is to encourage the exchange of ideas and knowledge between university researchers and members of the turfgrass industry. Research summaries included within this report are designed to provide turfgrass managers, extension specialists, research scientists, and industry personnel with information about current topics related to managing turfgrass.

This report is divided into various sections and includes original research results in turf pathology, athletic field and golf turf maintenance, fertility and nutrient management, and cultivar evaluation and improvement. Additionally, abstracts and citations of scientific publications and presentations published in calendar year 2020 by University of Connecticut turfgrass researchers are included. This information is presented in the hopes of providing current information on relevant research topics for use by members of the turfgrass industry.

Special thanks are given to those individuals, companies, and agencies that provided support to the University of Connecticut's Turfgrass Research, Extension, and Teaching Programs.

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UNIVERSITY OF CONNECTICUT TURFGRASS SCIENCE PROGRAM

PREVENTIVE ANTHRACNOSE CONTROL WITH VARIOUS FUNGICIDES ON AN ANNUAL BLUEGRASS PUTTING GREEN TURF, 2020

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INTRODUCTION

Anthracnose (caused by *Colletotrichum cereale*) is a devastating disease of annual bluegrass putting green turf. An integrated disease control program including cultural management and fungicides is required to minimize turf loss due to this disease. Rotational fungicide programs utilizing different chemical modes of action and multi-site fungicides have been found to be most effective in providing season-long anthracnose control. Identifying new fungicides with unique modes of action effective against anthracnose is important to continued control of this disease and resistance management. The objective of this study was to examine the efficacy of experimental and commonly used fungicides for anthracnose control on an annual bluegrass putting green turf.

MATERIALS & METHODS

A field study was conducted on an annual bluegrass (*Poa annua*) turf grown on a Paxton fine sandy loam at the Plant Science Research and Education Facility in Storrs, CT. Turf was mowed five days wk^{-1} at a bench setting of 0.125-inches. Minimal nitrogen was applied to the study area to encourage anthracnose development. A total of 1.5 lbs N $1000\text{-}ft^{-2}$ was applied as water soluble sources from April through 3 August. Mono-potassium phosphate was applied to correct measured deficiencies in P and K. A total of 1.5 lbs P_2O_5 and 0.96 lbs K_2O were applied from May through 3 August. A wetting agent (Revolution, 3 fl.oz.) was applied every 14-d beginning on 11 May. Overhead irrigation and hand-watering was applied as needed to prevent drought stress. A rotation of Xzemplar (0.16 fl.oz.) and Pinpoint (0.275 oz.) was applied every 14-d between 18 May and 13 July to prevent dollar spot development. Tempo was applied on 12 May and Conserve was applied on 3 June for control of annual bluegrass weevil and white grubs. Primo Maxx (0.125 fl.oz.) was applied to the entire study area beginning on 14 May and was reapplied on a 200 GDD basis.

Treatments consisted of commercially available and developmental fungicides. Initial applications were made on 28 May prior to disease development. Subsequent applications were made every 14-d through 6 August. All treatments were applied using a handheld CO_2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal $1000\text{-}ft^{-2}$ at 40 psi. Plots measured 3 x 6 ft and were arranged in a randomized complete block design with four replications.

Anthracnose severity was evaluated visually as the percent area blighted by *C. cereale* from 26 June through 14 August. Turf quality was visually assessed on a 1 to 9 scale; where 9 represented the best possible quality turf and 6 was the minimum acceptable level. Phytotoxicity was also assessed visually on a 0 to 5 scale, where 0 was equal to no discoloration and 2 represented the maximum acceptable level of injury. Yellow Spot, caused by a cyanobacteria sp. was assessed as a the number of chlorotic spots per plot. All data were subjected to an analysis of variance and means were separated using Fisher's protected least significant difference test. Anthracnose severity data were log-transformed as necessary for ANOVA and mean separation tests, means were de-transformed for presentation.

RESULTS & DISCUSSION

Anthracnose Severity

Anthracnose symptoms developed from a natural infestation in mid-to-late June, increasing from approximately 1% plot area blighted to 10% in untreated control plots through 9 July (Table 1). Disease steadily increased during July as high day and nighttime temperatures and humidity contributed to favorable disease conditions. Anthracnose in untreated control plots increased from 33% plot area blighted on 16 July and peaked at 44% blighted on 27 July.

Syngenta Programs 1 and 2 consisted of Daconil Action + Appear II applied every 14-d, tank-mixed with a rotation of various other fungicides (see Table 1 footnotes). Daconil Action + Appear II were also applied as a standalone tank-mix. Both programs and the standalone tank-mix provided near-complete control of disease for the entirety of the trial, with no significant difference between these treatments.

EXP A and EXP B failed to control anthracnose in this trial with disease severity of both entries generally no different from untreated control, regardless of rate or if tank mixed with Heritage (this site has history of resistance to stobilurin fungicides).

Premion (PCNB + tebuconazole) was applied at 3 different rates (4, 6, 8 fl.oz.) tank-mixed with Par. All three rates provided near-complete control of anthracnose. Autilus (PCNB) tank-mixed with Par also provided near-complete control of disease. Oximus, a premix of azoxystrobin and tebuconazole, was applied at three different rates (0.8, 1.0, 1.6 fl.oz.) and provided excellent anthracnose control, as did the AMVAC rotational program consisting of a rotation of Premion, Oximus with other fungicides.

EXP C was applied individually and as a tank-mix with Spectro 90. Individually, EXP C failed to provide acceptable control from 16 July onwards, peaking at ~40% plot area blighted on 31 July, and was never significantly better than untreated control plots. Whereas, the tank-mix with Spectro 90 provided near complete disease control for the entirety of the trial.

Maxtima, a DMI fungicide with increased phytosafety launched in 2019, was applied at both 0.4 and 0.6 fl.oz. Both rates provided excellent (<1% plot area blighted) control for the duration of the trial. Navicon, a premix containing the active ingredient in Maxtima and pyraclostrobin, also provided near-complete control. Insignia tank-mixed with Civitas One, a mineral-oil based fungicide provided excellent to good control during the trial.

Medallion + Signature Xtra provided excellent control and Affirm + Signature Xtra provided acceptable control for all but the final rating date of the trial, when both treatments yielded unacceptable levels of control.

Turf Quality and Phytotoxicity

Turf quality (Table 2) was primarily influenced by anthracnose severity, however some treatments enhanced or reduced turf quality.

Treatments that consistently resulted in high turf quality included Syngenta programs 1 and 2, Daconil Action + Appear II, Autilus + Par, the AMV rotational program, EXP C + Spectro 90, Navicon, Maxtima, Daconil Weatherstik and Daconil Action. All of these treatments were statistically tied for highest quality on 6 August, following the peak of the disease outbreak in late July.

From late-June and for much of the rest of the trial, all three rates of Oximus resulted in moderate phytotoxicity (Table 3) expressed as a growth regulation effect, causing unacceptable quality for these treatments, despite excellent disease control. Growth regulation fluctuated and recovered somewhat, especially at the 0.8 and 1.0 fl.oz. rates, during July and August. It is worth noting that this response is typical of repeated applications (i.e., every 14-d) of most DMI fungicides. This is not a typical use pattern for any fungicide, but in particular those containing a DMI active ingredient. When DMI fungicides are applied within a more typical rotational program their occasional application generally has minimal negative effect on putting green turf quality. However, some DMI fungicides such as Briskway, Maxtima, and Navicon do appear to have less of a growth regulation effect than most DMIs.

Cyanobacteria Yellow Spot

An outbreak of yellow spot caused by cyanobacteria occurred in late July. Most treatments were impacted, especially EXP A, EXP B, Oximus (0.8 and 1.0 fl.oz.), EXP C, Navicon, Insignia, Maxtima, and Velista. However, all treatments containing chlorothalonil, individually or as part of a rotational program, developed very little symptoms, including Syngentra Programs 1 and 2, Daconil Action + Appear II, the AMV rotational program, EXP C + Spectro 90, Daconil Action, and Daconil Weatherstik. Premion and Autilus also seemed to consistently suppress yellow spot symptoms.

Table 1. Effect of various fungicides on preventive anthracnose control in an annual bluegrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft^2	Application Dates[v]	Anthracnose Severity 26 June	2 Jul	9 Jul	16 Jul	27 Jul	31 Jul	6 Aug	14 Aug
			--- % plot area blighted ---							
Syngenta Program 1	pgm[y]	ACEGIK	0.0 d[u]	0.0 d	0.0 c	0.3 c	0.2[t] cd	0.0 e	0.0[t] d	0.0 e
Syngenta Program 2	pgm[x]	ACEGIK	0.0 d	0.0 d	0.0 c	0.0 c	0.0 d	0.0 e	0.0 d	0.0 e
Daconil Action	3.5 fl.oz.	ACEGIK	0.0 d	0.0 d	0.0 c	0.3 c	0.0 d	0.1 e	0.0 d	0.0 e
+Appear II	6.0 fl.oz.									
EXP A	1.18 fl.oz.	ACEGIK	0.8 bcd	4.0 bc	6.8 bc	22.5 ab	32.6 ab	46.3 abc	36.6 a	50.5 a
EXP A	1.62 fl.oz.	ACEGIK	0.4 cd	2.9 bcd	5.0 bc	30.0 ab	46.8 a	53.8 a	39.8 a	51.3 a
Heritage	0.2 oz.	ACEGIK	0.9 bcd	3.0 bcd	3.5 bc	17.0 b	25.8 b	39.3 cd	25.4 ab	39.8 ab
EXP B	3.4 oz.	ACEGIK	2.3 bc	6.3 ab	10.3 ab	29.5 ab	41.7 ab	50.0 ab	37.1 a	53.0 a
EXP B	3.4 oz.	ACEGIK	2.8 b	6.0 ab	13.9 a	28.8 ab	31.8 ab	29.3 d	14.4 b	18.5 cd
+Heritage	0.2 oz.									
Premion	4 fl.oz.	ACEGIK	0.0 d	0.0 d	0.0 c	0.0 c	0.0 d	0.1 e	0.0 d	0.0 e
+Par	0.37 fl.oz.									
Premion	6 fl.oz.	ACEGIK	0.0 d	0.0 d	0.0 c	0.0 c	0.3 cd	0.3 e	0.0 d	0.0 e
+Par	0.37 fl.oz.									
Premion	8 fl.oz.	ACEGIK	0.0 d	0.0 d	0.0 c	0.0 c	0.0 d	0.1 e	0.2 d	0.0 e
+Par	0.37 fl.oz.									
Autilus	6 fl.oz.	ACEGIK	0.0 d	0.0 d	0.0 c	0.3 c	0.0 d	0.5 e	0.2 d	1.0 de
+Par	0.37 fl.oz.									
AMV Rotational Program	pgm[w]	ACEGIK	0.0 d	0.0 d	0.0 c	0.0 c	0.0 d	0.1 e	0.0 d	0.0 e
Oximus	0.8 fl.oz.	ACEGIK	0.3 cd	0.3 d	0.0 c	0.0 c	0.0 d	0.4 e	0.0 d	0.0 e
Oximus	1.0 fl.oz.	ACEGIK	0.0 d	0.0 d	0.3 c	0.0 c	0.2 cd	0.3 e	0.0 d	0.0 e
Oximus	1.6 fl.oz.	ACEGIK	0.0 d	0.0 d	0.0 c	0.0 c	0.0 d	0.3 e	0.0 d	0.0 e
EXP C	0.213 fl.oz.	ACEGIK	5.0 a	7.5 a	9.5 ab	28.8 ab	34.6 ab	40.0 bc	29.0 a	29.5 bc
EXP C	0.213 fl.oz.	ACEGIK	0.0 d	0.0 d	0.0 c	0.0 c	0.0 d	0.0 e	0.0 d	2.0 de
+Spectro 90	3.0 oz.									
Navicon	0.85 fl.oz.	ACEGIK	0.0 d	0.0 d	0.0 c	0.1 c	0.0 d	0.0 e	0.0 d	0.0 e
Insignia	0.7 fl.oz.	ACEGIK	0.1 d	0.5 d	0.6 c	0.8 c	0.6 cd	2.4 e	2.5 c	9.3 de
+Civitas One	8.5 fl.oz.									
Maxtima	0.4 fl.oz.	ACEGIK	0.0 d	0.1 d	0.0 c	0.1 c	0.0 d	0.3 e	0.0 d	0.0 e
Maxtima	0.6 fl.oz.	ACEGIK	0.3 cd	0.3 d	0.0 c	0.1 c	0.0 d	0.1 e	0.0 d	0.0 e
Velista	0.5 oz.	ACEGIK	0.1 d	0.8 cd	0.0 c	0.0 c	0.0 d	0.1 e	0.0 d	5.3 de
Daconil Weatherstik	3.5 fl.oz.	ACEGIK	0.5 cd	1.4 cd	0.1 c	0.3 c	0.2 cd	0.8 e	0.3 d	12.0 cde
Daconil Action	3.44 fl.oz.	ACEGIK	0.0 d	0.5 d	0.0 c	0.3 c	0.0 d	0.0 e	0.0 d	0.0 e
Medallion	1.5 fl.oz.	ACEGIK	0.0 d	0.0 d	0.0 c	0.0 c	0.0 d	0.5 e	0.6 d	12.5 cde
+Signature Xtra	4.0 oz.									
Affirm	0.88 oz.	ACEGIK	0.0 d	0.4 d	0.4 c	1.0 c	0.9 c	8.3 e	4.2 c	12.5 cde
+Signature Xtra	4.0 oz.									
Untreated			1.6 bcd	5.3 ab	10.3 ab	33.8 a	43.7 a	41.3 bc	29.8 a	27.5 bc
ANOVA: Treatment (P > F)			0.0025	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
Days after treatment		14-d	1	7	13	7	4	9	14	8

[z]All treatments were applied using a hand held CO_2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft^{-2} at 40 psi.

[y]Syngenta Program 1 was applied every 14-d. All Applications included Daconil Action (3.5 fl.oz.) + Appear II (6.0 fl.oz.). Additional fungicides were tank-mixed and applied as follows: A=Secure Action (0.5 fl.oz.); C=Ascernity (1.0 fl.oz.); E=Medallion (1.5 fl.oz.); G=Velista (0.5 oz.); I=Secure Action (0.5 fl.oz.); K=Ascernity (1.0 fl.oz.)

[x]Syngenta Program 2 was applied every 14-d. All Applications included Daconil Action (3.5 fl.oz.) + Appear II (6.0 fl.oz.). Additional fungicides were tank-mixed and applied as follows: A=Secure Action (0.5 fl.oz.); C=Ascernity (1.0 fl.oz.); E=Medallion (1.5 fl.oz.); G=Briskway (0.5 fl.oz.); I=Secure Action (0.5 fl.oz.); K=Ascernity (1.0 fl.oz.)

[w]AMV Rotational Program was applied every 14-d. Fungicides were tank-mixed and applied as follows: A=Premion (6 fl.oz.) + Par (0.37 fl.oz.); C=Signature Xtra (4.0 oz.) + Previa (3.6 fl.oz.); E=Velista (0.3 oz.) + Affirm (0.88 oz.); G=Oximus (1.0 fl.oz.) + Medallion (1.5 fl.oz.); I= Signature Xtra (4.0 oz.) + Previa (3.6 fl.oz.); K= Velista (0.3 oz.) + Affirm (0.88 oz.)

[v]Treatment application dates were as follows: A=28 May; C=11 June; E=25 June; G=9 July; I=23 July; K=6 August

[u]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test ($\alpha = 0.05$)

[t]Means were log-transformed for homogeneity of variance, then de-transformed for presentation.

Table 2. Effect of various fungicides on turf quality in an annual bluegrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

			Turf Quality							
Treatment[z]	Rate per 1000ft^2	Application Dates[v]	5 Jun	14 Jun	18 Jun	26 Jun	2 Jul	9 Jul	16 Jul	6 Aug
			---------- 1-9; 6=min acceptable ----------							
Syngenta Program 1	pgm[y]	ACEGIK	7.3 bcd[u]	8.0 abc	8.3 abc	7.3 bcd	7.5 a-d	7.3 b-f	8.3 ab	8.8 a
Syngenta Program 2	pgm[x]	ACEGIK	8.3 a	8.8 a	8.8 a	8.5 a	8.5 a	8.0 abc	8.5 a	8.5 ab
Daconil Action	3.5 fl.oz.	ACEGIK	8.3 a	8.3 ab	8.5 ab	8.3 ab	7.8 abc	7.8 a-d	8.3 ab	8.5 ab
+Appear II	6.0 fl.oz.									
EXP A	1.18 fl.oz.	ACEGIK	6.8 c-f	6.8 efg	6.5 ghi	6.5 c-g	6.0 e-h	5.5 g-j	4.5 ijk	3.8 h
EXP A	1.62 fl.oz.	ACEGIK	6.5 def	6.8 efg	6.3 hij	6.3 d-h	6.8 c-f	6.0 f-j	4.5 ijk	3.5 h
Heritage	0.2 oz.	ACEGIK	6.5 def	6.3 fgh	6.8 fgh	6.0 e-i	6.5 d-g	6.3 e-i	5.3 hij	4.3 h
EXP B	3.4 oz.	ACEGIK	6.3 ef	6.3 fgh	6.5 ghi	5.0 ij	5.8 fgh	5.5 g-j	4.5 ijk	3.8 h
EXP B	3.4 oz.	ACEGIK	6.8 c-f	6.5 e-h	7.3 d-g	5.5 g-j	5.3 h	4.8 j	4.3 jk	4.5 gh
+Heritage	0.2 oz.									
Premion	4 fl.oz.	ACEGIK	7.3 bcd	8.0 abc	7.5 c-f	7.5 abc	7.3 bcd	7.8 a-d	7.0 c-f	7.5 bcd
+Par	0.37 fl.oz.									
Premion	6 fl.oz.	ACEGIK	8.0 ab	8.0 abc	7.8 b-e	7.3 bcd	6.8 c-f	7.0 b-f	6.5 efg	6.8 cde
+Par	0.37 fl.oz.									
Premion	8 fl.oz.	ACEGIK	7.5 abc	7.8 bcd	7.3 d-g	7.3 bcd	7.5 a-d	7.3 b-f	6.5 efg	6.0 ef
+Par	0.37 fl.oz.									
Autilus	6 fl.oz.	ACEGIK	7.3 bcd	7.8 bcd	7.5 c-f	7.3 bcd	7.3 bcd	7.3 b-f	7.3 b-e	8.0 ab
+Par	0.37 fl.oz.									
AMV Rotational Program	pgm[w]	ACEGIK	7.5 abc	8.0 abc	8.0 a-d	7.3 bcd	8.3 ab	8.8 a	7.3 b-e	7.8 abc
Oximus	0.8 fl.oz.	ACEGIK	6.3 ef	5.8 h	5.8 ij	5.3 hij	5.5 gh	7.0 b-f	5.5 ghi	6.5 def
Oximus	1.0 fl.oz.	ACEGIK	6.8 c-f	6.5 e-h	5.8 ij	5.8 f-j	5.5 gh	6.5 d-h	6.0 fgh	6.0 ef
Oximus	1.6 fl.oz.	ACEGIK	6.5 def	6.0 gh	5.5 j	4.8 j	5.0 h	6.0 f-j	5.3 hij	5.5 fg
EXP C	0.213 fl.oz.	ACEGIK	6.0 f	6.3 fgh	6.5 ghi	5.0 ij	5.5 gh	5.0 ij	4.0 k	4.5 gh
EXP C	0.213 fl.oz.	ACEGIK	7.0 cde	7.3 cde	7.5 c-f	7.5 abc	7.8 abc	7.8 a-d	8.3 ab	8.0 ab
+Spectro 90	3.0 oz.									
Navicon	0.85 fl.oz.	ACEGIK	6.3 ef	6.8 efg	7.0 e-h	6.8 c-f	7.3 bcd	7.3 b-f	7.8 a-d	8.0 ab
Insignia	0.7 fl.oz.	ACEGIK	7.0 cde	7.8 bcd	7.5 c-f	6.8 c-f	7.0 cde	6.8 c-g	6.8 def	6.8 cde
+Civitas One	8.5 fl.oz.									
Maxtima	0.4 fl.oz.	ACEGIK	7.0 cde	7.0 def	7.0 e-h	6.5 c-g	7.3 bcd	7.8 a-d	8.0 abc	8.3 ab
Maxtima	0.6 fl.oz.	ACEGIK	6.3 ef	6.5 e-h	6.8 fgh	6.0 e-i	7.3 bcd	8.3 ab	8.0 abc	8.5 ab
Velista	0.5 oz.	ACEGIK	6.8 c-f	6.3 fgh	6.5 ghi	6.3 d-h	6.8 c-f	7.3 b-f	7.8 a-d	7.5 bcd
Daconil Weatherstik	3.5 fl.oz.	ACEGIK	7.0 cde	7.0 def	7.5 c-f	7.0 cde	7.0 cde	8.0 abc	8.3 ab	7.8 abc
Daconil Action	3.44 fl.oz.	ACEGIK	6.5 def	6.8 efg	6.8 fgh	6.0 e-i	6.5 d-g	7.5 a-e	7.0 c-f	8.0 ab
Medallion	1.5 fl.oz.	ACEGIK	8.0 ab	8.3 ab	8.5 ab	7.5 abc	7.8 abc	7.5 a-e	7.8 a-d	6.8 cde
+Signature Xtra	4.0 oz.									
Affirm	0.88 oz.	ACEGIK	7.0 cde	7.3 cde	7.5 c-f	6.8 c-f	7.5 a-d	7.3 b-f	7.3 b-e	6.0 ef
+Signature Xtra	4.0 oz.									
Untreated			7.0 cde	6.5 e-h	6.8 fgh	5.8 f-j	6.0 e-h	5.3 hij	4.0 k	4.0 h
ANOVA: Treatment (P > F)			0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Days after treatment		14-d	7	3	7	1	7	14	7	13

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft^{-2} at 40 psi.

[y]Syngenta Program 1 was applied every 14-d. All Applications included Daconil Action (3.5 fl.oz.) + Appear II (6.0 fl.oz.). Additional fungicides were tank-mixed and applied as follows: A=Secure Action (0.5 fl.oz.); C=Ascernity (1.0 fl.oz.); E=Medallion (1.5 fl.oz.); G=Velista (0.5 oz.); I=Secure Action (0.5 fl.oz.); K=Ascernity (1.0 fl.oz.)

[x]Syngenta Program 2 was applied every 14-d. All Applications included Daconil Action (3.5 fl.oz.) + Appear II (6.0 fl.oz.). Additional fungicides were tank-mixed and applied as follows: A=Secure Action (0.5 fl.oz.); C=Ascernity (1.0 fl.oz.); E=Medallion (1.5 fl.oz.); G=Briskway (0.5 fl.oz.); I=Secure Action (0.5 fl.oz.); K=Ascernity (1.0 fl.oz.)

[w]AMV Rotational Program was applied every 14-d. Fungicides were tank-mixed and applied as follows: A=Premion (6 fl.oz.) + Par (0.37 fl.oz.); C=Signature Xtra (4.0 oz.) + Previa (3.6 fl.oz.); E=Velista (0.3 oz.) + Affirm (0.88 oz.); G=Oximus (1.0 fl.oz.) + Medallion (1.5 fl.oz.); I= Signature Xtra (4.0 oz.) + Previa (3.6 fl.oz.); K= Velista (0.3 oz.) + Affirm (0.88 oz.)

[v]Treatment application dates were as follows: A=28 May; C=11 June; E=25 June; G=9 July; I=23 July; K=6 August

[u]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

Table 3. Effect of various fungicides on phytotoxicity in an annual bluegrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft²	Application Dates[v]	Phytotoxicity							
			5 Jun	14 Jun	18 Jun	26 Jun	2 Jul	9 Jul	16 Jul	6 Aug
			0-5; 2=max acceptable							
Syngenta Program 1	pgm[y]	ACEGIK	0.0 -	0.0 -	0.0 b[u]	0.0 c	0.0 b	0.0 d	0.8 cd	0.0 e
Syngenta Program 2	pgm[x]	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
Daconil Action +Appear II	3.5 fl.oz. 6.0 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
EXP A	1.18 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
EXP A	1.62 fl.oz.	ACEGIK	0.0 -	0.3 -	0.1 b	0.0 c	0.0 b	0.3 cd	0.0 e	0.0 e
Heritage	0.2 oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
EXP B	3.4 oz.	ACEGIK	0.0 -	0.3 -	0.0 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
EXP B +Heritage	3.4 oz. 0.2 oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.5 b	0.0 d	0.0 e	0.0 e
Premion +Par	4 fl.oz. 0.37 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.0 e	0.8 d
Premion +Par	6 fl.oz. 0.37 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.3 b	0.5 c	0.3 de	1.3 c
Premion +Par	8 fl.oz. 0.37 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.5 cde	1.5 c
Autilus +Par	6 fl.oz. 0.37 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.5 c	0.8 b	0.3 cd	1.0 bc	0.0 e
AMV Rotational Program	pgm[w]	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.5 cde	0.5 d
Oximus	0.8 fl.oz.	ACEGIK	0.0 -	0.8 -	0.9 a	2.0 b	1.8 a	1.0 b	2.0 a	2.0 b
Oximus	1.0 fl.oz.	ACEGIK	0.0 -	0.3 -	1.5 a	2.8 a	1.8 a	1.0 b	1.5 ab	2.0 b
Oximus	1.6 fl.oz.	ACEGIK	0.0 -	0.5 -	0.7 a	3.3 a	2.3 a	2.0 a	1.5 ab	2.5 a
EXP C	0.213 fl.oz.	ACEGIK	0.0 -	0.3 -	0.1 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
EXP C +Spectro 90	0.213 fl.oz. 3.0 oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
Navicon	0.85 fl.oz.	ACEGIK	0.0 -	0.0 -	0.1 b	0.0 c	0.8 b	0.0 d	0.0 e	0.0 e
Insignia +Civitas One	0.7 fl.oz. 8.5 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.3 c	0.0 b	0.0 d	0.0 e	0.0 e
Maxtima	0.4 fl.oz.	ACEGIK	0.0 -	0.3 -	0.1 b	0.5 c	0.5 b	0.0 d	0.0 e	0.0 e
Maxtima	0.6 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
Velista	0.5 oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
Daconil Weatherstik	3.5 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
Daconil Action	3.44 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
Medallion +Signature Xtra	1.5 fl.oz. 4.0 oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.8 b	0.0 d	0.0 e	0.0 e
Affirm +Signature Xtra	0.88 oz. 4.0 oz.	ACEGIK	0.0 -	0.0 -	0.0 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
Untreated			0.0 -	0.0 -	0.1 b	0.0 c	0.0 b	0.0 d	0.0 e	0.0 e
ANOVA: Treatment (P > F)			1.0000	0.0720	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Days after treatment		14-d	7	3	7	1	7	14	7	13

[z]All treatments were applied using a hand held CO_2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft^{-2} at 40 psi.

[y]Syngenta Program 1 was applied every 14-d. All Applications included Daconil Action (3.5 fl.oz.) + Appear II (6.0 fl.oz.). Additional fungicides were tank-mixed and applied as follows: A=Secure Action (0.5 fl.oz.); C=Ascernity (1.0 fl.oz.); E=Medallion (1.5 fl.oz.); G=Velista (0.5 oz.); I=Secure Action (0.5 fl.oz.); K=Ascernity (1.0 fl.oz.)

[x]Syngenta Program 2 was applied every 14-d. All Applications included Daconil Action (3.5 fl.oz.) + Appear II (6.0 fl.oz.). Additional fungicides were tank-mixed and applied as follows: A=Secure Action (0.5 fl.oz.); C=Ascernity (1.0 fl.oz.); E=Medallion (1.5 fl.oz.); G=Briskway (0.5 fl.oz.); I=Secure Action (0.5 fl.oz.); K=Ascernity (1.0 fl.oz.)

[w]AMV Rotational Program was applied every 14-d. Fungicides were tank-mixed and applied as follows: A=Premion (6 fl.oz.) + Par (0.37 fl.oz.); C=Signature Xtra (4.0 oz.) + Previa (3.6 fl.oz.); E=Velista (0.3 oz.) + Affirm (0.88 oz.); G=Oximus (1.0 fl.oz.) + Medallion (1.5 fl.oz.); I= Signature Xtra (4.0 oz.) + Previa (3.6 fl.oz.); K= Velista (0.3 oz.) + Affirm (0.88 oz.)

[v]Treatment application dates were as follows: A=28 May; C=11 June; E=25 June; G=9 July; I=23 July; K=6 August

[u]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test ($\alpha = 0.05$)

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Table 4. Effect of various fungicides on yellow spot in an annual bluegrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft²	Application Dates[v]	Yellow Spot 27 Jul	Yellow Spot 31 Jul
			-- # of yellow spots 18ft⁻² --	
Syngenta Program 1	pgm[y]	ACEGIK	0.7 b-e[u]	0.6 f-i
Syngenta Program 2	pgm[x]	ACEGIK	0.0 e	0.0 i
Daconil Action	3.5 fl.oz.	ACEGIK	0.0 e	0.2 ghi
+Appear II	6.0 fl.oz.			
EXP A	1.18 fl.oz.	ACEGIK	4.4 ab	7.4 a-f
EXP A	1.62 fl.oz.	ACEGIK	4.0 ab	17.5 ab
Heritage	0.2 oz.	ACEGIK	2.6 a-d	3.9 d-i
EXP B	3.4 oz.	ACEGIK	6.6 a	11.6 a-e
EXP B	3.4 oz.	ACEGIK	2.9 a-d	13.3 a-e
+Heritage	0.2 oz.			
Premion	4 fl.oz.	ACEGIK	1.7 a-e	4.1 d-i
+Par	0.37 fl.oz.			
Premion	6 fl.oz.	ACEGIK	3.3 abc	3.4 e-i
+Par	0.37 fl.oz.			
Premion	8 fl.oz.	ACEGIK	0.0 e	0.2 ghi
+Par	0.37 fl.oz.			
Autilus	6 fl.oz.	ACEGIK	3.1 a-d	3.0 e-i
+Par	0.37 fl.oz.			
AMV Rotational Program	pgm[w]	ACEGIK	0.2 de	0.1 hi
Oximus	0.8 fl.oz.	ACEGIK	4.3 ab	12.2 a-e
Oximus	1.0 fl.oz.	ACEGIK	2.3 a-e	7.8 a-f
Oximus	1.6 fl.oz.	ACEGIK	1.3 a-e	3.0 e-i
EXP C	0.213 fl.oz.	ACEGIK	5.4 a	19.2 a
EXP C	0.213 fl.oz.	ACEGIK	0.4 cde	0.0 i
+Spectro 90	3.0 oz.			
Navicon	0.85 fl.oz.	ACEGIK	1.5 a-e	7.0 a-f
Insignia	0.7 fl.oz.	ACEGIK	2.9 a-d	14.7 a-d
+Civitas One	8.5 fl.oz.			
Maxtima	0.4 fl.oz.	ACEGIK	2.0 a-e	10.6 a-e
Maxtima	0.6 fl.oz.	ACEGIK	4.3 ab	16.6 abc
Velista	0.5 oz.	ACEGIK	5.9 a	13.0 a-e
Daconil Weatherstik	3.5 fl.oz.	ACEGIK	0.0 e	0.1 hi
Daconil Action	3.44 fl.oz.	ACEGIK	0.4 cde	0.3 ghi
Medallion	1.5 fl.oz.	ACEGIK	2.6 a-d	4.0 d-i
+Signature Xtra	4.0 oz.			
Affirm	0.88 oz.	ACEGIK	2.3 a-e	4.8 c-h
+Signature Xtra	4.0 oz.			
Untreated			1.2 a-e	5.9 b-g
ANOVA: Treatment (P > F)			0.0052	0.0001
Days after treatment		14-d	4	8

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft⁻² at 40 psi.

[y]Syngenta Program 1 was applied every 14-d. All Applications included Daconil Action (3.5 fl.oz.) + Appear II (6.0 fl.oz.). Additional fungicides were tank-mixed and applied as follows: A=Secure Action (0.5 fl.oz.); C=Ascernity (1.0 fl.oz.); E=Medallion (1.5 fl.oz.); G=Velista (0.5 oz.); I=Secure Action (0.5 fl.oz.); K=Ascernity (1.0 fl.oz.)

[x]Syngenta Program 2 was applied every 14-d. All Applications included Daconil Action (3.5 fl.oz.) + Appear II (6.0 fl.oz.). Additional fungicides were tank-mixed and applied as follows: A=Secure Action (0.5 fl.oz.); C=Ascernity (1.0 fl.oz.); E=Medallion (1.5 fl.oz.); G=Briskway (0.5 fl.oz.); I=Secure Action (0.5 fl.oz.); K=Ascernity (1.0 fl.oz.)

[w]AMV Rotational Program was applied every 14-d. Fungicides were tank-mixed and applied as follows: A=Premion (6 fl.oz.) + Par (0.37 fl.oz.); C=Signature Xtra (4.0 oz.) + Previa (3.6 fl.oz.); E=Velista (0.3 oz.) + Affirm (0.88 oz.); G=Oximus (1.0 fl.oz.) + Medallion (1.5 fl.oz.); I= Signature Xtra (4.0 oz.) + Previa (3.6 fl.oz.); K= Velista (0.3 oz.) + Affirm (0.88 oz.)

[v]Treatment application dates were as follows: A=28 May; C=11 June; E=25 June; G=9 July; I=23 July; K=6 August

[u]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

PREVENTIVE ANTHRACNOSE CONTROL WITH VARIOUS FUNGICIDES ON AN ANNUAL BLUEGRASS PUTTING GREEN TURF II, 2020

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INTRODUCTION

Anthracnose (caused by *Colletotrichum cereale*) is a devastating disease of annual bluegrass putting green turf. An integrated disease control program including cultural management and fungicides is required to minimize turf loss due to this disease. Rotational fungicide programs utilizing different chemical modes of action and multi-site fungicides have been found to be most effective in providing season-long anthracnose control. Identifying new fungicides with unique modes of action effective against anthracnose is important to continued control of this disease and resistance management. The objective of this study was to examine the efficacy of experimental and commonly used fungicides for anthracnose control on an annual bluegrass putting green turf.

MATERIALS & METHODS

A field study was conducted on an annual bluegrass (*Poa annua*) turf grown on a Paxton fine sandy loam at the Plant Science Research and Education Facility in Storrs, CT. Turf was mowed five days wk^{-1} at a bench setting of 0.125-inches. Minimal nitrogen was applied to the study area to encourage anthracnose development. A total of 1.5 lbs N $1000\text{-}ft^{-2}$ was applied as water soluble sources from April through 3 August. Mono-potassium phosphate was applied to correct measured deficiencies in P and K. A total of 1.5 lbs P_2O_5 and 0.96 lbs K_2O were applied from May through 3 August. A wetting agent (Revolution, 3 fl.oz.) was applied every 14-d beginning on 11 May. Overhead irrigation and hand-watering was applied as needed to prevent drought stress. A rotation of Xzemplar (0.16 fl.oz.) and Pinpoint (0.275 oz.) was applied every 14-d between 18 May and 13 July to prevent dollar spot development. Tempo was applied on 12 May and Conserve was applied on 3 June for control of annual bluegrass weevil and white grubs. Primo Maxx (0.125 fl.oz.) was applied to the entire study area beginning on 14 May and was reapplied every 200 GDD (base 0°C).

Treatments consisted of commercially available and developmental fungicides. Initial applications were made on 28 May prior to disease development. Subsequent applications were made every 14-d through 6 August. All treatments were applied using a hand held CO_2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal $1000\text{-}ft^{-2}$ at 40 psi. Plots measured 3 x 6 ft and were arranged in a randomized complete block design with four replications.

Anthracnose severity was evaluated visually as the percent area blighted by *C. cereale* from 26 June through 14 August. Turf quality was visually assessed on a 1 to 9 scale; where 9 represented the best possible quality turf and 6 was the minimum acceptable level. Phytotoxicity was also assessed visually on a 0 to 5 scale, where 0 was equal to no discoloration and 2 represented the maximum acceptable level of injury. Yellow Spot, caused by a cyanobacteria sp. was assessed as a the number of chlorotic spots per plot. All data were subjected to an analysis of variance and means were separated using Fisher's protected least significant difference test. Anthracnose severity data were log-transformed as necessary for ANOVA and mean separation tests, means were de-transformed for presentation.

RESULTS & DISCUSSION

Anthracnose Severity

Anthracnose symptoms developed from a natural infestation beginning in late June, with untreated control (UTC) plots averaging ~6% plot area blighted (Table 1). Disease progressed steadily through the end of July, peaking at 55% plot area blighted in the UTC plots. Conditions remained conducive for disease during August with anthracnose increasing in several treatments by the end of the study. Generally, most treatments provided acceptable (<10%) anthracnose control through 27 July.

EXP A & B were applied at 0.5 and 1.0 fl.oz. rates. Both variants provided excellent control (<1%) until 6 August, regardless of rate. By 14 August, anthracnose differences between the variants were observed at the low application rate (0.5 fl.oz.). Symptoms developed in EXP A treated turf, whereas minimal anthracnose developed in EXP B turf at the same rate. Minimal anthracnose was observed at the increased rate (1.0 fl.oz.), regardless of variant throughout the trial.

EXP C, EXP D, EXP E, and EXP F were tank-mixed and applied at a low and high rate (see table 1 for complete breakdown of rates). Both rates of the tank-mix provided excellent control through 6 August, although minor anthrancose symptoms developed at the low rate by the last observation date.

EXP G, EXP H, EXP I, EXP J, and the high rate (2.87 fl.oz.) of EXP F all provided excellent control for the duration of the trial. Velista provided excellent control on all dates except 14 August, although control of anthracnose was still acceptable on this date.

Beginning at the peak of the epidemic on 31 July, plots treated with the low rate of Briskway averaged 13% plot area blighted, and remained unacceptably high through the end of the trial. All other treatments provided acceptable control until 14 August, when plots treated with EXP F (1.44 fl.oz.), the high rate of Briskway, and Secure all had over 10% plot area blighted.

Turf Quality and Phytotoxicity

There was no phytoxicity (Table 3) observed on any of the rating dates, therefore turf quality (Table 2) was primarily influenced by anthracnose severity. No significant differences in turf quality were observed through 2 July, with all treatments showing acceptable levels (1-9; 6=min acceptable) of turf quality. As of 6 August, turf quality for all treatments was generally 7.5 or greater, with the exception of plots treated with Briskway, Secure, Secure Action, or UTC plots. All treatments except for UTC showed acceptable quality for the entirety of the trial.

Cyanobacteria Yellow Spot

An outbreak of yellow spot caused by cyanobacteria occurred in late July. While differences between treatments were not significant, every treatment showed yellow spot symptoms with the exception of EXP H, which averaged 0 spots per plot on both rating dates.

Table 3. Effect of various fungicides on preventive anthracnose control in an annual bluegrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft^2	Application Dates[y]	Anthracnose Severity: 26 June	2 Jul	9 Jul	16 Jul[x]	27 Jul[x]	31 Jul	6 Aug	14 Aug[x]
			% plot area blighted							
EXP A	0.5 fl.oz.	ACEGIK	0.0 -	0.3 -	0.4 -	0.4 c[w]	0.0 c	0.0 c	0.8 cd	8.3 bcd
EXP B	0.5 fl.oz.	ACEGIK	1.1 -	0.9 -	0.3 -	0.2 c	0.0 c	0.0 c	0.0 d	0.9 e
EXP C	0.0785 fl.oz.	ACEGIK	0.1 -	0.4 -	0.3 -	0.2 c	0.0 c	0.0 c	0.0 d	5.4 d
+EXP D	0.118 fl.oz.	ACEGIK								
+EXP E	0.25 fl.oz.	ACEGIK								
+EXP F	0.00655 oz.	ACEGIK								
EXP A	1.0 fl.oz.	ACEGIK	0.3 -	0.1 -	0.0 -	0.0 c	0.0 c	0.0 c	0.0 d	0.2 e
EXP B	1.0 fl.oz.	ACEGIK	0.6 -	0.0 -	0.0 -	0.2 c	0.0 c	0.0 c	0.0 d	0.0 e
EXP C	0.157 fl.oz.	ACEGIK	1.0 -	0.0 -	0.0 -	0.1 c	0.0 c	0.1 c	0.0 d	0.2 e
+EXP D	0.236 fl.oz.	ACEGIK								
+EXP E	0.5 fl.oz.	ACEGIK								
+EXP F	0.0131 oz.	ACEGIK								
Velista	0.5 oz.	ACEGIK	0.3 -	0.1 -	0.0 -	0.1 c	0.0 c	0.0 c	0.3 cd	6.8 cd
EXP F	1.44 fl.oz.	ACEGIK	1.0 -	0.3 -	0.0 -	0.0 c	0.2 bc	0.8 c	4.3 bcd	14.2 bc
EXP F	2.87 fl.oz.	ACEGIK	1.0 -	0.3 -	0.0 -	0.0 c	0.0 c	0.0 c	0.0 d	0.2 e
EXP G	1.0 fl.oz.	ACEGIK	1.9 -	0.0 -	0.1 -	0.0 c	0.0 c	0.0 c	0.0 d	0.1 e
Briskway	0.9 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 c	0.8 bc	13.6 b	10.0 b	17.0 ab
Briskway	1.2 fl.oz.	ACEGIK	0.1 -	0.0 -	0.0 -	0.0 c	0.0 c	3.8 c	6.5 bcd	14.4 bc
EXP H	3.5 fl.oz.	ACEGIK	0.9 -	0.5 -	0.4 -	0.4 c	0.2 bc	0.3 c	0.0 d	0.6 e
EXP I	0.85 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 c	0.0 c	0.0 c	0.0 d	0.0 e
EXP J	0.6 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.2 c	0.0 c	0.0 c	0.0 d	0.0 e
Secure Action	0.5 fl.oz.	ACEGIK	1.5 -	1.1 -	1.8 -	2.5 b	0.7 bc	1.4 c	5.8 bcd	8.8 bcd
Secure	0.5 fl.oz.	ACEGIK	0.9 -	0.3 -	0.0 -	0.2 c	1.1 b	3.5 c	7.0 bc	17.9 ab
Untreated		ACEGIK	6.4 -	7.5 -	16.8 -	26.4 a	47.2 a	55.0 a	47.5 a	35.9 a
ANOVA: Treatment (P > F)			0.1022	0.1022	0.0752	0.0001	0.0001	0.0001	0.0001	0.0001
Days after treatment		14-d	1	7	13	7	4	9	14	8

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft^{-2} at 40 psi.
[y]Treatment application dates were as follows: A=28 May; C=11 June; E=25 June; G=9 July; I=23 July; K=6 August
[x]Means were log-transformed for homogeneity of variance, then de-transformed for presentation.
[w]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test ($\alpha = 0.05$)

Table 2. Effect of various fungicides on turf quality in an annual bluegrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft²	Application Dates[y]	Turf Quality 5 Jun	14 Jun	18 Jun	26 Jun	2 Jul	9 Jul	16 Jul	6 Aug
			1-9; 6=min acceptable							
EXP A	0.5 fl.oz.	ACEGIK	6.5 -	7.0 -	7.0 -	7.3 -	7.5 -	8.5 ab[x]	7.8 ab	7.8 a
EXP B	0.5 fl.oz.	ACEGIK	6.3 -	7.0 -	6.8 -	6.8 -	7.8 -	8.0 ab	7.8 ab	7.8 a
EXP C	0.0785 fl.oz.	ACEGIK	6.5 -	6.8 -	7.5 -	7.3 -	7.8 -	8.3 ab	8.0 a	8.3 a
+EXP D	0.118 fl.oz.	ACEGIK								
+EXP E	0.25 fl.oz.	ACEGIK								
+EXP F	0.00655 oz.	ACEGIK								
EXP A	1.0 fl.oz.	ACEGIK	6.5 -	7.0 -	7.3 -	7.3 -	7.5 -	8.3 ab	7.8 ab	7.8 a
EXP B	1.0 fl.oz.	ACEGIK	6.8 -	7.0 -	7.3 -	7.0 -	8.0 -	8.5 ab	8.0 a	8.3 a
EXP C	0.157 fl.oz.	ACEGIK	6.8 -	6.8 -	7.0 -	6.8 -	7.8 -	8.0 ab	8.0 a	8.0 a
+EXP D	0.236 fl.oz.	ACEGIK								
+EXP E	0.5 fl.oz.	ACEGIK								
+EXP F	0.0131 oz.	ACEGIK								
Velista	0.5 oz.	ACEGIK	6.5 -	6.8 -	7.5 -	7.3 -	8.3 -	8.5 ab	8.5 a	7.5 ab
EXP F	1.44 fl.oz.	ACEGIK	6.5 -	7.0 -	7.3 -	7.0 -	7.5 -	8.5 ab	8.5 a	7.5 ab
EXP F	2.87 fl.oz.	ACEGIK	6.3 -	7.0 -	7.0 -	6.5 -	7.3 -	8.0 ab	7.5 ab	8.3 a
EXP G	1.0 fl.oz.	ACEGIK	6.5 -	7.0 -	7.5 -	6.5 -	8.0 -	8.8 a	8.0 a	7.8 a
Briskway	0.9 fl.oz.	ACEGIK	7.0 -	7.0 -	7.0 -	7.5 -	8.3 -	8.5 ab	7.5 ab	6.8 bc
Briskway	1.2 fl.oz.	ACEGIK	6.5 -	7.0 -	7.8 -	7.0 -	8.0 -	8.3 ab	7.8 ab	6.8 bc
EXP H	3.5 fl.oz.	ACEGIK	6.5 -	7.0 -	7.0 -	7.3 -	7.5 -	7.5 bc	7.8 ab	8.0 a
EXP I	0.85 fl.oz.	ACEGIK	6.5 -	7.0 -	7.5 -	7.0 -	8.3 -	8.5 ab	8.3 a	8.0 a
EXP J	0.6 fl.oz.	ACEGIK	6.8 -	7.0 -	7.3 -	7.0 -	8.3 -	8.8 a	8.5 a	8.0 a
Secure Action	0.5 fl.oz.	ACEGIK	6.8 -	6.8 -	7.3 -	6.5 -	7.5 -	6.8 c	6.8 b	6.3 c
Secure	0.5 fl.oz.	ACEGIK	6.5 -	7.0 -	6.8 -	6.8 -	7.5 -	8.0 ab	7.8 ab	6.5 c
Untreated		ACEGIK	6.5 -	7.0 -	6.5 -	6.0 -	6.0 -	5.3 d	4.3 c	3.5 d
ANOVA: Treatment (P > F)			0.9634	0.6768	0.2230	0.4300	0.0668	0.0001	0.0001	0.0001
Days after treatment		14-d	7	3	7	1	7	14	7	13

[z]All treatments were applied using a hand held CO_2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft^{-2} at 40 psi.
[y]Treatment application dates were as follows: A=28 May; C=11 June; E=25 June; G=9 July; I=23 July; K=6 August
[x]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

Table 3. Effect of various fungicides on phytotoxicity in an annual bluegrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft²	Application Dates[y]	Phytotoxicity							
			5 Jun	14 Jun	18 Jun	26 Jun	2 Jul	9 Jul	16 Jul	6 Aug
			0-5; 2=max acceptable							
EXP A	0.5 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP B	0.5 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP C	0.0785 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
+EXP D	0.118 fl.oz.	ACEGIK								
+EXP E	0.25 fl.oz.	ACEGIK								
+EXP F	0.00655 oz.	ACEGIK								
EXP A	1.0 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP B	1.0 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP C	0.157 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
+EXP D	0.236 fl.oz.	ACEGIK								
+EXP E	0.5 fl.oz.	ACEGIK								
+EXP F	0.0131 oz.	ACEGIK								
Velista	0.5 oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP F	1.44 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP F	2.87 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP G	1.0 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Briskway	0.9 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Briskway	1.2 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP H	3.5 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP I	0.85 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP J	0.6 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Secure Action	0.5 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Secure	0.5 fl.oz.	ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Untreated		ACEGIK	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
ANOVA: Treatment (P > F)			1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Days after treatment		14-d	7	3	7	1	7	14	7	13

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft $^{-2}$ at 40 psi.
[y]Treatment application dates were as follows: A=28 May; C=11 June; E=25 June; G=9 July; I=23 July; K=6 August

Table 4. Effect of various fungicides on yellow spot in an annual bluegrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft^2	Application Dates[y]	Yellow Spot 27 Jul	Yellow Spot 31 Jul
			--- # of yellow spots 18ft^{-2} ---	
EXP A	0.5 fl.oz.	ACEGIK	12.0 -	26.0 -
EXP B	0.5 fl.oz.	ACEGIK	12.2 -	37.2 -
EXP C	0.0785 fl.oz.	ACEGIK	6.3 -	15.4 -
+EXP D	0.118 fl.oz.	ACEGIK		
+EXP E	0.25 fl.oz.	ACEGIK		
+EXP F	0.00655 oz.	ACEGIK		
EXP A	1.0 fl.oz.	ACEGIK	8.8 -	13.8 -
EXP B	1.0 fl.oz.	ACEGIK	6.4 -	10.8 -
EXP C	0.157 fl.oz.	ACEGIK	8.0 -	15.1 -
+EXP D	0.236 fl.oz.	ACEGIK		
+EXP E	0.5 fl.oz.	ACEGIK		
+EXP F	0.0131 oz.	ACEGIK		
Velista	0.5 oz.	ACEGIK	6.4 -	9.9 -
EXP F	1.44 fl.oz.	ACEGIK	10.3 -	17.6 -
EXP F	2.87 fl.oz.	ACEGIK	12.1 -	17.0 -
EXP G	1.0 fl.oz.	ACEGIK	15.3 -	33.3 -
Briskway	0.9 fl.oz.	ACEGIK	7.1 -	15.5 -
Briskway	1.2 fl.oz.	ACEGIK	3.4 -	8.6 -
EXP H	3.5 fl.oz.	ACEGIK	0.0 -	0.0 -
EXP I	0.85 fl.oz.	ACEGIK	4.7 -	14.1 -
EXP J	0.6 fl.oz.	ACEGIK	10.2 -	17.6 -
Secure Action	0.5 fl.oz.	ACEGIK	9.6 -	20.9 -
Secure	0.5 fl.oz.	ACEGIK	8.2 -	13.8 -
Untreated		ACEGIK	13.0 -	20.2 -
ANOVA: Treatment (P > F)			0.3536	0.1201
Days after treatment		14-d	4	8

[z]All treatments were applied using a hand held CO_2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft^{-2} at 40 psi.
[y]Treatment application dates were as follows: A=28 May; C=11 June; E=25 June; G=9 July; I=23 July; K=6 August

PREVENTIVE DOLLAR SPOT CONTROL WITH VARIOUS FUNGICIDES ON A CREEPING BENTGRASS FAIRWAY TURF, 2020

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INTRODUCTION

Dollar spot is a common disease of cool-season turfgrasses caused by the fungal pathogen *Clarireedia jacksonii*. On golf course fairways it is characterized by light, straw-colored spots that may coalesce into larger irregularly shaped areas. It is particularly active during periods of warm daytime temperatures (80°F), cool nighttime temperatures (60°F), and high humidity. It can be managed in part with cultural practices such as maintaining moderate nitrogen fertility, reducing leaf wetness period. However, the use of fungicides is often still necessary on high priority areas such as greens, tees and fairways. The objective of this study was to evaluate the efficacy of rotational fungicide programs as well as using new and existing fungicides in controlling dollar spot on a creeping bentgrass putting green turf.

MATERIALS & METHODS

A field study was conducted on an 'Ninety-six Two' creeping bentgrass (*Agrostis stolonifera*) turf grown on a Paxton fine sandy loam at the Plant Science Research and Education Facility in Storrs, CT. Turf was mowed three days wk^{-1} at a bench setting of 0.4-inches. Nitrogen was applied at a total of 1.4 lb N 1000-ft^{-2} as water soluble sources from April through September. Mono-potassium phosphate was applied to correct measured deficiencies in P and K. A total of 2.0 lbs P_2O_5 and 1.28 lbs K_2O were applied from May through 31 August. A wetting agent (Revolution, 6 fl.oz.) was applied every 28-d beginning on 11 May. Overhead irrigation was applied as needed to prevent drought stress. Daconil Ultrex (3.25 oz) was applied on 20 May to prevent dollar spot development in the trial area before treatments were initiated due to research delays associated with the COVID-19 pandemic. Primo Maxx (0.25 fl.oz.) was applied to the entire study area beginning on 14 May and was reapplied 200 GDD (base 0°C).

Treatments consisted of new fungicide formulations and currently available products applied individually, as tank mixes, and/or in rotational program. Initial applications were made on 2 June, prior to disease developing in the trial area. Subsequent applications were made at specified intervals through 8 September. All treatments were applied using a hand held CO_2 powered spray boom outfitted with a single AI9504E flat fan nozzle calibrated to deliver 1.0 gal 1000-ft^{-2} at 40 psi. Plots measured 3 x 6 ft and were arranged in a randomized complete block design with four replications.

Dollar spot incidence were assessed as a count of individual disease foci within each plot. Turf quality was visually assessed on a 1 to 9 scale; where 9 represented the best quality turf and 6 was the minimum acceptable level. Phytotoxicity was also assessed visually where 0 was equal to no discoloration and 2 represented the maximum acceptable level. All data were subjected to an analysis of variance and means were separated using Fisher's protected least significant difference test.

RESULTS AND DISCUSSION

Dollar Spot Incidence

Dollar spot symptoms were first observed on 26 June (Table 1a + 1b), with untreated control (UTC) plots averaging 24.5 dollar spot infection centers (DSIC) $plot^{-1}$ on 2 July. Disease incidence progressed slowly during June, July, and the beginning of August. UTC plots averaged 29.2 DSIC $plot^{-1}$ on 7 August, with little to no symptoms in any treated plots. Differences among treatments became evident by mid-August.

Maxtima, a DMI fungicide with increased phytosafety, introduced in 2019, provided excellent (<5 DSIC $plot^{-1}$) control through 3 September when applied every 14-d (0.2 fl.oz.) or 21-d (0.4 fl.oz.). Maxtima (0.4 fl.oz.) applied every 28-d, generally provided acceptable dollar spot control, although disease breakthrough was observed at the end of the 28-d application interval (2 Jul, 31 Jul), and consistently during the last weeks of the trial. Navicon, a premix containing the active ingredient in Maxtima and pyraclostrobin, provided excellent control through 3 September when applied every 21-d (0.85 fl.oz.), and good control as of 11 September (9.7 DSIC $plot^{-1}$).

Other DMI fungicides, Rayora (21-d), and Tourney (14-d), provided good-to-excellent dollar spot control through 3 September. However, disease increased to unacceptable levels by the end of the trial, with Rayora averaging 45.7 DSIC $plot^{-1}$, and Tourney averaging 34.1 DSIC $plot^{-1}$. Tourney (0.28 oz) was also applied as a tank-mix with Pinpoint (0.28 fl.oz.) a QoI fungicide. The tank-mix provided excellent control through 28 August, and acceptable control thereafter, however these results did not significantly differ from Pinpoint applied alone at the same rate/interval.

Several SDHI fungicides were applied at various rates and intervals. Xzemplar was applied at both a 14- and 21-d interval at 0.26 fl.oz. Both intervals provided excellent dollar spot control for the entirety of the trial, with all but two dates at the 21-d interval showing no disease at any point during the trial. Emerald was applied every 21-d both as a stand-alone treatment and tank-mixed with Civitas One. Both treatments provided excellent control throughout the trial, with no difference between the stand-alone and tank-mixed treatments. Encartis, a premix containing an SDHI and chlorothalonil, also provided excellent control through the end of the trial.

Posterity XT is a new premix fungicide combining the active ingredient in Posterity (pydiflumetofen) with Headway (azoxystrobin and propiconazole) to increase the spectrum of activity and improve disease control with these fungicides. Posterty Forte is similar, but the ratios are optimized for disase issues more prevalent in the Southern U.S. Posterity XT was applied every 14-, 21-, and 28-d at 1.5, 2.25, and 3.0 fl.oz., respectively. All three intervals generally provided excellent dollar spot control throughout the study, although disease was greater in turf treated every 28-d compared to the 14-d interval by the last observation date. Posterity Forte applied every 21-d provided good to excellent control for the entirety of the trial. Posterity XT and Forte were also applied in a rotation with Secure Action. Both rotations provided good to excellent control for the entire trial. Ascernity (benzovindiflupyr), another new SDHI fungicide premixed with difenoconazole, was also applied in a rotation with Secure Action, providing good to excellent control through 3 September, and acceptable control as of 11 September (15.3 DSIC plot^{-1}).

Secure Action was also applied in a rotatioan with EXP B, which provided excellent control through 28 August and good control thereafter. EXP A and Spectro 90 were tank-mixed and applied every 21-d, providing near-complete control of dollar spot for the duration of the trial. EXP C was applied every 14-d at 1.18 and 1.62 fl.oz. Both rates provided acceptable control, with the low and high rates averaging 16.2 and 8.2 DSIC plot^{-1} respectively as of 11 September.

Tekken (3.0 fl.oz., 21-d) provided excellent control through 28 August. Dollar spot increased to ~20 DSIC plot^{-1} on 11 September, but remained at acceptable levels. Daconil Weatherstik (4.0 fl.oz., 14-d) provided acceptable control through 28 August, before increasing to ~30 and ~55 average DSIC plot^{-1} on 3 and 11 September, respectively.

Turf Quality and Phytotoxicity

Turf quality (Tables 2a+2b) was primarily influenced by dollar spot incidence. Because of this, there were no significant differences in quality through 26 June. As of 2 July, turf quality on UTC plots decreased to 5.3 (1-9; 6=min acceptable), 4.8 on 31 July, 4.0 on 21 August, and 1.7 at the end of the trial on 11 September due to increasing dollar spot pressure. Quality remained acceptable on all treated plots through 21 August.

Treatments that showed particularly high quality prior to the bulk of the dollar spot outbreak include Maxtima (14-d), Rayora, Xzemplar (14 + 21-d), Encartis, Emerald, Emerald + Civitas, Navicon, Pinpoint (0.28 fl.oz.), Tourney, Pinpoint + Tourney, EXP A + Spectro 90, Secure Action + Ascernity, EXP C (1.18 fl.oz.), Tekken, Posterity XT (all intervals) and Posterity Forte.

Most treatments retained acceptable quality through 3 September, with the exception of Daconil Weatherstik (5.5). At the end of the trial on 11 September, Xzemplar (14 and 21-d), Encartis, Emerald, Emerald + Civitas One, EXP A + Spectro 90, Secure Action + EXP B and Posterity XT (14 and 21-d) all had very high quality despite intense disease pressure. Daconil Weatherstik, Tourney, and Tekken had unacceptable quality as of this date.

There was no phytotoxicity observed for the duration of the trial (Table 3).

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Table 1a. Effect of various fungicides on preventive dollar spot control on a creeping bentgrass fairway turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft²	Int	Application Codes[y]	Dollar Spot Incidence 19 Jun	26 Jun	2 Jul	10 Jul	16 Jul	24 Jul	31 Jul
				# of dollar spot foci per 18ft^{-2}						
Maxtima	0.2 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 d[x]	0.0 b	0.0 -	0.0 b	0.0 c
Maxtima	0.4 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	2.8 bc
Maxtima	0.4 fl.oz.	28-d	AEIM	0.0 -	0.0 -	5.8 bc	0.3 b	0.0 -	0.8 b	7.5 b
Rayora	1.4 fl.oz.	21-d	ADGJM	0.0 -	1.3 -	7.3 b	0.5 b	0.0 -	0.0 b	1.3 c
Xzemplar	0.26 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
Encartis	4.0 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
Emerald	0.18 oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
Daconil Weatherstik	4.0 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	1.5 cd	0.0 b	0.0 -	0.0 b	3.0 bc
Emerald	0.18 oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
+Civitas One	8.5 fl.oz.									
Navicon	0.85 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
Pinpoint	0.28 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	1.0 cd	0.0 b	0.0 -	0.0 b	0.0 c
Tourney	0.28 oz.	14-d	ACEGIKMO	0.0 -	0.0 -	1.8 cd	0.0 b	0.0 -	0.0 b	0.8 c
Pinpoint	0.28 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.3 d	0.0 b	0.0 -	0.0 b	0.0 c
+Tourney	0.28 oz.									
Xzemplar	0.26 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
EXP A	0.203 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
+Spectro 90	3.0 oz.									
Secure Action	0.5 fl.oz.	14-d	ACIKMO	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	1.0 c
-Ascernity	1.0 fl.oz.		EG							
Secure Action	0.5 fl.oz.	14-d	ACIKMO	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
-Posterity XT	1.5 fl.oz.		EG							
Secure Action	0.5 fl.oz.	14-d	ACIKMO	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
-Posterity Forte	0.64 fl.oz.		EG							
Secure Action	0.5 fl.oz.	14-d	ACIKMO	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
-EXP B	0.21 fl.oz.		EG							
Secure Action	0.5 fl.oz.	14-d	CGKMO	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
-Posterity Forte	0.16 fl.oz.		AI							
-Daconil Action	1.6 fl.oz.		AE							
-Posterity XT	1.5 fl.oz.		E							
-Ascernity	1.0 fl.oz.		I							
Secure Action	0.5 fl.oz.	14-d	CGKMO	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
-Posterity	0.63 fl.oz.		A							
-Daconil Action	1.6 fl.oz.		AEIM							
-Posterity XT	1.5 fl.oz.		E							
-Ascernity	1.0 fl.oz.		I							
EXP C	1.18 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	1.8 cd	0.0 b	0.0 -	0.0 b	0.3 c
EXP C	1.62 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
Pinpoint	0.17 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	3.3 bcd	0.3 b	0.0 -	0.0 b	5.3 bc
Tekken	3.0 fl.oz.	21-d	ADGJM	0.0 -	0.5 -	0.0 d	0.0 b	0.0 -	0.0 b	0.3 c
Posterity XT	1.5 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.3 d	0.0 b	0.0 -	0.0 b	0.0 c
Posterity XT	2.25 fl.oz.	21-d	ADGJM	0.0 -	1.5 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
Posterity XT	3.0 fl.oz.	28-d	AEIM	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
Posterity Forte	0.64 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 d	0.0 b	0.0 -	0.0 b	0.0 c
Untreated				0.0 -	6.0 -	24.5 a	13.0 a	6.5 -	16.8 a	37.3 a
ANOVA: Treatment (P > F)				1.0000	1.0000	0.0001	0.0003	0.1314	0.0001	0.0001
Days after treatment			14-d	3	10	2	10	2	10	3
			21-d	17	3	9	17	2	10	17
			28-d	17	24	2	10	16	24	3

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9504E flat fan nozzle calibrated to deliver 1 gal 1000-ft^{-2} at 40 psi.
[y]Treatment application dates were as follows: A=2 June; C=16 June; D=23 June; E=30 June; G=14 July; I=28 July; J=5 August; K=11 August; M=25 August; O=8 September
[x]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

Table 1b. Effect of various fungicides on preventive dollar spot control on a creeping bentgrass fairway turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft²	Int	Application Codes[y]	Dollar Spot Incidence 7 Aug	13 Aug	21 Aug	28 Aug	3 Sep	11 Sep
				# of dollar spot foci per 18ft⁻²					
Maxtima	0.2 fl.oz.	14-d	ACEGIKMO	0.0 d[x]	0.0 d	0.0 d	0.0 i	0.9 k-n	2.2 kl
Maxtima	0.4 fl.oz.	21-d	ADGJM	0.9 b	0.8 d	1.8 d	2.5 efg	2.8 g-k	10.1 f-i
Maxtima	0.4 fl.oz.	28-d	AEIM	0.0 d	7.8 b	10.8 b	11.2 bc	8.2 c-f	18.7 def
Rayora	1.4 fl.oz.	21-d	ADGJM	0.6 bc	1.3 cd	3.8 cd	9.2 bcd	13.8 bcd	45.7 bc
Xzemplar	0.26 fl.oz.	21-d	ADGJM	0.3 bcd	0.0 d	0.0 d	0.2 hi	0.0 n	0.0 m
Encartis	4.0 fl.oz.	21-d	ADGJM	0.0 d	0.0 d	0.3 d	0.0 i	0.4 lmn	1.1 l
Emerald	0.18 oz.	21-d	ADGJM	0.0 d	0.0 d	0.5 d	0.4 ghi	0.2 mn	2.0 kl
Daconil Weatherstik	4.0 fl.oz.	14-d	ACEGIKMO	0.2 cd	5.3 bcd	7.3 bc	11.7 bc	31.2 b	55.6 b
Emerald	0.18 oz.	21-d	ADGJM	0.0 d	0.5 d	0.0 d	0.0 i	0.2 mn	1.0 lm
+Civitas One	8.5 fl.oz.								
Navicon	0.85 fl.oz.	21-d	ADGJM	0.0 d	0.0 d	0.5 d	0.6 e-i	1.7 i-m	9.7 f-i
Pinpoint	0.28 fl.oz.	14-d	ACEGIKMO	0.0 d	0.3 d	0.0 d	0.6 f-i	6.2 d-h	16.3 d-g
Tourney	0.28 oz.	14-d	ACEGIKMO	0.2 cd	0.3 d	0.8 d	0.6 f-i	14.7 bcd	34.1 bcd
Pinpoint	0.28 fl.oz.	14-d	ACEGIKMO	0.0 d	0.0 d	0.0 d	0.0 i	4.7 e-i	16.6 d-g
+Tourney	0.28 oz.								
Xzemplar	0.26 fl.oz.	14-d	ACEGIKMO	0.0 d	0.0 d	0.0 d	0.0 i	0.0 n	0.0 m
EXP A	0.203 fl.oz.	21-d	ADGJM	0.0 d	0.0 d	0.0 d	0.9 e-i	0.2 mn	0.0 m
+Spectro 90	3.0 oz.								
Secure Action	0.5 fl.oz.	14-d	ACIKMO	0.0 d	0.8 d	3.3 cd	3.2 def	8.9 cde	15.3 e-h
-Ascernity	1.0 fl.oz.		EG						
Secure Action	0.5 fl.oz.	14-d	ACIKMO	0.3 bcd	0.0 d	0.3 d	1.1 e-i	4.2 e-j	8.1 g-j
-Posterity XT	1.5 fl.oz.		EG						
Secure Action	0.5 fl.oz.	14-d	ACIKMO	0.0 d	0.0 d	0.0 d	0.4 ghi	2.9 f-k	6.0 ij
-Posterity Forte	0.64 fl.oz.		EG						
Secure Action	0.5 fl.oz.	14-d	ACIKMO	0.0 d	0.0 d	0.5 d	0.7 e-i	4.6 e-i	7.6 g-j
-EXP B	0.21 fl.oz.		EG						
Secure Action	0.5 fl.oz.	14-d	CGKMO	0.0 d	0.0 d	0.5 d	0.0 i	1.2 j-n	2.4 kl
-Posterity Forte	0.16 fl.oz.		AI						
-Daconil Action	1.6 fl.oz.		AE						
-Posterity XT	1.5 fl.oz.		E						
-Ascernity	1.0 fl.oz.		I						
Secure Action	0.5 fl.oz.	14-d	CGKMO	0.0 d	0.0 d	0.8 d	0.7 e-i	3.0 f-k	10.1 f-i
-Posterity	0.63 fl.oz.		A						
-Daconil Action	1.6 fl.oz.		AEIM						
-Posterity XT	1.5 fl.oz.		E						
-Ascernity	1.0 fl.oz.		I						
EXP C	1.18 fl.oz.	14-d	ACEGIKMO	0.0 d	0.3 d	0.8 d	2.0 e-h	6.2 d-h	16.2 d-g
EXP C	1.62 fl.oz.	14-d	ACEGIKMO	0.0 d	0.0 d	0.0 d	0.0 i	3.2 e-k	8.2 g-j
Pinpoint	0.17 fl.oz.	14-d	ACEGIKMO	0.0 d	6.3 bc	9.8 b	15.5 b	17.0 bc	22.0 cde
Tekken	3.0 fl.oz.	21-d	ADGJM	0.0 d	0.3 d	0.5 d	0.6 f-i	5.1 e-i	20.8 def
Posterity XT	1.5 fl.oz.	14-d	ACEGIKMO	0.0 d	0.0 d	0.5 d	0.8 e-i	2.7 g-k	3.7 jk
Posterity XT	2.25 fl.oz.	21-d	ADGJM	0.0 d	0.0 d	0.0 d	0.0 i	2.1 h-l	7.1 hij
Posterity XT	3.0 fl.oz.	28-d	AEIM	0.0 d	0.8 d	2.3 d	3.5 cde	6.3 d-h	15.5 e-h
Posterity Forte	0.64 fl.oz.	21-d	ADGJM	0.3 bcd	0.8 d	1.5 d	1.6 e-i	7.4 c-g	8.5 g-j
Untreated				29.2 a	44.0 a	66.5 a	82.7 a	140.1 a	195.1 a
ANOVA: Treatment (P > F)				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Days after treatment			14-d	10	2	10	3	8	3
			21-d	2	8	16	3	8	16
			28-d	10	16	24	3	8	16

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9504E flat fan nozzle calibrated to deliver 1 gal 1000-ft⁻² at 40 psi.
[y]Treatment application dates were as follows: A=2 June; C=16 June; D=23 June; E=30 June; G=14 July; I=28 July; J=5 August; K=11 August; M=25 August; O=8 September
[x]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

Table 2a. Effect of various fungicides on turf quality on a creeping bentgrass fairway turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft²	Int	Application Codes[y]	Turf Quality 5 Jun	12 Jun	19 Jun	26 Jun	2 Jul	16 Jul	31 Jul
				---- 0-9; 6=min acceptable ----						
Maxtima	0.2 fl.oz.	14-d	ACEGIKMO	6.5 -	6.8 -	7.0 -	8.3 -	7.3 ab[x]	8.0 ab	8.0 abc
Maxtima	0.4 fl.oz.	21-d	ADGJM	5.8 -	6.5 -	6.5 -	7.8 -	7.3 ab	8.0 ab	7.5 b-e
Maxtima	0.4 fl.oz.	28-d	AEIM	5.5 -	6.3 -	6.3 -	8.0 -	6.3 d	7.5 a-d	7.3 cde
Rayora	1.4 fl.oz.	21-d	ADGJM	5.8 -	6.8 -	6.8 -	7.3 -	6.3 d	8.0 ab	8.0 abc
Xzemplar	0.26 fl.oz.	21-d	ADGJM	6.3 -	6.8 -	7.0 -	8.0 -	7.3 ab	7.8 abc	8.5 a
Encartis	4.0 fl.oz.	21-d	ADGJM	6.0 -	7.0 -	7.0 -	8.0 -	7.3 ab	8.0 ab	8.0 abc
Emerald	0.18 oz.	21-d	ADGJM	6.3 -	6.5 -	7.0 -	8.0 -	7.5 a	7.8 abc	8.0 abc
Daconil Weatherstik	4.0 fl.oz.	14-d	ACEGIKMO	6.0 -	6.8 -	6.8 -	7.8 -	6.8 bcd	8.0 ab	7.0 de
Emerald	0.18 oz.	21-d	ADGJM	6.3 -	6.5 -	7.0 -	8.0 -	7.3 ab	7.0 cd	7.8 a-d
+Civitas One	8.5 fl.oz.									
Navicon	0.85 fl.oz.	21-d	ADGJM	6.0 -	6.5 -	7.3 -	8.3 -	7.5 a	8.3 a	8.0 abc
Pinpoint	0.28 fl.oz.	14-d	ACEGIKMO	6.5 -	6.8 -	7.0 -	8.0 -	7.0 abc	8.3 a	8.0 abc
Tourney	0.28 oz.	14-d	ACEGIKMO	5.5 -	6.3 -	6.3 -	8.0 -	6.3 d	7.5 a-d	7.8 a-d
Pinpoint	0.28 fl.oz.	14-d	ACEGIKMO	5.5 -	6.5 -	7.0 -	8.0 -	7.5 a	7.8 abc	8.3 ab
+Tourney	0.28 oz.									
Xzemplar	0.26 fl.oz.	14-d	ACEGIKMO	6.0 -	6.5 -	7.0 -	7.8 -	7.3 ab	8.0 ab	8.0 abc
EXP A	0.203 fl.oz.	21-d	ADGJM	5.8 -	7.0 -	7.0 -	7.8 -	7.5 a	8.0 ab	8.5 a
+Spectro 90	3.0 oz.									
Secure Action	0.5 fl.oz.	14-d	ACIKMO	6.0 -	6.8 -	7.0 -	8.0 -	7.0 abc	8.0 ab	7.8 a-d
-Ascernity	1.0 fl.oz.		EG							
Secure Action	0.5 fl.oz.	14-d	ACIKMO	6.0 -	6.3 -	6.3 -	7.8 -	7.0 abc	8.0 ab	7.5 b-e
-Posterity XT	1.5 fl.oz.		EG							
Secure Action	0.5 fl.oz.	14-d	ACIKMO	5.8 -	6.3 -	6.8 -	8.0 -	6.8 bcd	8.0 ab	7.5 b-e
-Posterity Forte	0.64 fl.oz.		EG							
Secure Action	0.5 fl.oz.	14-d	ACIKMO	5.8 -	6.5 -	6.5 -	8.0 -	7.0 abc	8.0 ab	7.5 b-e
-EXP B	0.21 fl.oz.		EG							
Secure Action	0.5 fl.oz.	14-d	CGKMO	6.0 -	6.3 -	6.8 -	7.5 -	7.0 abc	7.5 a-d	7.5 b-e
-Posterity Forte	0.16 fl.oz.		AI							
-Daconil Action	1.6 fl.oz.		AE							
-Posterity XT	1.5 fl.oz.		E							
-Ascernity	1.0 fl.oz.		I							
Secure Action	0.5 fl.oz.	14-d	CGKMO	6.0 -	6.5 -	6.5 -	8.0 -	7.0 abc	7.8 abc	6.8 e
-Posterity	0.63 fl.oz.		A							
-Daconil Action	1.6 fl.oz.		AEIM							
-Posterity XT	1.5 fl.oz.		E							
-Ascernity	1.0 fl.oz.		I							
EXP C	1.18 fl.oz.	14-d	ACEGIKMO	6.5 -	6.3 -	6.5 -	8.0 -	6.5 cd	7.5 a-d	8.0 abc
EXP C	1.62 fl.oz.	14-d	ACEGIKMO	5.8 -	6.8 -	6.8 -	8.0 -	6.5 cd	7.8 abc	7.5 b-e
Pinpoint	0.17 fl.oz.	14-d	ACEGIKMO	5.5 -	6.8 -	7.0 -	8.0 -	6.5 cd	7.8 abc	6.8 e
Tekken	3.0 fl.oz.	21-d	ADGJM	5.5 -	6.8 -	6.5 -	7.5 -	7.0 abc	7.3 bcd	7.8 a-d
Posterity XT	1.5 fl.oz.	14-d	ACEGIKMO	5.8 -	6.0 -	6.5 -	8.0 -	6.5 cd	8.3 a	7.8 a-d
Posterity XT	2.25 fl.oz.	21-d	ADGJM	6.5 -	6.8 -	6.8 -	8.0 -	6.5 cd	8.3 a	8.0 abc
Posterity XT	3.0 fl.oz.	28-d	AEIM	5.5 -	6.5 -	6.8 -	8.0 -	6.8 bcd	8.3 a	7.8 a-d
Posterity Forte	0.64 fl.oz.	21-d	ADGJM	6.0 -	7.0 -	7.3 -	8.0 -	7.0 abc	8.3 a	8.0 abc
Untreated				6.3 -	6.8 -	6.8 -	7.3 -	5.3 e	6.8 d	4.8 f
ANOVA: Treatment (P > F)				0.3318	0.7123	0.3590	0.0739	0.0001	0.0179	0.0001
Days after treatment			14-d	3	13	3	10	2	2	3
			21-d	3	13	16	3	9	2	17
			28-d	3	13	16	24	2	16	3

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9504E flat fan nozzle calibrated to deliver 1 gal 1000-ft^{-2} at 40 psi.

[y]Treatment application dates were as follows: A=2 June; C=16 June; D=23 June; E=30 June; G=14 July; I=28 July; J=5 August; K=11 August; M=25 August; O=8 September

[x]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

UCONN TURFGRASS

Table 2b. Effect of various fungicides on turf quality on a creeping bentgrass fairway turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft^2	Int	Application Codes[y]	Turf Quality 13 Aug	21 Aug	3 Sept	11 Sept
				------------ 0-9; 6=min acceptable -----------			
Maxtima	0.2 fl.oz.	14-d	ACEGIKMO	8.0 a-d[x]	8.0 a-d	8.0 a-d	7.7 b-f
Maxtima	0.4 fl.oz.	21-d	ADGJM	7.8 bcd	7.5 cd	7.8 b-e	6.7 f-k
Maxtima	0.4 fl.oz.	28-d	AEIM	7.5 cde	6.5 ef	7.3 def	6.2 i-l
Rayora	1.4 fl.oz.	21-d	ADGJM	8.0 a-d	7.3 de	7.0 ef	4.5 m
Xzemplar	0.26 fl.oz.	21-d	ADGJM	8.5 ab	8.0 a-d	8.3 abc	9.0 a
Encartis	4.0 fl.oz.	21-d	ADGJM	8.0 a-d	8.5 ab	8.5 ab	8.5 abc
Emerald	0.18 oz.	21-d	ADGJM	8.0 a-d	8.0 a-d	8.3 abc	8.2 a-d
Daconil Weatherstik	4.0 fl.oz.	14-d	ACEGIKMO	7.3 de	6.3 f	5.5 g	4.4 m
Emerald	0.18 oz.	21-d	ADGJM	7.8 bcd	8.0 a-d	8.5 ab	8.5 abc
+Civitas One	8.5 fl.oz.						
Navicon	0.85 fl.oz.	21-d	ADGJM	8.0 a-d	8.0 a-d	8.5 ab	7.5 c-g
Pinpoint	0.28 fl.oz.	14-d	ACEGIKMO	8.0 a-d	8.5 ab	7.0 ef	6.2 h-l
Tourney	0.28 oz.	14-d	ACEGIKMO	8.0 a-d	8.0 a-d	6.5 f	5.4 l
Pinpoint	0.28 fl.oz.	14-d	ACEGIKMO	8.3 abc	8.5 ab	7.8 b-e	6.5 g-k
+Tourney	0.28 oz.						
Xzemplar	0.26 fl.oz.	14-d	ACEGIKMO	8.5 ab	8.3 abc	8.5 ab	9.0 a
EXP A	0.203 fl.oz.	21-d	ADGJM	8.8 a	8.8 a	8.8 a	8.7 ab
+Spectro 90	3.0 oz.						
Secure Action	0.5 fl.oz.	14-d	ACIKMO	7.8 bcd	7.3 de	7.0 ef	6.5 g-k
-Ascernity	1.0 fl.oz.		EG				
Secure Action	0.5 fl.oz.	14-d	ACIKMO	7.5 cde	8.0 a-d	7.5 cde	7.5 c-g
-Posterity XT	1.5 fl.oz.		EG				
Secure Action	0.5 fl.oz.	14-d	ACIKMO	7.8 bcd	8.5 ab	7.8 b-e	7.2 d-i
-Posterity Forte	0.64 fl.oz.		EG				
Secure Action	0.5 fl.oz.	14-d	ACIKMO	7.8 bcd	7.8 bcd	7.8 b-e	8.0 a-e
-EXP B	0.21 fl.oz.		EG				
Secure Action	0.5 fl.oz.	14-d	CGKMO	7.3 de	7.3 de	8.0 a-d	8.2 a-d
-Posterity Forte	0.16 fl.oz.		AI				
-Daconil Action	1.6 fl.oz.		AE				
-Posterity XT	1.5 fl.oz.		E				
-Ascernity	1.0 fl.oz.		I				
Secure Action	0.5 fl.oz.	14-d	CGKMO	7.3 de	7.3 de	7.5 cde	7.2 d-h
-Posterity	0.63 fl.oz.		A				
-Daconil Action	1.6 fl.oz.		AEIM				
-Posterity XT	1.5 fl.oz.		E				
-Ascernity	1.0 fl.oz.		I				
EXP C	1.18 fl.oz.	14-d	ACEGIKMO	8.3 abc	8.3 abc	7.5 cde	6.5 g-k
EXP C	1.62 fl.oz.	14-d	ACEGIKMO	7.3 de	7.5 cd	7.5 cde	6.9 e-j
Pinpoint	0.17 fl.oz.	14-d	ACEGIKMO	6.8 e	6.5 ef	6.5 f	6.0 jkl
Tekken	3.0 fl.oz.	21-d	ADGJM	7.5 cde	7.8 bcd	7.3 def	5.7 kl
Posterity XT	1.5 fl.oz.	14-d	ACEGIKMO	8.0 a-d	8.3 abc	7.8 b-e	8.0 a-e
Posterity XT	2.25 fl.oz.	21-d	ADGJM	8.0 a-d	8.0 a-d	8.0 a-d	8.0 a-e
Posterity XT	3.0 fl.oz.	28-d	AEIM	7.8 bcd	7.5 cd	7.3 def	6.7 f-k
Posterity Forte	0.64 fl.oz.	21-d	ADGJM	7.8 bcd	7.8 bcd	7.3 def	7.2 d-i
Untreated				4.5 f	4.0 g	3.0 h	1.7 n
ANOVA: Treatment (P > F)				0.0001	0.0001	0.0001	0.0001
Days after treatment			14-d	2	10	8	3
			21-d	8	16	8	16
			28-d	16	24	8	16

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9504E flat fan nozzle calibrated to deliver 1 gal 1000-ft^{-2} at 40 psi.
[y]Treatment application dates were as follows: A=2 June; C=16 June; D=23 June; E=30 June; G=14 July; I=28 July; J=5 August; K=11 August; M=25 August; O=8 September
[x]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

Table 3. Effect of various fungicides on phytotoxicity on a creeping bentgrass fairway turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft^2	Int	Application Codes[y]	Phytotoxicity 12 Jun	19 Jun	26 Jun	16 Jul	13 Aug	3 Sept
				------------------- 0-5; 2=max acceptable					-------------
Maxtima	0.2 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Maxtima	0.4 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Maxtima	0.4 fl.oz.	28-d	AEIM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Rayora	1.4 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Xzemplar	0.26 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Encartis	4.0 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Emerald	0.18 oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Daconil Weatherstik	4.0 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Emerald	0.18 oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
+Civitas One	8.5 fl.oz.								
Navicon	0.85 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Pinpoint	0.28 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Tourney	0.28 oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Pinpoint	0.28 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
+Tourney	0.28 oz.								
Xzemplar	0.26 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP A	0.203 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
+Spectro 90	3.0 oz.								
Secure Action	0.5 fl.oz.	14-d	ACIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
-Ascernity	1.0 fl.oz.		EG						
Secure Action	0.5 fl.oz.	14-d	ACIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
-Posterity XT	1.5 fl.oz.		EG						
Secure Action	0.5 fl.oz.	14-d	ACIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
-Posterity Forte	0.64 fl.oz.		EG						
Secure Action	0.5 fl.oz.	14-d	ACIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
-EXP B	0.21 fl.oz.		EG						
Secure Action	0.5 fl.oz.	14-d	CGKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
-Posterity Forte	0.16 fl.oz.		AI						
-Daconil Action	1.6 fl.oz.		AE						
-Posterity XT	1.5 fl.oz.		E						
-Ascernity	1.0 fl.oz.		I						
Secure Action	0.5 fl.oz.	14-d	CGKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
-Posterity	0.63 fl.oz.		A						
-Daconil Action	1.6 fl.oz.		AEIM						
-Posterity XT	1.5 fl.oz.		E						
-Ascernity	1.0 fl.oz.		I						
EXP C	1.18 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP C	1.62 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Pinpoint	0.17 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Tekken	3.0 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Posterity XT	1.5 fl.oz.	14-d	ACEGIKMO	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Posterity XT	2.25 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Posterity XT	3.0 fl.oz.	28-d	AEIM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Posterity Forte	0.64 fl.oz.	21-d	ADGJM	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Untreated				0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
ANOVA: Treatment (P > F)				1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Days after treatment			14-d	10	2	10	3	8	3
			21-d	2	8	16	3	8	16
			28-d	10	16	24	3	8	16

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9504E flat fan nozzle calibrated to deliver 1 gal 1000-ft^{-2} at 40 psi.
[y]Treatment application dates were as follows: A=2 June; C=16 June; D=23 June; E=30 June; G=14 July; I=28 July; J=5 August; K=11 August; M=25 August; O=8 September

PREVENTIVE DOLLAR SPOT CONTROL WITH VARIOUS FUNGICIDES ON A CREEPING BENTGRASS PUTTING GREEN TURF, 2020

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INTRODUCTION

Dollar spot is a common disease of cool-season turfgrasses caused by the fungal pathogen *Clarireedia jacksonii*. On golf course fairways it is characterized by light, straw-colored spots that may coalesce into larger irregularly shaped areas. It is particularly active during periods of warm daytime temperatures (80°F), cool nighttime temperatures (60°F), and high humidity. It can be managed in part with cultural practices such as maintaining moderate nitrogen fertility, reducing leaf wetness period. However, the use of fungicides is often still necessary on high priority areas such as greens, tees and fairways. The objective of this study was to evaluate the efficacy of new and existing fungicides in controlling dollar spot on a creeping bentgrass putting green turf.

MATERIALS & METHODS

A field study was conducted on a 'Penn A-4' creeping bentgrass (*Agrostis stolonifera*) turf grown on a Paxton fine sandy loam at the Plant Science Research and Education Facility in Storrs, CT. Turf was mowed five days wk^{-1} at a bench setting of 0.125-inches. Nitrogen was applied at a total of 1.1 lb N 1000-ft^{-2} as water soluble sources from April through August. A wetting agent (Revolution, 3 fl.oz.) was applied every 14-d beginning on 11 May. Overhead irrigation was applied as needed to prevent drought stress. Daconil Ultrex (3.25 oz) was applied on 20 May to prevent dollar spot development in the trial area before treatments were initiated due to research delays associated with the COVID-19 pandemic. Primo Maxx (0.125 fl.oz.) was applied to the entire study area beginning on 14 May and was reapplied on a 200 GDD basis.

Treatments consisted of new fungicide formulations and currently available products applied individually, as tank mixes, and/or in rotational program. Initial applications were made on 2 June, prior to disease developing in the trial area. Subsequent applications were made every 14-d through 7 August. All treatments were applied using a hand held CO_2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2.0 gal 1000-ft^{-2} at 40 psi. Plots measured 3 x 6 ft and were arranged in a randomized complete block design with four replications.

Dollar spot and copper spot incidence were assessed as a count of individual disease foci within each plot. Brown patch was assessed as a percentage of plot area blighted by disease Turf quality was visually assessed on a 1 to 9 scale; where 9 represented the best quality turf and 6 was the minimum acceptable level. Phytotoxicity was also assessed visually where 0 was equal to no discoloration and 2 represented the maximum acceptable level. All data were subjected to an analysis of variance and means were separated using Fisher's protected least significant difference test.

RESULTS AND DISCUSSION

Dollar Spot Incidence

Dollar spot symptoms first manifested on 26 June (Table 1), with untreated control (UTC) plots averaging 2.6 dollar spot infection centers (DSIC) plot^{-1}. Moderate disease pressure persisted for the remainder of the trial, with UTC plots averaging 17.8 DSIC plot^{-1} on 2 July, 23.0 DSIC plot^{-1} on 16 July, 26.6 DSIC plot^{-1} on 21 July, and 33.8 DSIC plot^{-1} at the conclusion of the trial on 13 August.

All treated plots showed acceptable control (<15 DSIC plot^{-1}) of dollar spot for the entirety of the trial. Lexicon Instrinsic, EXP A, and EXP A + Spectro 90 all provided excellent control (<3 DSIC plot^{-1}) on all rating dates. Pinpoint (0.28 fl.oz.) provided excellent control through 16 July, after which dollar spot increased somewhat to 10 DSIC-1 on 24 July, and peaked at 14 DSIC^{-1} on 7 August. When tank-mixed with Spectro 90, Pinpoint provided good (<10 DSIC plot^{-1}) for the entire trial.

Traction (1.3 fl.oz.) was applied with and without the addition of aluminum sulfate (2.0 oz.). There were no differences in dollar spot control between these two treatments at any point during the trial.

Copper Spot and Brown Patch

A natural outbreak of Copper spot (Table 3) (*Gloeocercospora sorghi*) occurred in early July, with UTC plots peaking at 131 copper spot infection centers (CSIC) plot^{-1} on 9 July. While most treated plots were free of disease, EXP A plots were not distinguishable from UTC plots as of this date. EXP A + Spectro 90 treated plots were disease-free.

Brown patch (*Rhizoctonia solani*) was also present within the trial area (Table 4). Untreated plots were ~30% blighted by brown patch as of 9 July. All treated plots provided some control of disease, with Lexicon, EXP A + Spectro 90, Traction, and Traction + Ammonium sulfate all providing complete control of disease throughout the trial.

Turf Quality and Phytotoxicity

No phytotoxicity (Table 5) was observed at any point during the trial, so turf quality (Table 2) was primarily influenced by disease incidence. Most treatments yielded acceptable quality (1-9, 6=min acceptable) at all rating dates. The severe copper spot outbreak on 9 July contributed to EXP A having unacceptable turf quality on this date, as did the presence of dollar spot and brown patch on plots treated with Pinpoint alone. As of 31 July, plots treated with Lexicon, EXP A + Spectro 90, and Pinpoint + Spectro 90 had particularly high turf quality.

Table 1. Effect of various fungicides on preventive dollar spot control on a creeping bentgrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

			Dollar Spot Incidence								
Treatment[z]	Rate per $1000ft^2$	Int[y]	19 Jun	26 Jun	2 Jul	9 Jul	16 Jul	24 Jul	31 Jul	7 Aug	13 Aug
			# of foci 18^{-2}								
Lexicon	0.47 fl.oz.	14-d	0.0 -	0.0 b[x]	1.3 b	0.5 b	0.5 c	1.9 c	1.6 cde	2.3 cd	1.3 bc
EXP A	0.16 fl.oz.	14-d	0.0 -	0.0 b	0.5 b	0.0 b	0.5 c	0.2 cd	0.2 de	0.3 de	1.8 bc
EXP A +Spectro 90	1.2 fl.oz. 3.0 oz.	14-d	0.0 -	0.0 b	0.5 b	0.0 b	0.0 c	0.0 d	0.0 e	0.0 e	0.0 c
Pinpoint	0.28 fl.oz.	14-d	0.0 -	0.0 b	1.8 b	2.3 b	2.5 b	10.0 b	12.4 b	14.0 b	5.6 b
Spectro 90 +Pinpoint	3.0 oz. 0.28 fl.oz.	14-d	0.0 -	0.1 b	0.8 b	0.3 b	0.4 c	1.8 c	2.2 cde	5.2 c	0.9 c
Traction	1.3 fl.oz.	14-d	0.0 -	0.0 b	0.0 b	0.0 b	0.0 c	1.4 cd	3.1 cd	3.8 c	0.2 c
Traction +Ammonium Sulfate	1.3 fl.oz. 2.0 oz.	14-d	0.0 -	0.0 b	0.3 b	0.0 b	0.2 c	1.4 cd	4.7 c	5.1 c	0.9 c
Untreated			0.0 -	2.6 a	17.8 a	18.8 a	23.0 a	28.1 a	26.6 a	28.8 a	33.8 a
ANOVA: Treatment (P > F)			1.0000	0.0007	0.0310	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Days after treatment		14-d	3	4	2	9	2	10	3	10	2

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal $1000\text{-}ft^{-2}$ at 40 psi.
[y]Treatments were initiated on 2 June and repeated every 14-d as follows: 16 June; 30 June; 14 July; 28 July; 11 August
[x]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

Table 2. Effect of various fungicides on turf quality on a creeping bentgrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

			Turf Quality									
Treatment[z]	Rate per $1000ft^2$	Int[y]	5 Jun	12 Jun	19 Jun	26 Jun	2 Jul	9 Jul	16 Jul	24 Jul	31 Jul	13 Aug
			1-9; 6=min acceptable									
Lexicon	0.47 fl.oz.	14-d	6.0 -	6.8 -	6.8 -	7.0 b[x]	6.8 ab	6.8 ab	6.8 a	6.5 ab	8.0 ab	6.0 ab
EXP A	0.16 fl.oz.	14-d	6.3 -	6.3 -	7.0 -	7.0 b	6.3 b	4.0 c	6.8 a	7.3 ab	7.5 bc	6.3 ab
EXP A +Spectro 90	1.2 fl.oz. 3.0 oz.	14-d	6.3 -	6.5 -	7.3 -	8.0 a	7.3 a	6.8 ab	7.0 a	7.5 a	8.5 a	7.0 a
Pinpoint	0.28 fl.oz.	14-d	6.3 -	6.5 -	6.8 -	7.3 b	6.5 ab	5.8 b	6.3 a	5.3 cd	5.8 d	5.8 b
Spectro 90 +Pinpoint	3.0 oz. 0.28 fl.oz.	14-d	6.8 -	6.8 -	7.3 -	8.0 a	7.0 ab	6.0 ab	7.0 a	7.0 ab	8.5 a	6.3 ab
Traction	1.3 fl.oz.	14-d	6.3 -	6.8 -	7.3 -	7.5 ab	7.0 ab	7.0 a	7.3 a	6.8 ab	7.3 bc	6.8 ab
Traction +Ammonium Sulfate	1.3 fl.oz. 2.0 oz.	14-d	6.5 -	6.8 -	7.3 -	8.0 a	7.0 ab	7.0 a	7.3 a	6.3 bc	6.8 c	6.5 ab
Untreated			7.0 -	7.0 -	7.3 -	7.3 b	5.0 c	2.8 d	4.3 b	4.5 d	5.0 d	3.8 c
ANOVA: Treatment (P > F)			0.5407	0.6367	0.4218	0.0073	0.0025	0.0001	0.0001	0.0001	0.0001	0.0001
Days after treatment		14-d	3	10	3	10	2	11	2	10	3	2

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal $1000\text{-}ft^{-2}$ at 40 psi.
[y]Treatments were initiated on 2 June and repeated every 14-d as follows: 16 June; 30 June; 14 July; 28 July; 11 August
[x]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

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Table 3. Effect of various fungicides on copper spot incidence on a creeping bentgrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft²	Int[y]	Copper Spot 2 Jul	Copper Spot 9 Jul
			----# of foci 18ft⁻²----	
Lexicon	0.47 fl.oz.	14-d	0.0 b[x]	0.0 b
EXP A	0.16 fl.oz.	14-d	48.5 ab	75.0 a
EXP A	1.2 fl.oz.	14-d	0.0 b	0.0 b
+Spectro 90	3.0 oz.			
Pinpoint	0.28 fl.oz.	14-d	0.0 b	0.3 b
Spectro 90	3.0 oz.	14-d	0.0 b	0.3 b
+Pinpoint	0.28 fl.oz.			
Traction	1.3 fl.oz.	14-d	0.0 b	0.0 b
Traction	1.3 fl.oz.	14-d	0.0 b	0.0 b
+Ammonium Sulfate	2.0 oz.			
Untreated			98.8 a	131.0 a
ANOVA: Treatment (P > F)			0.0310	0.0015
Days after treatment		14-d	2	9

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft $^{-2}$ at 40 psi.
[y]Treatments were initiated on 2 June and repeated every 14-d as follows: 16 June; 30 June; 14 July; 28 July; 11 August
[x]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

Table 4. Effect of various fungicides on brown patch incidence on a creeping bentgrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft²	Int[y]	Brown Patch 9 Jul	Brown Patch 13 Aug
			---% plot area blighted---	
Lexicon	0.47 fl.oz.	14-d	0.0 b[x]	0.0 b
EXP A	0.16 fl.oz.	14-d	6.5 b	1.0 b
EXP A	1.2 fl.oz.	14-d	0.0 b	0.0 b
+Spectro 90	3.0 oz.			
Pinpoint	0.28 fl.oz.	14-d	4.0 b	0.0 b
Spectro 90	3.0 oz.	14-d	3.3 b	0.0 b
+Pinpoint	0.28 fl.oz.			
Traction	1.3 fl.oz.	14-d	0.0 b	0.0 b
Traction	1.3 fl.oz.	14-d	0.0 b	0.0 b
+Ammonium Sulfate	2.0 oz.			
Untreated			28.8 a	12.1 a
ANOVA: Treatment (P > F)			0.0001	0.0024
Days after treatment		14-d	9	2

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft $^{-2}$ at 40 psi.
[y]Treatments were initiated on 2 June and repeated every 14-d as follows: 16 June; 30 June; 14 July; 28 July; 11 August
[x]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

Table 5. Effect of various fungicides on phytotoxicty on a creeping bentgrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per $1000ft^2$	Int[y]	Phytotoxicity						
			12 Jun	19 Jun	26 Jun	2 Jul	9 Jul	16 Jul	31 Jul
			------------------------- 0-5; 2=max acceptable ---------------------						
Lexicon	0.47 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP A	0.16 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP A	1.2 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
+Spectro 90	3.0 oz.								
Pinpoint	0.28 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Spectro 90	3.0 oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
+Pinpoint	0.28 fl.oz.								
Traction	1.3 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Traction	1.3 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
+Ammonium Sulfate	2.0 oz.								
Untreated			0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
ANOVA: Treatment (P > F)			1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Days after treatment		14-d	10	3	10	2	11	2	3

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft^{-2} at 40 psi.
[y]Treatments were initiated on 2 June and repeated every 14-d as follows: 16 June; 30 June; 14 July; 28 July; 11 August

PREVENTIVE BROWN PATCH CONTROL WITH FUNGICIDES AND BIOFUNGICIDES ON A CREEPING BENTGRASS PUTTING GREEN TURF, 2020

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INTRODUCTION

Brown patch, caused by *Rhizoctonia solani* is characterized by round patches of diffusely-blighted, thinned turf. It is a summer disease that is most active under warm (nighttime temps ≥ 65° F) and humid conditions. It is commonly controlled using cultural practices such as avoiding excess nitrogen and improving air movement, as well as through the use of preventative fungicides. The objective of this study was to evaluate the effectiveness of new and existing fungicides at controlling brown patch in a creeping bentgrass putting green turf.

MATERIALS & METHODS

A field study was conducted on a 'Penn A-4' creeping bentgrass (*Agrostis stolonifera*) turf grown on a Paxton fine sandy loam at the Plant Science Research and Education Facility in Storrs, CT. Turf was mowed five days wk^{-1} at a bench setting of 0.125-inches. Nitrogen was applied at a total of 1.1 lb N $1000\text{-}ft^{-2}$ as water soluble sources from April through August. A wetting agent (Revolution, 3 fl.oz.) was applied every 14-d beginning on 11 May. Overhead irrigation was applied as needed to prevent drought stress. Primo Maxx (0.125 fl.oz.) was applied to the entire study area beginning on 14 May and was reapplied every 200 GDD (base 0°C).

Treatments consisted of fungicides and biofungicides applied individually, or as tank mixes. Initial applications were made on 10 June prior to disease developing in the trial area. Subsequent applications were made every 7 or 14-d through 5 August. All treatments were applied using a hand held CO_2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2.0 gal $1000\text{-}ft^{-2}$ at 40 psi. Plots measured 3 x 6 ft and were arranged in a randomized complete block design with four replications.

Brown patch was assessed visually as a percentage of the plot area blighted by *Rhizoctonia solani*. Dollar spot was assessed as a count of individual disease foci within each plot. Turf quality was visually assessed on a 1 to 9 scale; where 9 represented the best quality turf and 6 was the minimum acceptable level. All data were subjected to an analysis of variance and means were separated using Fisher's protected least significant difference test.

RESULTS AND DISCUSSION

Brown Patch Incidence

Brown patch developed in the trial area beginning in early July (Table 1). Untreated control plots (UTC) averaged 6.5% plot area blighted on 9 July. Disease increased steadily thereafter, with UTC plots averaging 11.3% on 21 July, 22.5% on 7 August, and 34.3% at the end of the trial on 13 August.

Plots treated with EXP A (high and low rates), Briskway, Heritage Action, or EXP B were all disease-free or nearly disease free (<2% blighted) fot the entirety of the trial.

Zio, a biofungicide containing *Pseudomonas chlororaphis* AFS009, was applied every 7 and 14-d at 1.8 oz. $1000ft^{-2}$. While there were no significant treatment differences through 31 July, both Zio treatments showed some brown patch beginning in early July. Beginning on 7 August, both treatments provided an unacceptable level of control (>10% plot area blighted), and were indistinguishable from UTC plots.

Dollar Spot

Dollar spot developed in the trial area beginning in June (Table 3). As of 2 July, UTC plots averaged ~50 dollar spot infection centers (DSIC) $plot^{-1}$. EXP A (high-rate), Briskway, and EXP B all provided good dollar spot control. Heritage Action and Zio (7-d and 14-d interval) were indistinguishable from UTC plots, however the 7-d interval of Zio did provide better control compared to the 14-d interval, averaging 15 DSIC $plot^{-1}$ and 68.9 DSIC $plot^{-1}$, respectively.

Turf Quality and Phytotoxicity

There was no phytotoxicity observed on any of the rating dates (Table 4). Turf quality (Table 2) was therefore primarily influenced by disease incidence. On 31 July, EXP A (both rates), Briskway, Heritage Action, and EXP B all provided particularly high turf quality. Zio-treated and UTC plots remained acceptable as of this date (1-9; 6-min acceptable), however quality dropped on all treatments as disease pressure increased, with Zio-treated plots showing unacceptable turf quality (3.8), and were indistinguishable from UTC plots.

Table 1. Effect of various fungicides on preventive brown patch control on a creeping bentgrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft^2	Int[y]	Brown Patch Incidence 19 Jun	26 Jun	2 Jul	9 Jul	16 Jul	24 Jul	31 Jul	7 Aug	13 Aug
			---- % plot area blighted ----								
EXP A	1.44 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 b[x]	1.4 b
EXP A	2.87 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 b	0.6 b
Briskway	1.2 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 b	0.0 b
Heritage Action	0.2 oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 b	0.6 b
EXP B	0.85 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 b	0.0 b
Zio	1.8 oz.	7-d	0.0 -	0.0 -	0.0 -	2.0 -	6.3 -	11.8 -	19.3 -	15.3 a	19.4 a
Zio	1.8 oz.	14-d	0.0 -	0.0 -	1.3 -	6.5 -	8.5 -	8.0 -	5.3 -	11.6 a	14.8 a
Untreated			0.0 -	0.0 -	0.0 -	6.5 -	6.3 -	9.8 -	11.3 -	22.5 a	34.3 a
ANOVA: Treatment (P > F)			1.0000	1.0000	0.4586	0.3108	0.3040	0.2280	0.1235	0.0051	0.0001
Days after treatment		7-d	2	2	1	1	1	1	2	2	8
		14-d	9	2	8	1	7	1	7	2	8

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft^{-2} at 40 psi.
[y]Treatments were initiated on 10 June and repeated every (7) or 14-d as follows: (17 June); 24 June; (1 July); 8 July; (15 July); 23 July; (29 July); 5 August
[x]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

Table 2. Effect of various fungicides on turf quality on a creeping bentgrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft^2	Int[y]	Turf Quality 26 Jun	2 Jul	9 Jul	16 Jul	24 Jul	31 Jul	13 Aug
			---- 1-9; 6=min acceptable ----						
EXP A	1.44 fl.oz.	14-d	8.0 -	7.3 -	7.0 -	7.5 -	8.0 a[x]	8.0 ab	6.3 a
EXP A	2.87 fl.oz.	14-d	8.0 -	7.3 -	7.3 -	7.5 -	7.8 a	8.5 a	6.8 a
Briskway	1.2 fl.oz.	14-d	7.5 -	7.3 -	6.8 -	7.5 -	7.3 abc	8.3 a	7.0 a
Heritage Action	0.2 oz.	14-d	7.8 -	6.3 -	6.8 -	7.0 -	7.5 ab	7.8 ab	6.3 a
EXP B	0.85 fl.oz.	14-d	8.0 -	7.5 -	7.0 -	7.8 -	7.5 ab	8.0 ab	7.5 a
Zio	1.8 oz.	7-d	8.0 -	6.8 -	5.8 -	6.5 -	6.0 bcd	6.3 c	3.8 b
Zio	1.8 oz.	14-d	7.5 -	6.8 -	5.5 -	5.8 -	5.8 cd	6.8 bc	3.8 b
Untreated			7.5 -	7.0 -	5.8 -	6.0 -	5.3 d	6.0 c	3.0 b
ANOVA: Treatment (P > F)			0.7772	0.3184	0.1603	0.1276	0.0084	0.0051	0.0001
Days after treatment		7-d	2	1	1	1	1	2	8
		14-d	2	8	1	7	1	7	8

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft^{-2} at 40 psi.
[y]Treatments were initiated on 10 June and repeated every (7) or 14-d as follows: (17 June); 24 June; (1 July); 8 July; (15 July); 23 July; (29 July); 5 August
[x]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

Table 3. Effect of various fungicides on dollar spot incidence in a creeping bentgrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

Treatment[z]	Rate per 1000ft^2	Int[y]	Dollar Spot 26 Jun	2 Jul
			---- # of foci 18ft^{-2} ----	
EXP A	1.44 fl.oz.	14-d	12.3 abc[x]	5.2 cd
EXP A	2.87 fl.oz.	14-d	4.5 bc	1.4 de
Briskway	1.2 fl.oz.	14-d	1.0 c	0.2 e
Heritage Action	0.2 oz.	14-d	7.6 bc	23.3 ab
EXP B	0.85 fl.oz.	14-d	2.2 bc	1.1 de
Zio	1.8 oz.	7-d	16.7 ab	15.0 bc
Zio	1.8 oz.	14-d	31.7 a	68.9 a
Untreated			30.8 a	50.9 ab
ANOVA: Treatment (P > F)			0.0160	0.0001
Days after treatment		7-d	2	1
		14-d	2	8

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft^{-2} at 40 psi.
[y]Treatments were initiated on 10 June and repeated every (7) or 14-d as follows: (17 June); 24 June; (1 July); 8 July; (15 July); 23 July; (29 July); 5 August
[x]Means followed by the same letter, within each column, are not significantly different based on Fisher's protected least significant difference test (α = 0.05)

Table 4. Effect of various fungicides on phytotoxicity on a creeping bentgrass putting turf at the Plant Science Research and Education Facility in Storrs, CT during 2020.

			Phytotoxicity					
Treatment[z]	Rate per 1000ft²	Int	19 Jun	26 Jun	2 Jul	9 Jul	24 Jul	31 Jul
			--------------------- 0-5; 2=max acceptable ---------------------					
EXP A	1.44 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP A	2.87 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Briskway	1.2 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Heritage Action	0.2 oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
EXP B	0.85 fl.oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Zio	1.8 oz.	7-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Zio	1.8 oz.	14-d	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
Untreated			0.0 -	0.0 -	0.0 -	0.0 -	0.0 -	0.0 -
ANOVA: Treatment (P > F)			1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Days after treatment		7-d	2	1	1	1	1	2
		14-d	9	8	1	7	1	7

[z]All treatments were applied using a hand held CO2 powered spray boom outfitted with a single AI9508E flat fan nozzle calibrated to deliver 2 gal 1000-ft^{-2} at 40 psi.
[y]Treatments were initiated on 10 June and repeated every (7) or 14-d as follows: (17 June); 24 June; (1 July); 8 July; (15 July); 23 July; (29 July); 5 August

EFFECT OF TURF SPECIES, SEEDING RATE AND MOWING TIMING ON WEED POPULATIONS DURING AND POST TURFGRASS ESTABLISHMENT

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INTRODUCTION

The pressure to reduce/eliminate pesticide use on turfgrass areas continues to increase due to potential human exposure and concerns regarding subsequent negative health impacts. Conventional turfgrass management includes the use of different types of pesticides to control a variety of pests; such as herbicides (weeds), fungicides (diseases) and insecticides (insects). However, herbicides are one of the more commonly used products due to the prolific weed seed bank inherently in the soil and traffic associated with many turfgrass areas.

Cultural management of weeds in turfgrass is important because it can reduce the dependence on synthetic pesticides. Though synthetic pesticides have been shown to be very effective in managing weeds, concerns regarding their potential negative impact on human and environmental health have sparked legislative actions that severely restrict or ban their use in many areas. For example, Connecticut has banned the use of all EPA registered pesticides on the grounds of all public and private school's pre-K to 8th grade. The state of New York has a similar ban that extends through grade 12. EPA 25b products, or minimum risk pesticides, can be used in these areas, but are expensive, largely ineffective for selective weed control and/or require several follow up applications. Additionally, there is limited data on the efficacy of many of the products. For municipal turfgrass workers, these restrictions have resulted in considerable reduction in turfgrass quality and a sense of urgency to find alternative management methods.

Herbicides have been researched extensively and are widely popular to control both broadleaf and grassy weeds in turfgrass management. Chemical weed control has many factors that affect their efficacy including matching the appropriate active ingredient to the target weed species, maturity of a weed, and application rate/timing. Overall, when used correctly, herbicides are effective and minimally phytotoxic to a desirable turf.

Though many chemical control options are effective, the new laws and heightened health concerns have increased interest in alternative methods of weed control, particularly cultural methods.

Cultural practices are aimed at developing a dense turf stand to crowd out young weed seedlings, as weeds can only exist if there is space in the turfgrass canopy (Landschoot, 2006). Effective cultural practices include but are not limited to proper turfgrass species selection, proper mowing practices, adequate liming and fertilization, and irrigating effectively (Landschoot, 2006).

Turfgrass species selection could be one of the most important methods in minimizing weed colonization. A turfgrass species ability to establish quickly will reduce weed encroachment as the turf matures. Perennial ryegrass *(Lolium perenne)* has been shown to greatly reduce weed biomass compared to Kentucky bluegrass *(Poa pratensis)* during establishment (Par, 1985). In another study, tall fescue has been reported to have allelopathic effects on broadleaf weeds such as birdsfoot trefoil *(Lotus corniculatus)* and red clover *(Trifolium pratense)* (Peters & Mohammed Zam, 1981).

Proper mowing practices on established turfgrass areas have also been shown to influence weed populations. The turf industry has moved toward mowing at the high end of the recommended range for a species to limit the colonization of annual weeds. Generally, higher mowing heights have more impact on crabgrass cover than broadleaf weed populations (Dernoeden et al., 1993, Voigt et. al., 2001). Increased mowing height (8.9cm) was the best cultural strategy for reducing smooth crabgrass encroachment and maintaining tall fescue cover (Dernoeden et.al., 1993). In another study, out of seventeen different species of broadleaf weeds, only populations of dandelion *(Taraxacum officinale)* and white clover *(Trifolium repens)* resulted in greater populations at 3cm-5cm turf height compared to 7cm-10cm (Abu-Dieyeh, 2005).

Altering mowing height and mowing timing during establishment are other cultural options that could considerably enhance turfgrass density and reduce weed competitiveness. A study conducted to evaluate the effects of close mowing on the establishment and development of KBG/PRG mixes and monocultures indicated that monocultures of both species became denser when exposed to closer and earlier mowing treatments (Brede and Duich, 1984). In mixes of 95% KBG, greater shoot density was observed when the first mowing took place at two weeks from planting under a low height of cut compared to the first mowing taking place at five weeks from planting at a high height of cut (Brede and Duich, 1984). The opposite was true of PRG (Brede and Duich, 1984) Certain species may respond with greater vigor and density under low mowing during establishment. This cultural practice could provide turfgrasses a competitive advantage by shading out weed seedlings quickly.

Seeding rate has also been shown to influence the encroachment of undesirable species during the establishment phase of turfgrass swards. Higher seeding rates can result in higher shoot density up to almost four years after seeding. Regardless of species, as seeding rate increased, weed numbers decreased (Ayan et. al. 2017).

This research was designed to assess the impact of turfgrass species, seeding rate and mowing regime on weed populations during turfgrass establishment. The objectives were to determine the effects of turfgrass species, seeding rate and mowing height/timing on percent turfgrass cover, density and color, percent weed cover.

MATERIALS AND METHODS

This field study was conducted at the University of Connecticut Plant Science Research and Education Facility in Storrs CT (41° 47' 44.9268" N, 72° 13'46.8156" W). The study was arranged in a split-split plot design as a 2x2x4x2 factorial with three replications. The main plots were set out as a randomized complete block and each block size was 7.3m x 7.3m. Each block was split by herbicide that had two levels: herbicides used and no herbicides used. Each herbicide plot was split by mowing height and had two levels: mowed at 3.2cm (1.25in.) (M1) and mowed at 8.2cm (3.25in.) (M2). These mowing heights were maintained throughout the post-establishment phase. The sub-plot factor was turfgrass species randomized by seeding rate. Four turfgrass species were seeded as blends: fine fescue (FF) *(Festuca ovina and Festuca rubra),* perennial ryegrass (PRG) *(Lolium perenne),* Kentucky bluegrass (KBG) *(Poa pratensis)* and tall fescue (TF) (Festuca arundinacea). These were each seeded at the recommended rate and twice the recommended rate. Individual experimental plots were 1.8m x 1.8m. The blends and seeding rates were as follows: fine fescue blend (Viking H20 hard fescue 39.75%, Ambrose chewings fescue 29.99%, Shadow II chewings fescue 29.93%) was seeded at 279.7kg PLS ha^{-1} and 559.4kg PLS ha^{-1}. Perennial ryegrass blend (Fiesta 4 33.72%, Dasher 3 31.98%, Express II 31.94%) was seeded at 376.5kg PLS ha^{-1} and 753kg PLS ha^{-1}. Kentucky bluegrass blend (Shannon 30%, SPF30 Texas Hybrid 25%, Jumpstart 25%, Hampton 20%) was seeded at 118.3kg PLS ha^{-1} and 236.6kg PLS ha^{-1}. Tall fescue blend (Regenerate 33.78%, Reflection 33.09%, Maestro 32.76%) was seeded at 376.5kg PLS ha^{-1} and 753kg PLS ha^{-1}. Fifty seeds each of white clover *(Trifolium repens)*, buckhorn plantain *(Plantago lanceolata)* and dandelion *(Taraxacum officianale)* were distributed into each individual plot at the time of seeding.

The study was seeded on Sep 10, 2019 on a Paxton, fine sandy loam soil (coarse-loamy, mixed, active, mesic Oxyaquic Dystrudepts). Following seedbed preparations, turfgrass and weed seeds were mixed and then spread in each plot using a handheld shaker in two directions at 90° angles. Hand weasels were then used to lightly incorporate the seed into the soil 0.6cm to 1.2cm. Shaw's starter fertilizer (14-25-10) (Knox Fertilizer Co, Knox, IN) was applied at a rate of 49kg P_2O_5 ha^{-1} using a broadcast spreader.

A germination blanket (Covertan Pro 19, Suntex CP, Sarasota, FL) (85% light transmission) was placed over the entire research area and held in place with plastic stakes. The site was lightly irrigated by hand as needed to maintain adequate soil moisture for seed germination for 15 days. The cover was removed on Sep 18, 2019. Thereafter, no additional irrigation was applied. M1 plots received the first mowing when the turf reached a height of 7.6cm with clippings removed on Oct 2,2019. M2 plots received the first mowing when the turf reached a height of approximately 10.1cm with clippings removed on Oct 4, 2019. Subsequent mowings were completed weekly until mowing ceased on Oct 18, 2019.

Herbicide treated plots received T-Zone™ (3,5,6-Trichloro-2-pyridinyloxyacetic acid, 2,4-dichloro-5-[4-(difluoromethyl)-4,5 dihydro-3-methyl-5-oxo-1h-1,2,4-triazol-1-yl]phenyl] methanesulfonamide, 2 4-dichlorophenoxyacetic acid, 3 6-dichloro-o-anisic acid) (PBI Gordon, Shawnee, KS) on Nov 6, 2019 and Barricade™4L (Prodiamine) (Syngenta, Wilmington, DE) on Apr 17, 2020. Both herbicides were applied with a Toro Multipro 1250 sprayer (The Toro Company, Bloomington, MN) using air induction nozzles calibrated to 818L/ha^{-1}, at a rate of 4.3L/ ha^{-1} and 144L/ ha^{-1} total water carrier volume (T-Zone) and at a rate of 1.6L/ha^{-1} and 144L/ha^{-1} of total water carrier volume (Barricade).

Percent weed cover was quantified using the line intersect method. Weed cover data was collected weekly during establishment (Oct 2019) and monthly during post establishment (May 2020 to Sep 2020). Weed species observed during establishment in order of abundance include; common lambsquarter (*Chenopodium album*), common purslane (*Portulaca oleracea*), buckhorn plantain (*Plantago lanceolata*), Mouse-ear chickweed (*Cerastium fontanum*), ground ivy (*Glechoma hederacea*), white clover (*Trifolium repens*), shepards purse (*Capsella bursa-pastoris*), and thistle (*Cirsium* spp.). Weed species observed throughout the post establishment phase in order of abundance include; white clover, dandelion, buckhorn plantain, smooth crabgrass (*Digitaria ischaemum*), broadleaf plantain (*Plantago major*), and mouse-ear chickweed.

2020 POST ESTABLISHMENT RESULTS

Significant differences between treatments resulted primarily from turfgrass species (SP), mowing height (MH) and herbicide (HB) (Table 1). Significant interactions were observed throughout the post-establishment phase and included SP X MH, SP X HB, MH X HB and SP X MH X HB.

Treatment Main Effects

Turfgrass species main effect was highly significant ($P<0.001$) in reducing total weed cover and was observed in every date data was collected (Table 1 and Figure 1). Turfgrass species also showed significance ($P<0.01$) in reducing smooth crabgrass cover in August and September (Week 15 and Week 20) (Table 1 and Figure 2).

There were no significant seeding rate main effects observed during post-establishment (Table 1). In the establishment phase, twice the recommended seeding rate reduced weed cover up to 4 weeks after seeding.

Mowing height main effect was highly significant in reducing total weed cover throughout most of the season (Table 1). Lower mowing (1.25") consistently reduced total weed cover (Figure 3). Higher mowing (3.25") significantly reduced smooth crabgrass cover (Figure 4).

Herbicide main effect was highly significant in reducing total weed cover across all dates data was collected (Table 1). Herbicides were highly significant in reducing smooth crabgrass cover in August (Week 15) and showed some significance in September (Week 20) (Table 1)

Treatment Interactions

The SP X MH interaction observed that KBG consistently had more weed cover at 1.25” compared to the rest of the species, while TF and FF consistently had the least amount weed cover at 1.25” and 3.25” (Figure 6). KBG and PRG had higher incidences of smooth crabgrass, and were more abundant at 1.25” compared to 3.25” (Figure 7). TF and FF had the least amount of smooth crabgrass cover and were not significantly different from each other (Figure 7).

The SP X HB interaction observed that the use of herbicides reduces weed cover across all species (Figure 8). All herbicide treated species had similar weed cover until greater weed cover was observed in KBG at week 15 (Figure 8). Non-herbicide treated KBG had the greatest weed cover compared to the other species, but by week 15, PRG weed cover increased and was not statistically different from KBG (Figure 8). TF and FF consistently had the lowest weed cover compared to the other non-herbicide treated species (Figure 8).

The MH X HB interaction observed that 3.25” non-herbicide treated plots consistently had more weed cover compared to 1.25” (Figure 9). Mowing height did not provide any additional benefit to reducing weed cover when herbicides were applied (Figure 9). Non-herbicide treated 3.25” turf had less crabgrass cover than 1.25” (Figure 10). Herbicide treated 1.25” and 3.25” turf showed no significant difference in crabgrass cover (Figure 10). In September (Week 20), herbicide treated and non-treated turf at 3.25” had the same amount of crabgrass cover (Figure 10).

The SP X MH X HB interaction observed significant differences at week 1, 6 and 10 of data collection between herbicide and non-herbicide treated species maintained at 1.25” and 3.25”. Some of the most compelling results of this interaction was that some herbicide treated species had no differences in weed cover compared to non-treated. Non-herbicide treated TF and FF at 1.25” had similar weed cover to all herbicide treated species at 1.25” up to 10 weeks post establishment (Figures 11, 12, 13). At 3.25”, The non-herbicide treated TF had similar weed cover compared to the herbicide treated KBG up to 10 weeks post establishment, but not the rest of the herbicide treated species (Figures 14,15,16). Non herbicide treated FF at 3.25” had similar weed cover to herbicide treated KBG at 3.25” at 1- and 10-weeks post establishment (Figures 14,16). Non-herbicide treated PRG at 3.25” had similar weed cover to herbicide treated KBG at 3.25” 1 week post establishment (Figure 14).

Table 1. Analysis of variance for percent weed cover.

Main Effects	Week[a] 1	Week 6	Week 10	Week 15	Week 15 CG Cover	Week 20	Week 20 CG Cover
Variation Source							
Species (SP)	***	***	***	***	**	***	**
Rate (RT)	NS	NS	NS	NS	NS	NS	NS
Mowing Height (MH)	***	***	***	**	**	NS	**
Herbicide (HB)	***	***	***	***	***	***	**
Interactions							
SP*RT	NS	NS	NS	NS	NS	NS	NS
SP*MH	**	***	**	NS	*	NS	**
RT*MH	NS	NS	NS	NS	NS	NS	NS
SP*RT*MH	NS	NS	NS	NS	NS	NS	NS
SP*HB	***	***	***	**	**	NS	**
RT*HB	NS	NS	NS	NS	NS	NS	NS
SP*RT*HB	NS	NS	NS	NS	NS	NS	NS
MH*HB	**	***	***	***	**	*	**
SP*MH*HB	*	***	*	NS	NS	NS	NS
RT*MH*HB	NS	NS	NS	NS	NS	NS	NS
SP*RT*MH*HB	NS	NS	NS	NS	NS	NS	NS

Levels of significance obtained with PROC MIXED in SAS
[a] Weeks after first data collection of 2020
*P<0.05
**P<0.01
***P<0.001

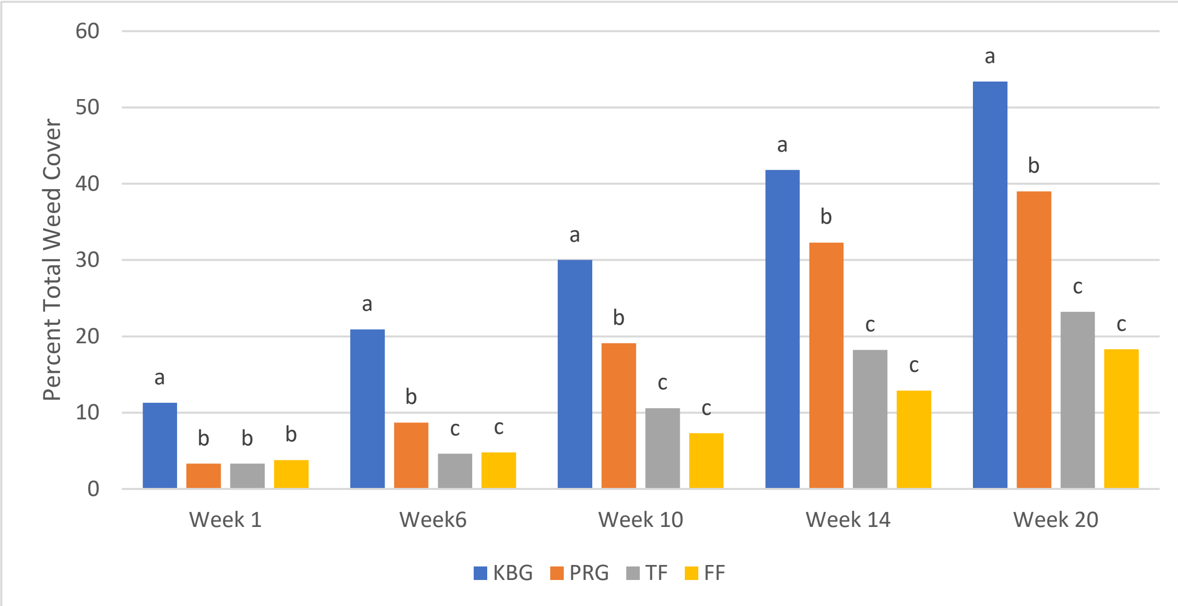

Figure 1. Turfgrass species main effect on total percent weed cover.

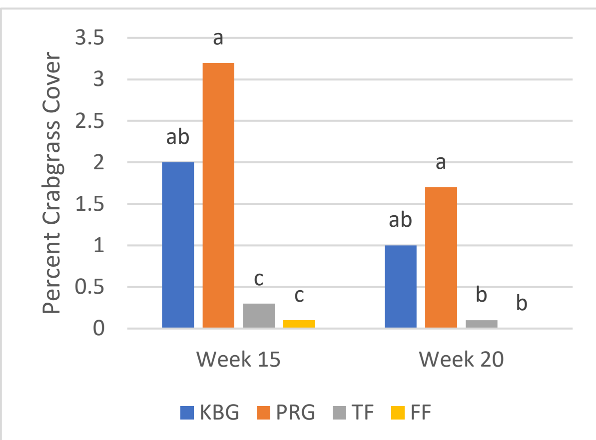

Figure 2. Turfgrass species main effect on percent smooth crabgrass cover.

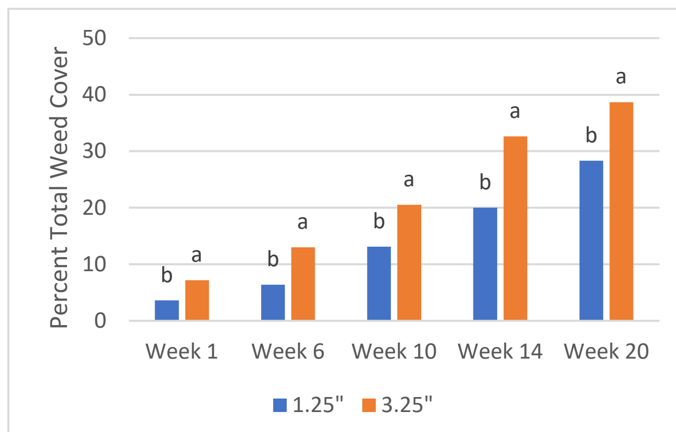

Figure 3. Mowing height main effect on percent total weed cover.

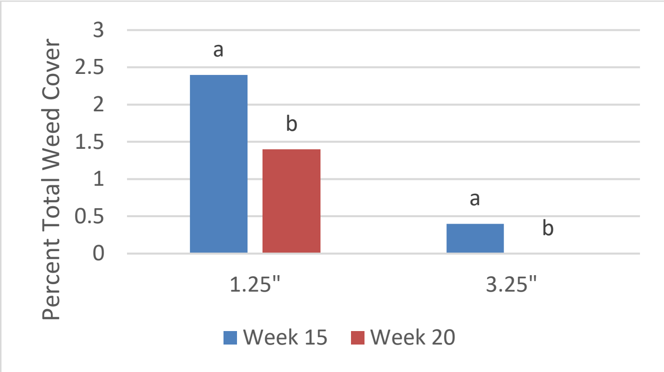

Figure 4. Mowing height main effect on percent smooth crabgrass cover.

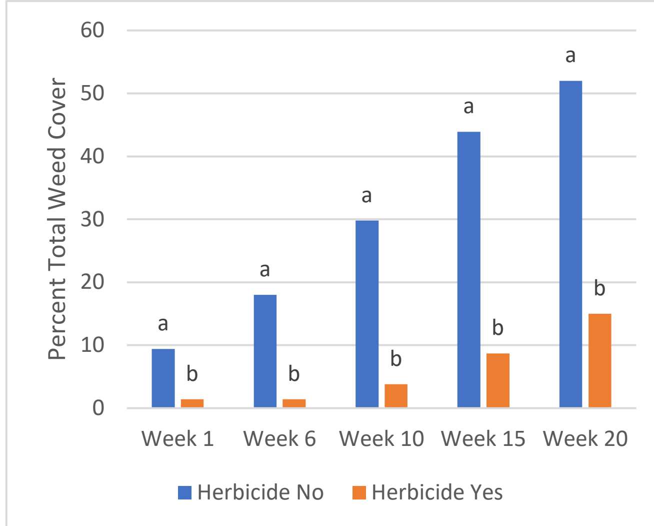

Figure 5. Herbicide main effect on percent total weed cover.

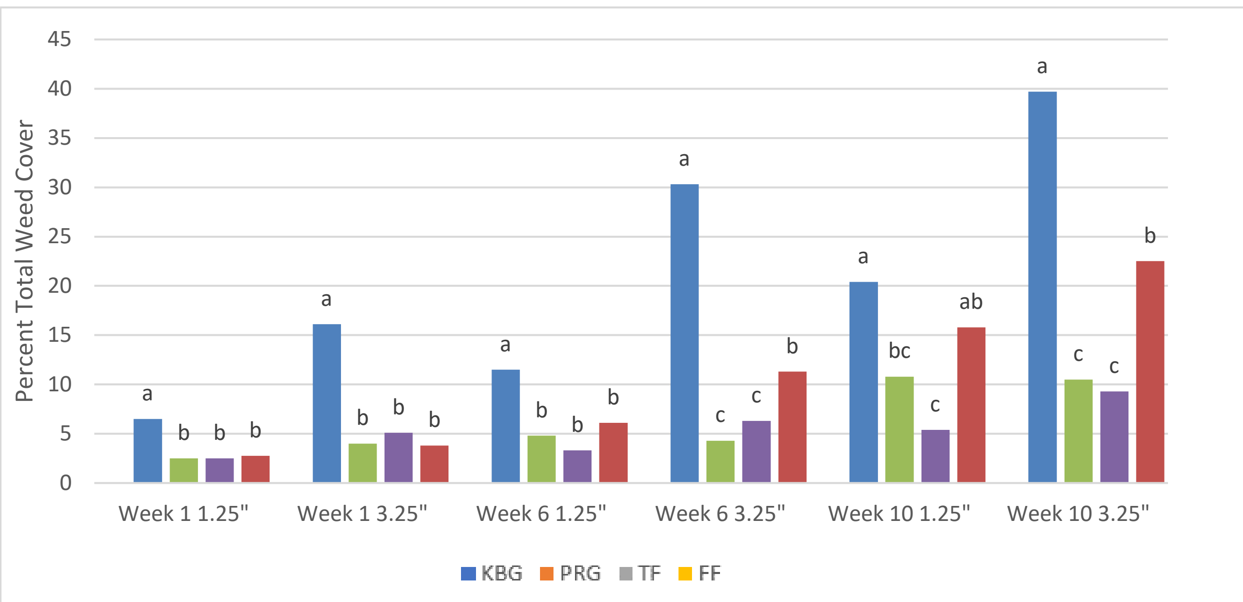

Figure 6. Interaction of turfgrass species and mowing height on percent total weed cover.

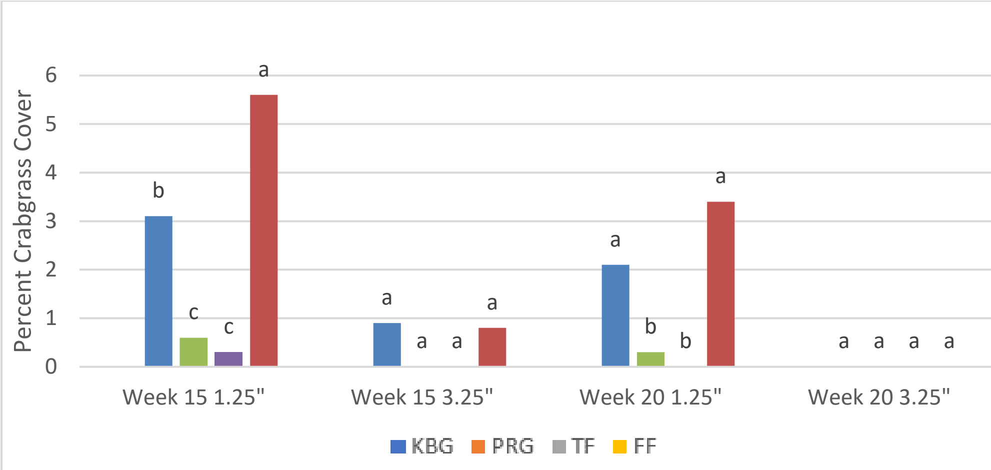

Figure 7. Interaction of turfgrass species and mowing height on percent smooth crabgrass cover.

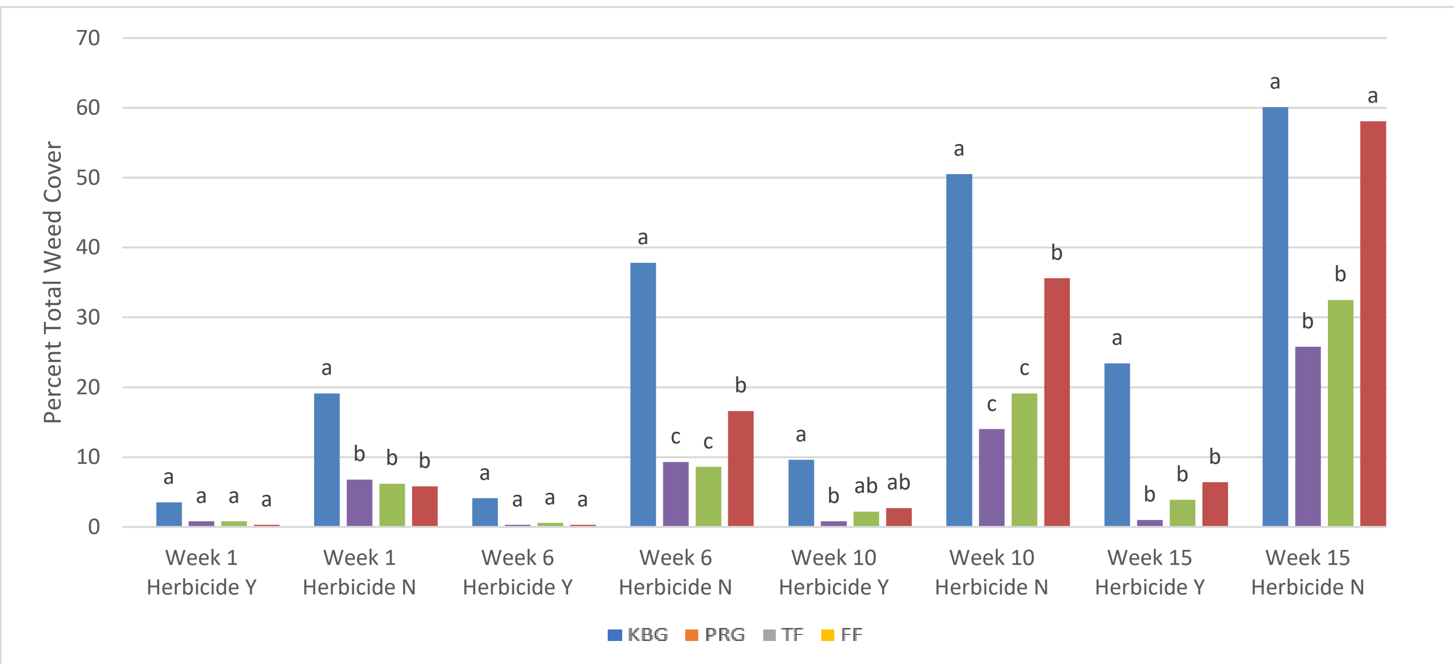

Figure 8. Interaction of turfgrass species and herbicide on percent total weed cover.

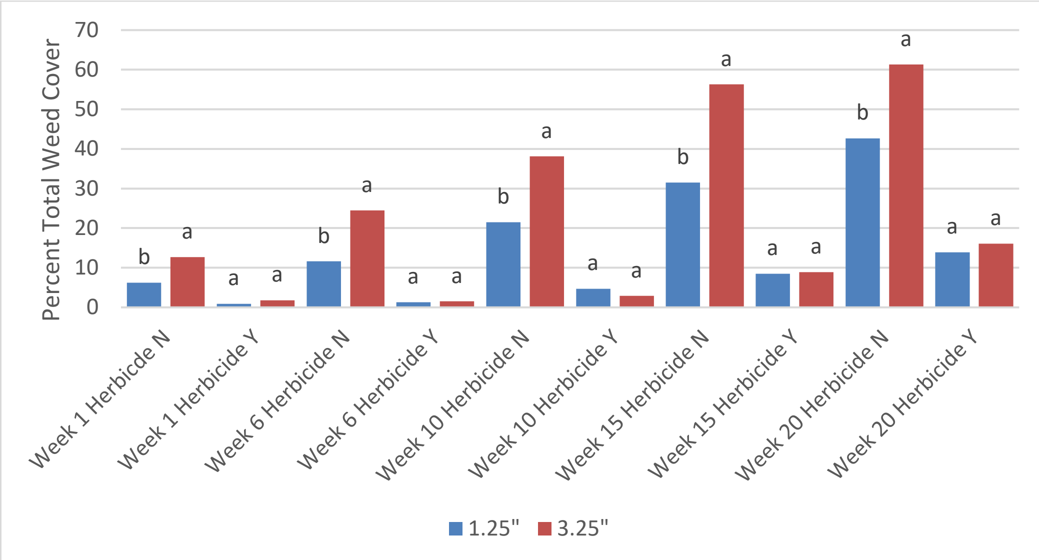

Figure 9. Interaction of mowing height and herbicide on percent total weed cover.

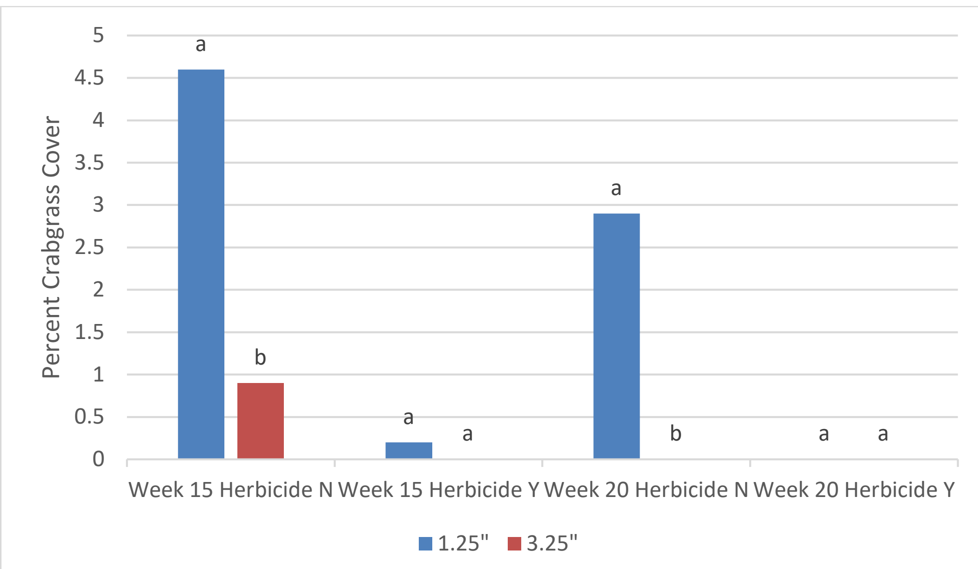

Figure 10. Interaction of mowing height and herbicide on percent smooth crabgrass cover.

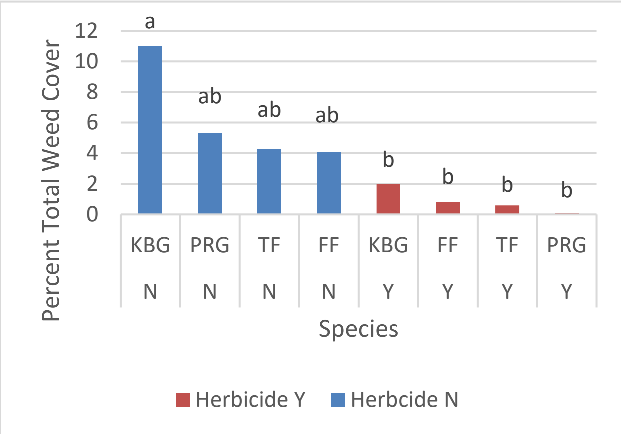

Figure 11. Week 1 interaction of species, mowing height and herbicide at 1.25" on total percent weed cover.

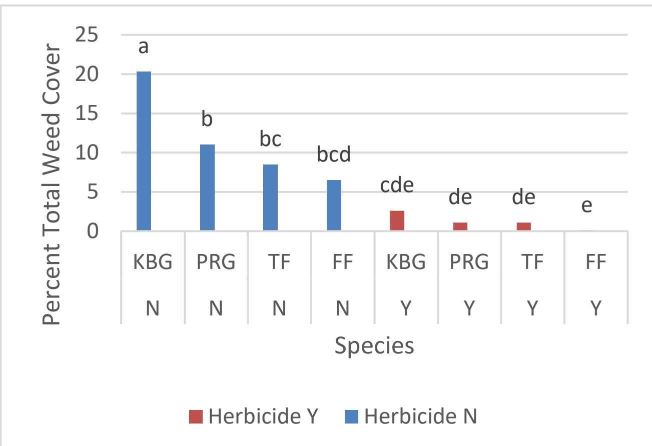

Figure 12. Week 6 interaction of species, mowing height and herbicide at 1.25" on total percent weed cover.

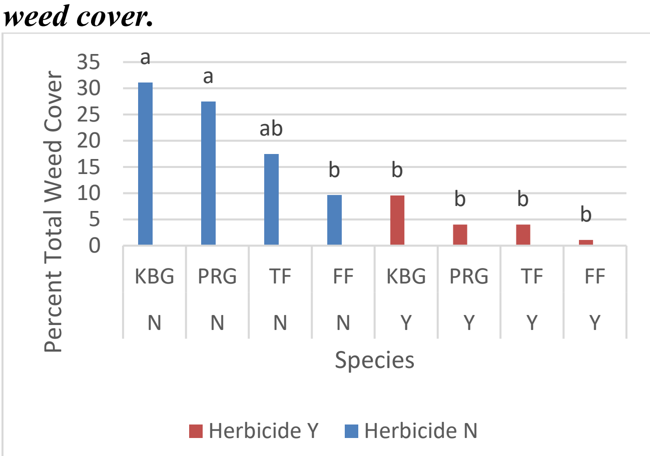

Figure 13. Week 10 interaction of species, mowing height, and herbicide at 1.25" on total percent weed cover.

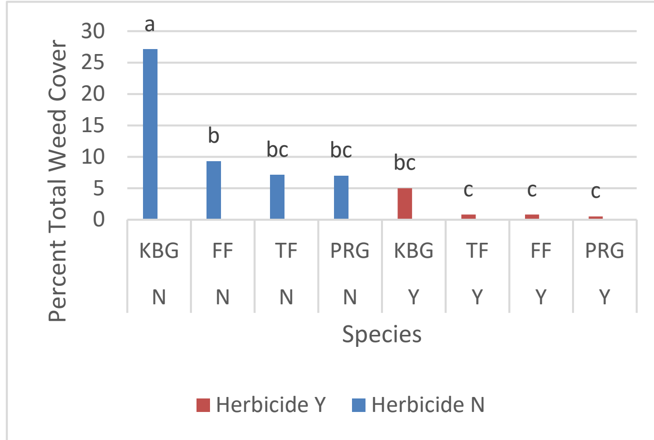

Figure 14. Week 1 interaction of species, mowing height, and herbicide at 3.25" on total percent weed cover.

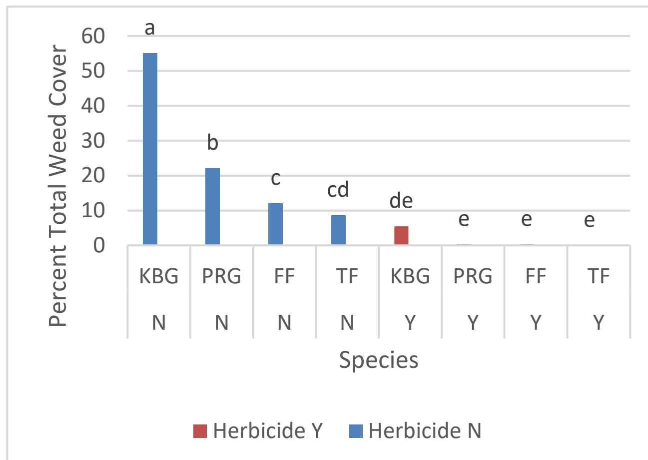

Figure 15. Week 6 interaction of species, mowing height and herbicide at 3.25" on total percent weed cover.

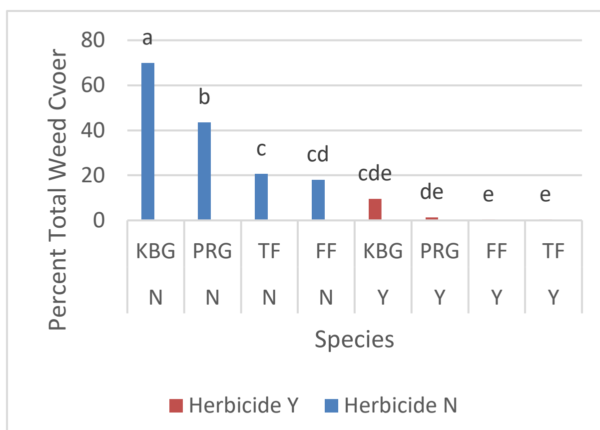

Figure 16. Week 10 interaction of species, mowing height and herbicide at 3.25" on total percent weed cover.

DISCUSSION AND CONCLUSION

The ability or inability of a weed species to compete with desirable turfgrasses during post establishment is dependent upon the turfgrass species, mowing height and whether herbicides are applied. The primary objective of this research was to identify these key factors or which combination of these factors that the turfgrass manager can implement to minimize weed cover during post establishment without the use of herbicides. Based on the results to date, utilizing turfgrass species such as fine fescue or tall fescue will help to reduce broadleaf weed and smooth crabgrass colonization consistently throughout the post-establishment phase. Mowing at 1.25" consistently reduced broadleaf weed cover throughout the season. Mowing at 3.25" reduced smooth crabgrass cover in August and September. Mowing at 1.25" will reduce weed cover in KBG compared to mowing at 3.25". TF and FF will maintain low weed cover regardless of mowing height. Non-herbicide treated TF and FF at 1.25" had similar weed cover to all herbicide treated species maintained at 1.25" up until 10 weeks post establishment. Seeding rate did not have an effect on weed cover during the post establishment phase. A post emergent herbicide application in November and a pre-emergent application the following April, were shown to be extremely effective in reducing weed cover.

Turfgrass managers desiring less weed cover in the post-establishment phase should consider seeding with TF or FF. Perennial Ryegrass is the ideal choice for managers who value less weed cover in the establishment phase. Increasing the height to 3.25" in August and September, will reduce smooth crabgrass cover. The use of herbicides on KBG and PRG would be highly recommended and should be maintained at 1.25" in the post-establishment phase. TF or FF can be maintained at 1.25" or 3.25". TF and FF were effective at minimizing smooth crabgrass cover in August and September at either height. The use of herbicides on TF or FF would not be necessary.

These results conclude the first year of this research. The study was reseeded in fall 2020 in order to collect a total of two years of data for both the establishment and post establishment phases of this research.

ACKNOWLEDGEMENTS

Funding for this research is provided by the New England Regional Turfgrass Foundation. Kentucky bluegrass seed was donated by Atlantic Golf and Turf, Turner Falls, MA. Tall fescue seed was donated by Noble Turf, Mt. Laurel, NJ.

Thank you to the entire research farm staff for their support. Thank you to Dr. Jason Henderson and Victoria Wallace for their help and guidance throughout this research. Thank you to Chris Dunhill for assisting in data collection and maintenance of the research area.

REFERENCES

Ayan, I., Saygin, A., Can, M., Mut, H., & Acar, Z. (2017). Green area performance of some cool season turfgrasses planted with different seeding ratios. *VIII International Scientific Agriculture Symposium, "Agrosym 2017", Jahorina, Bosnia and Herzegovina, October 2017. Book of Proceedings*, 2044–2048.

Brede, A. D., & Duich, J. M. (1984). Initial mowing of Kentcky bluegrass-perennial ryegrass seedling turf mixtures. *Agronomy Journal*, *76*(5), 711–714.

Dernoeden, PH.,M.J. Carroll and J.M. Krouse.1993. Weed management and tall fescue quality as influenced by mowing, nitrogen and herbicides. Crop Sci. 33:1055-1061

Landschoot, P. (2006, September 21). Weed Management in Turf. Retrieved from https://extension.psu.edu/weed-management-in-turf#section-40

Parr, T.W.(1985) The control of weed populations during grass establishment by manipulation of seed rates British Crop Protection Council 29 20-28

Peters, E. J., & Mohammed Zam, A. H. B. (1981). Allelopathic effects of tall fescue genotypes. *Agronomy Journal*, *73*(1), 56–58.

Voigt, T.B., T.W. Fermanian, and J.E. Haley. 2001. Influence of mowing and nitrogen fertility on tall fescue turf. Int. Turfgrass Soc. Res. J. 9:953-956

GREENHOUSE GAS EMISSIONS AND SOIL MICROBIAL COMMUNITIES FROM TURFGRASS FERTILIZED WITH SLOW-RELEASE SYNTHETIC AND ORGANIC NITROGEN FERTILIZER SOURCES - 2020

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INTRODUCTION

The three most consequential greenhouse gases in turfgrass systems are carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4). Managed turfgrass areas have shown potential for high soil C sequestration, but the emission of greenhouse gases from these fertilized landscapes may offset sequestration. The addition of N fertilizers to turfgrass has shown to increase the amount of N_2O emissions compared to non-fertilized turfgrass (Maggiotto et al., 2000). However, the emission of N_2O from fertilized turfgrass soils may vary by source of N. While several studies have evaluated greenhouse gas emissions from synthetic fertilizers, there are limited data that report on organic N fertilizer sources and no studies have compared greenhouse gas emissions between urban grassland lawns fertilized with slow-release synthetic and organic N sources.

The common perception that organic fertilizers are less harmful to the environment than synthetic fertilizers has led to an increasing use of organic amendments in turfgrass systems, including organic sources of N. Currently, synthetic fertilizers are the most commonly used N source for managed turfgrasses. As more people begin to switch to organic fertilizers, it is important to quantify and compare the greenhouse gas emissions from the soils of turf fertilized with organic and synthetic fertilizers.

Another common perception is that synthetic fertilizers reduce soil microbial populations. Moreover, organic N sources are routinely used as a means of increasing soil microbial activity and population diversity. Studying the differences in microbial populations between soils fertilized with organic and synthetic fertilizers will provide insight into how these inputs affect soil health. The 16S rRNA gene sequencing technology allows for the analysis of the microorganisms in these soil environments.

The objective of this study was to determine how slow-release synthetic and organic fertilizers influence greenhouse gas emissions and soil microbial community populations of turfgrass lawns.

MATERIALS & METHODS

Experimental and Study Design

This field study was conducted during June through October 2019 and 2020 at the Plant Science Research and Education Facility in Storrs, CT on an existing tall fescue [Schedonorus arundinaceus (Schreb.) Dumort.] turf that was established in September 2007. The experiment was set out as a randomized complete block design with three replications. Plot size was 1 x 1 m. Plots were fertilized once in June and October 2019 and 2020 with either a poly coated urea 60% slow-release synthetic fertilizer (ProSeries 25-0-12) consisting of 24% urea nitrogen, 0.1% slowly available water soluble nitrogen, and 0.9% water insoluble nitrogen, or an all-natural organic fertilizer (Suståne 5-2-4). A non-fertilized control plot was also included in this study. Fertilizers were applied at four rates (50, 100, 150, and 200 kg N ha^{-1}) in equal split applications in June and October. Plots have received the same rate of synthetic or organic N yearly since 2008 (with the exception of 2010).

Greenhouse Gas Emissions

CO_2, N_2O, and CH_4 emissions were measured once a month (June through October 2020) using the static chamber method (Livingston and Hutchinson, 1995) with a modification in chamber design as described by Morse et al. (2012). PVC collars were placed in the soil of each plot and remained there in order to minimize soil disturbance. On the day of sampling, PVC chambers were positioned into the soil collars and a gas sample was collected immediately, then again 30 and 60 minutes later. Gas samples were collected using a gas tight syringe through septa on the chambers. Gas samples were immediately injected into a 22 mL pre-evacuated gas vial after sampling. At the time of sampling, air temperature, barometric pressure, soil temperature and moisture at 10 cm, and chamber height were recorded.

Gas samples were taken to the laboratory and injected by a PerkinElmer TurboMatric 40 Trap headspace sampler into a PerkinElmer Clarus 580 gas chromatograph. The gas chromatograph uses a flame ionization detector and a Model Arnel methanizer to quantify CO_2 and CH_4 concentrations and an electron capture detector to measure N_2O. Concentrations of the gases were calculated in units of ppmv by comparing the chromatograph areas of samples to known standards.

Gas fluxes were calculated according to Helton et al. (2014) and Morse et al. (2012). Emissions for each gas were determined by calculating the slope of the regression between gas concentration and time over the one-hour incubation. Measurements of barometric pressure and temperature taken at the time of sampling were used with the ideal gas law to calculate in units of mass (mg m^{-3}) in R 3.6.1. The minimum detectable concentration difference (MDCD) was calculated for each gas (Yates et al., 2006) and all fluxes less than the MDCD were set equal to zero. The slope (mg m^{-3} hr^{-1}) was used to calculate emissions for any gas flux over the MDCD and had an r2 > 0.85. Any non-linear slope with an r2 < 0.85 was analyzed with the third time point dropped. Chamber heights were used to convert gas flux to units of mg m^{-2} hr^{-1}.

Greenhouse gas (CO_2, CH_4, and N_2O) flux (mg m^{-2} hr^{-1}) means were analyzed for treatment differences (treatment versus control, fertilizer source, fertilizer rate, and fertilizer source × fertilizer rate interaction) as a repeated measures design by using analysis of variance with Fisher's LSD for mean separation in the GLIMMIX procedure of SAS 9.4 (SAS Institute, Cary, NC).

Soil Microbiome

Soil samples were collected before and after fertilizer applications in June and October 2019. Pre-fertilization samples were collected 1 to 5 days before fertilizer treatments were applied, and post-fertilization samples were collected 14 days after treatments. A total of 10 1.5-cm diameter soil cores were collected from each plot and trimmed to include the upper 10 cm of rootzone. Soil samples were stored on ice in the field, and then transferred to a −20˚C freezer until ready to process, which occurred within 2 weeks after sampling. After passing samples through a 1-mm sieve, DNA was extracted using the Qiagen DNeasy PowerSoil Kit following the manufacturer's protocol. DNA isolates were submitted to the Microbial Analysis, Resources, and Services lab at the University of Connecticut for quantification, PCR amplification, library preparation, and 16S sequencing. The V4 hypervariable region of the bacterial 16S rDNA genes in each sample were amplified by PCR and sequenced by the Illumina MiSeq platform.

Raw sequences were processed using the "DADA2" package in R 4.0.3 following the DADA2 Pipeline Tutorial (1.8) and adjusting parameters to our dataset. Forward and reverse reads were filtered and merged. After removing chimeras and sequences belonging to chloroplast, mitochondria, Eukaryota, and any unassigned sequences at the Kingdom level, an amplicon sequence variants (ASVs) table was created. Taxonomic levels of ASVs were assigned using the SILVA database (v.138). Downstream analysis was conducted using the "phyloseq" package unless otherwise specified and graphics were created using the "ggplot2" package in R.

Alpha diversity was evaluated through the Shannon diversity index. To compare the alpha diversity between samples, the non-parametric Kruskal-Wallis test was conducted with the Benajmini-Hochberg correction applied for multiple pairwise comparisons with the "dunn.test" package. Reads for each sample were normalized using variance stabilizing transformation with the "DeSeq2" package. Beta diversity was analyzed by calculating the Bray-Curtis dissimilarity matrices. To study the effect of fertilizer and rate on the microbiome community between samples, permutational multivariate analysis of variance (PERMANOVA) and homogeneity of dispersion were calculated with the "betadisp" and "adonis" functions in the "vegan" package. Pairwise PERMANOVA comparisons were calculated and adjusted with the Bonferroni correction.

RESULTS & DISCUSSION

Greenhouse Gas Emissions

The results show that was a significant rate effect for the CO_2 gas emission ($P = 0.0242$). The plots that received the 50 kg N ha^{-1} rate of fertilizer had equal CO_2 emissions to the control plots that did not receive any fertilizer treatment. All other rates were significantly greater than the 50 kg N ha^{-1} rate, but they were also equal to the control plots. There was also a significant date effect ($P = <0.001$) for the repeated measures analysis where the CO_2 emissions were significantly greater in the gas samples collected during June and July compared to the samples collected in August, September, and October (Fig. 1). There was no significant effect or interaction for the N_2O and CH_4 gas concentration data ($P > 0.05$). CH_4 concentrations did showed a net intake of the gas throughout the entire season, regardless of treatment (Fig. 1).

Soil Microbiome

Analysis of soil microbiome data are ongoing. To date, preliminary analysis from the spring 2019 fertilization event have been performed. Results suggest a significant difference among fertilizer sources (PERMANOVA $P = 0.003$) 14-d after fertilization occurred. Principle coordinate analysis shows clustering by fertilizer source with clusters corresponding to fertilized and non-fertilized treatments separating along the x-axis (PC1) (Fig. 2). Pairwise comparisons of the different fertilizer sources show that the soil microbial communities (beta-diversity) associated with organic and synthetic fertilization are different from the control ($P = 0.042$ and $P = 0.021$, respectively); however, they do not differ from each other ($P > 0.05$). These data suggest that the soil microbiome of fertilized turf is more similar than the non-fertilized turf 14 days after fertilization, regardless or organic or synthetic N-source. The preliminary data also suggest that differences in the alpha-diversity may also exist among fertilized and non-fertilized turf ($P = 0.06$). Greater overall bacterial diversity, and greater uniformity among representatives of those bacterial communities was observed in soil of fertilized turf, regardless of N source compared to non-fertilized turf. No soil microbiome differences were observed among fertilizer source or rates in pre-fertilization sampling during spring 2019.

SUMMARY

The results of this study suggests that the greenhouse gas emissions are not significantly different between a tall fescue turf field fertilized with slow-release synthetic fertilizer and organic fertilizer and neither are significantly greater than the untreated control turf. The data also suggests that the rate at which the fertilizer is applied does not influence greenhouse gas emissions.

The preliminary results suggest that fertilization has a significant effect on the turfgrass soil microbiome regardless of synthetic or organic N sources.

These results will provide some preliminary data to assist turf practitioners, as well as policy makers and regulators, on deciding what types of N fertilizers to use to help minimize greenhouse gas emissions and detrimental soil health practices.

REFERENCES

Helton, A.M., E.S. Bernhardt, and A. Fedders, 2014. Biogeochemical regime shifts in coastal landscapes: the contrasting effects of saltwater incursion and agricultural pollution on greenhouse gas emissions from a freshwater wetland. Biogeochemistry. 120:133–147.

Livingston G.P., and G.L. Hutchinson. 1995. Enclosure-based measurement of trace gas exchange: Applications and sources of error. In: P.A. Matson and R.C. Harriss (editors). Methods in Ecology. Biogenic trace gases: Measuring emissions from soil and water. Blackwell Science, Oxford. p. 14–51.

Maggiotto, S.R., J.A. Webb, C. Wagner-Riddle, and G.W. Thurtell. 2000. Nitrous and nitrogen oxide emissions from turfgrass receiving different forms of nitrogen fertilizer. J. Environ. Qual. 29:621–630.

Morse, J.L., M. Ardón, and E.S. Bernhardt. 2012. Greenhouse gas fluxes in southeastern U.S. coastal plain wetlands under contrasting land uses. Ecol. Appl. 22:264–280.

Yates, T.T., B.C. Si, R.E. Farrell, and D.J. Pennock. 2006. Probability distribution and spatial dependence of nitrous oxide emission: temporal change in hummocky terrain. Soil Sci. Soc. Am. J. 70:753–762.

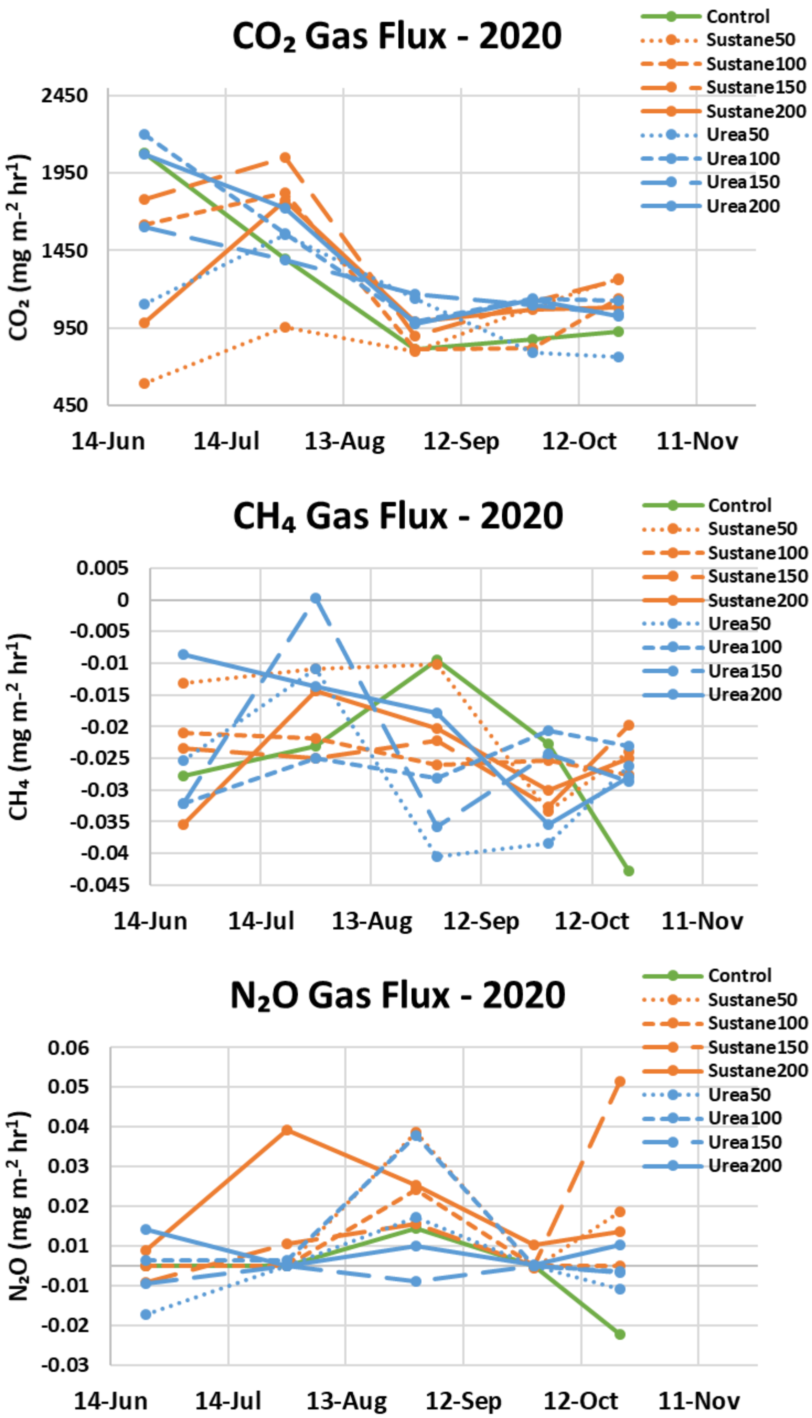

Figure 1. Responses of mean CO_2, N_2O, and CH_4 gas emissions (mg m^{-2} hr^{-1}) for each fertilizer source (non-fertilized control, Suståne, and Urea) and rate (0, 50, 100, 150, and 200 kg N ha^{-1}) across the monthly sampling dates in 2020.

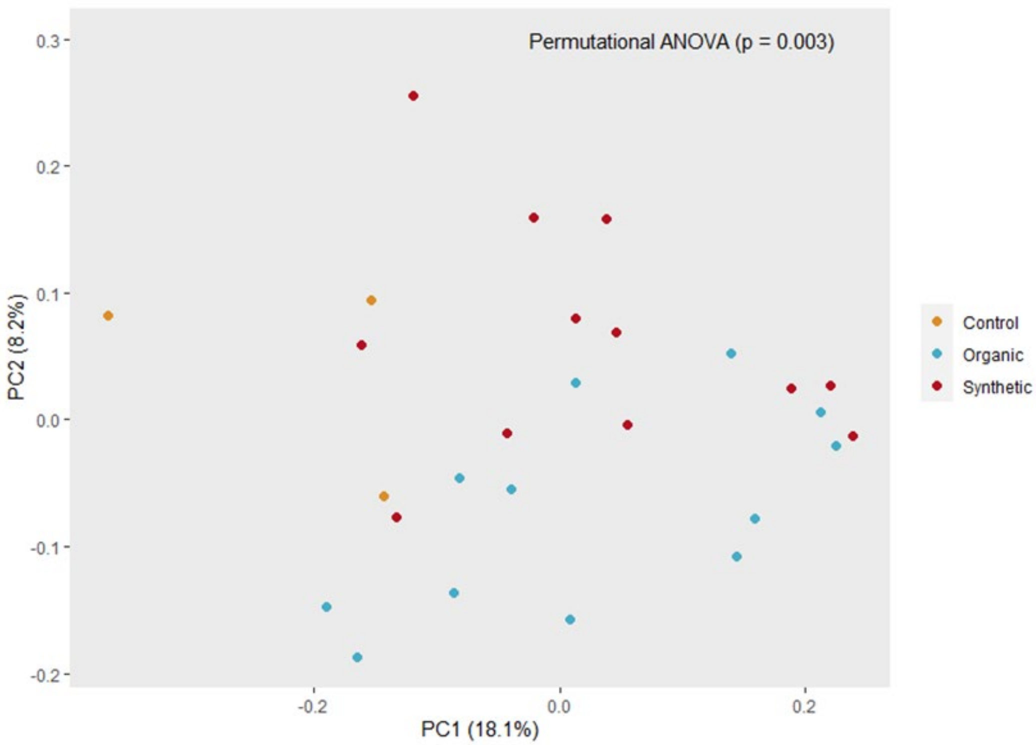

Figure 2. Principle coordinate analysis (PCoA) calculated as Bray-Curtis dissimilarity matrices of soil microbial communities associated with tall fescue turf after receiving applications of organic, slow-release synthetic, or no fertilizer. Permutational analysis of variance (PERMANOVA) *p* value = 0.003. Homogeneity of multivariate dispersions test *p* value = 0.8932.

NATIONAL TURFGRASS EVALUATION PROGRAM (NTEP)
2017 KENTUCKY BLUEGRASS TEST – 2020 RESULTS

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INTRODUCTION

Kentucky bluegrass is among the most widely utilized cool season turfgrasses. It is used in home lawns, sports turf, parks, and golf courses. Kentucky bluegrass is strongly rhizomatous. It produces a high-density turfgrass stand that is capable of spreading and quickly filling in voids. Other characteristics that make Kentucky bluegrass desirable are color, rapid recovery rate, good drought tolerance, and leaf texture. Limiting factors with Kentucky bluegrass are its lack of good shade tolerance, and its slow germination and establishment rate.

Maintenance requirements (water, fertility) are medium to medium high. Mowing heights can range from 0.5 inches (cultivar dependent) to 3 inches. Irrigation is required to avoid dormancy. However, when Kentucky bluegrass does go into dormancy, it is quick to recover once watering or rainfall resumes.

The National Turfgrass Evaluation Program (NTEP) is sponsored by the Beltsville Agriculture Research Center and the National Turfgrass Federation Inc. NTEP works with breeders and testing sites throughout the United States in evaluating turfgrass species and cultivars. Results from turfgrass evaluations can aid professionals in their selection of turfgrass species/cultivars that best meet their needs. Results also aid breeders in selecting new cultivars that they may put into production, as well as helping in marketing their varieties. In 2017 NTEP selected fourteen standard testing sites and seven ancillary test locations for the 2017 National Kentucky bluegrass test. The University of Connecticut, Plant Science Teaching and Research Facility in Storrs CT, was selected as a standard site for the 2017 Kentucky bluegrass test. NTEP trials typically run for five years, The 2017 Kentucky bluegrass trial will run through the 2022 growing season.

MATERIALS AND METHODS

Eighty-nine Kentucky bluegrass cultivars were seeded on August 25, 2017 in Storrs Connecticut. A complete randomized block design with 3 replicates of each cultivar was utilized for this study. Plot size is 3' X 5'. Sponsors and entries are listed in Table 1.

MANAGEMENT PRACTICES

Since establishment, all plots and cultivars received the same management protocol throughout the study. Management practices for 2020 were as follows:

<u>Mowing</u> - Plots were maintained at a mowing height of 2.0 inches and mowed two times per week. Clippings are returned.

<u>Irrigation</u> – Supplemental irrigation is applied to prevent stress or dormancy.

<u>Fertilizer and pesticide applications for 2020</u>
Apr 17- Prodiamine @ .55 fl oz/m
May 5, - 1#N/m using 25-0-12 (60% SCU
May 25 - Acelepryn @ .365 fl oz/m.
July 2- 1 #N/m using 25-0-12 (60% SCU)
Oct. 4 -1#N/m was applied using 25-0-12 (60% SCU).
Nov. 6- T Zone at a rate of 1.35 fl oz/m.

DATA COLLECTION

<u>Genetic Color Ratings</u> - Genetic color ratings (Table 2) were taken in early summer (June 25) while the grass was actively growing and not under stress conditions. Ratings were based on visual color with 1 being light green and 9 being dark green. Areas of plots that contained browning tissue (chlorosis or necrotic) from outside factors such as disease were not considered for genetic color (Table 2).

<u>Leaf Texture Ratings</u> - Visual leaf texture ratings were taken in in early summer (June 25) while the grass was actively growing and not under stress conditions. Texture ratings were made using a visual scale with 1 equaling coarse turf and 9 equaling fine (Table 2).

<u>Turfgrass Density Ratings</u> Density ratings of the planted varieties were made in August. Ratings were taken based on a visual estimate of living plants. A visual rating scale of 1 to 9 was used with 9 equaling maximum density. Density ratings are provided in table 2.

<u>Turfgrass Uniformity Ratings</u> Uniformity ratings were made in Sept. Uniformity ratings relate to color, leaf texture, growth habit, as well as from turf damaged from insects, disease, weeds, or non-biological factors. A visual rating of 1 to 9 was used where 9 equals the highest uniformity. Uniformity ratings are provided in table 2

<u>Quality Ratings</u> - Turfgrass quality ratings were taken monthly for overall turf quality (color / leaf texture / density) during the 2019 growing season. Overall turfgrass quality was determined using a visual rating system of 1-9. A score of 1 illustrates the poorest quality turf and 9 the highest quality. Turf plots rated with a score of less than six are deemed unacceptable. Monthly quality and mean quality ratings are provided in table 2.

RESULTS & DISCUSSION

Results for genetic color, texture, and monthly quality ratings, are provided in Table 2.

Thirty-nine cultivars had acceptable mean quality scores of 6 or greater for mean overall quality rankings. The six cultivars receiving the highest ratings for overall mean quality in 2020 were After Midnight (7.2), J-1319,(7.2), J-1138 (7.1), J-3510 (7.1), Midnight (7.1) and PPG-KB 1131 (7.1). However, there was no significant difference between the top 21 cultivars listed in table 2. The two cultivars that had the lowest overall ratings were MVS-130 and Kenblue.

Table 1- Sponsors and Entries			
ENTRY	**SPONSOR**	**ENTRY**	**SPONSOR**
A11-40	Landmark Turf & Native	Bombay (GO-22B23)	Grassland Oregon
A13-1	Landmark Turf & Native	Starr (GO-2628)	Grassland Oregon
A99-2897	Turf Merchants, Inc	Cloud (GO-2425)	Grassland Oregon
Syrah (LTP-11-41)	Lebanon Seedboard.	DLFPS-340/3364	DLF Pickseed
Blue Knight	Ledeboer Plant Breeding	DLFPS-340/3446	DLF Pickseed
Rad 553	Seeds Inc.	DLFPS-340/3556	DLF Pickseed
Selway	Seeds Inc.	DLFPS-340/3553	DLF Pickseed
Babe	Seeds Inc.	DLFPS-340/3494	DLF Pickseed
AKB3128	Pennington	DLFPS-340/3500	DLF Pickseed
AKB 3179	Pennington	DLFPS-340/3438	DLF Pickseed
AKB3241	Pennington	DLFPS-340/3549	DLF Pickseed
NK-1	Pennington	DLFPS-340/3548	DLF Pickseed
KH3492	Pennington Seed	DLFPS-340/3444	DLF Pickseed
Yellowstone (A12-7)	Landmark Turf &Native	DLFPS-340/3455	DLF Pickseed
After Midnight	Jacklin Seed by Simplot	DLFPS-340/3550	DLF Pickseed
J-1138	Jacklin Seed by Simplot	DLFPS-340/3551	DLF Pickseed
J-1319	Jacklin Seed by Simplot	DLFPS-340/3552	DLF Pickseed
J-2726	Jacklin Seed by Simplot	MVS-130	Mountain View
NuRush (J-3510)	Jacklin Seed by Simplot	A16-1	Mountain View
Bar PP 71213	Barenbrug	A16-7	Mountain View
Bar PP 7309V	Barenbrug	A12-34	Mountain View
Bar PP 79366	Barenbrug	A11-26	Mountain View
Barvette HGT	Standard	PPG-KB-1320	Mountain View
BAR PP 7K426	Barenbrug	A11-38	Peak Plant Genetics
BAR PP 7236V	Barenbrug	PPG-KB 1131	Mountain View
BAR PP 79494	Barenbrug	A10-280	Mountain View
Barserati (BAR PP 110358)	Barenbrug	Shamrock	Standard.
RAD-1776	Barenbrug	A16-2	Scotts
Jersey (NAI-A16-3)	Novel AG Inc.	PPG-KB 1304	ProSeeds
Twilight (NAI-13-132)	SiteOne Landscape	A15-6	Peak Plant Genetics
NAI-15-80	SiteOne Landscape	A16-17	Peak Plant Genetics.
Blue Gem (NAI-13-9)	Columbia River	Prosperity	Blue Mt.
United (NAI-13-14)	Columbia River	A06-8	Blue Mt.
NAI-14-122	Columbia River	Kenblue	Standard
Orion (PST-K13-143)	Pure Seed Testing	Paloma PST-K13-139	Pure-Seed Testing
NAI-14-128	Columbia River	PST-K13-141	Pure-Seed Testing
NAI-14-132	Columbia River	PST-K11-118	Pure-Seed Testing
Amaze (NAI-14-133)	Columbia River	PST-K15-157	Pure-Seed Testing
Comanche (NAI-14-176	Columbia River	PST-K11-7	DLF Pickseed
Finish Line NAI-14-178	Columbia River	PST-K15-167	Pure-Seed Testing
Heartland (NAI-14-187)	Columbia River	New Moon (PST-K15-177)	Pure-Seed Testing
Aviator (NAI-15-84)	Columbia River	PST-K15-172	Pure-Seed Testing
Pivot	Columbia River	Midnight	Standard.
Blue Devil	Columbia Seeds	PST—T14-39	Pure-Seed Testing
Skye	Standard		

Figure 1 – 2017 NTEP National Kentucky Bluegrass Test, University of Connecticut (photo- July 2018)

Table 2. Kentucky Bluegrass NTEP results 2020 for genetic color (ratings 1-9, where 9 equals darker green), leaf texture (rating 1-9, where 9 equals the finest texture leaf blade), Turfgrass Density (rating 1-9, where 9 equals the highest density, Turfgrass Uniformity a rating 1-9, where 9 equals the highest uniformity, and turfgrass quality (rating 1-9, where 9 equals the highest turf quality). Table is listed with highest mean quality cultivars listed first.

	Spring Green up	Genetic color	Texture	Density	Uniformity	Quality						
Entry	4/7	6/25	6/25	Sept.	9/1	5/17	6/9	7/17	8/14	9/24	10/27	mean
After Midnight	4.3	7.7	6.3	9.0	7.7	7.3	6.7	7.3	7.7	7.3	7.0	7.2
J-1319	3.3	9.0	6.3	7.0	7.0	7.3	7.0	7.0	6.7	8.0	7.3	7.2
J-1138	2.3	7.3	6.7	7.7	7.3	6.3	7.3	7.7	7.0	7.3	7.0	7.1
NuRush (J-3510)	3.0	6.3	6.7	7.0	7.3	6.7	6.7	7.3	7.3	7.3	7.0	7.1
PPG-KB 1131	3.3	7.0	6.7	7.3	6.7	6.7	7.3	7.7	6.7	7.3	6.7	7.1
Midnight	3.0	7.7	6.3	7.0	7.7	6.7	7.0	6.7	7.3	7.0	7.7	7.1
DLFPS-340/3500	5.0	6.0	6.7	7.0	7.7	7.3	7.3	6.7	6.7	7.0	6.7	6.9
BAR PP 79366	4.0	4.7	6.7	7.3	8.0	7.7	7.3	6.3	6.7	6.7	6.7	6.9
PST-11-7	4.7	6.7	6.3	6.7	7.3	7.3	6.0	6.7	6.3	8.0	7.0	6.9
Blue Gem (NAI-13-9)	2.7	7.3	7.0	7.7	7.0	7.0	6.7	6.7	6.7	6.7	7.3	6.8
United (NAI-13-14)	2.3	7.7	7.0	7.7	7.7	7.3	6.7	7.0	6.3	6.3	7.3	6.8
BAR PP 79494	3.0	7.7	6.3	7.0	7.0	7.0	6.0	6.7	6.7	7.0	7.3	6.8
New Moon (PST-K15-177)	5.7	6.7	7.7	7.0	6.0	7.3	6.7	7.0	6.0	7.0	6.3	6.7
DLFPS340/3556	5.3	5.7	6.3	6.0	7.0	7.7	7.0	6.0	5.7	6.3	7.3	6.7
J-2726	3.7	7.0	6.7	7.7	6.3	7.0	6.7	6.7	5.7	6.3	7.3	6.6
Blue Devil	2.7	7.3	6.7	6.7	8.0	5.7	6.7	6.0	6.7	7.3	7.3	6.6
NAI-15-80	6.7	5.7	7.3	8.0	5.7	6.7	5.3	6.3	6.7	7.0	7.3	6.6
DLFPS-340/3553	6.3	6.0	7.0	7.3	7.0	6.7	6.0	6.3	6.7	7.0	6.7	6.6
Cloud (GO-2425)	5.0	5.0	7.7	7.3	6.3	6.7	6.0	6.0	5.7	7.3	7.3	6.5
Twilight (NAI-13-132)	3.3	8.3	6.3	6.7	6.7	6.7	7.0	7.0	6.3	5.0	6.7	6.4
DLFPS-340/3550	5.0	7.0	6.7	6.7	6.7	7.0	6.3	6.7	5.3	6.3	6.7	6.4
Prosperity	3.7	8.0	6.0	8.0	6.0	6.0	7.0	7.3	5.7	6.7	5.3	6.3
Syrah (LTP-11-41)	6.0	5.0	6.7	7.3	7.3	6.7	5.7	6.0	5.7	7.3	6.3	6.3
A11-40	7.3	4.7	7.3	7.7	8.0	5.7	5.0	5.7	6.0	7.3	7.7	6.2
A99-2897	5.7	6.7	6.3	6.0	6.7	6.0	5.7	6.3	6.3	6.0	6.7	6.2
A16-7	4.7	7.3	6.3	6.0	7.0	7.0	5.7	6.3	6.0	5.7	6.3	6.2
A13-1	5.0	5.0	6.7	5.3	6.7	6.3	5.7	5.3	5.7	6.7	7.0	6.1
Bombay (GO-22B230)	4.3	5.0	7.0	7.3	6.7	7.0	6.0	6.0	5.7	6.0	6.0	6.1

A16-1	6.7	5.3	7.0	6.7	6.7	6.0	5.7	6.3	5.7	6.3	6.7	6.1
Babe	6.7	5.7	6.7	7.0	6.7	6.7	5.3	5.0	5.7	6.7	7.0	6.1
KH3492	7.0	5.7	6.7	7.7	6.3	5.7	6.0	5.3	5.3	6.7	7.3	6.1
DLFPS-340/3364	5.3	6.7	6.0	5.3	4.7	6.3	6.0	5.7	6.0	6.3	6.0	6.1
DLFPS-340/3551	6.3	6.3	6.0	6.7	6.3	6.0	5.3	6.7	6.3	5.7	6.3	6.1
DLFPS-340/3552	5.7	4.7	6.3	6.7	6.3	6.0	6.3	5.7	5.3	6.3	6.7	6.1
A16-2	7.0	5.3	6.0	7.0	7.7	5.7	6.0	5.3	5.3	6.7	7.3	6.1
Barserati (BAR PP 110358)	7.0	5.0	6.7	7.3	6.3	6.0	5.7	6.0	6.3	6.3	5.7	6.0
Finish Line (NAI-14-178)	7.7	6.3	7.3	7.0	6.3	6.0	6.0	5.7	5.3	5.7	7.3	6.0
Shamrock	7.3	5.3	6.0	7.3	7.3	6.0	5.7	5.0	5.7	7.0	6.7	6.0
PST-K11-118	5.3	5.3	6.3	6.7	7.0	5.3	6.0	5.7	5.7	6.3	7.0	6.0
Pivot	4.7	8.0	6.3	7.3	6.3	5.3	5.3	6.3	5.7	6.7	6.3	5.9
Starr (GO-2628)	4.0	6.3	6.3	7.3	6.7	6.0	5.3	6.0	5.7	6.3	6.3	5.9
PPG-KB 1304	8.0	6.0	6.7	6.7	6.0	6.0	5.3	5.7	6.0	6.3	6.3	5.9
Aviator II (NAI-15-84)	6.3	6.3	6.0	6.3	6.3	6.0	5.7	6.0	6.0	6.3	5.3	5.9
A16-17	7.3	4.7	6.7	7.0	7.0	5.7	5.7	5.7	5.7	5.7	7.0	5.9
Orion (PST-K13-143)	5.7	5.7	7.0	7.0	6.7	5.3	5.0	5.3	6.0	7.0	6.3	5.8
Blue Knight	3.3	7.0	6.7	5.7	5.0	6.7	5.7	6.0	5.3	5.3	5.7	5.8
DLFPS-340/3446	5.3	5.7	6.3	6.0	5.3	6.3	5.7	5.0	5.0	6.3	6.3	5.8
DLFPS340/3444	6.7	5.3	6.7	6.0	6.3	6.0	6.0	5.3	5.7	6.0	5.7	5.8
PPG-KB 1320	2.7	6.3	6.3	7.7	7.3	5.3	6.0	5.7	5.3	6.0	6.3	5.8
NK-1	6.3	5.3	5.7	5.3	7.3	6.0	5.3	5.3	5.3	6.0	6.3	5.7
Yellow Stone (A12-7)	6.3	5.3	6.7	6.7	5.7	6.0	5.7	5.7	5.0	6.3	5.7	5.7
BAR PP 71213	5.7	4.0	6.3	6.7	7.3	5.3	5.0	5.3	6.0	6.3	6.0	5.7
Jersey (NAI-A16-3)	6.0	5.0	6.3	6.3	6.7	6.3	6.0	5.0	5.0	5.3	6.3	5.7
DLFPS340/3438	5.7	5.0	6.0	6.0	6.7	6.0	5.3	5.7	5.0	5.7	6.3	5.7
RAD-1776	6.7	5.0	7.7	7.0	6.7	5.3	5.0	6.0	5.3	5.3	6.7	5.6
Skye	6.0	6.0	6.7	6.7	6.0	6.3	5.0	5.3	5.3	5.3	6.3	5.6
A12-34	5.0	6.3	6.7	5.7	5.0	6.0	5.3	5.7	5.3	5.7	5.7	5.6
A06-8	6.3	6.7	6.7	6.7	6.7	6.0	5.7	5.3	4.7	5.7	6.3	5.6
BAR PP 7309V	6.3	4.3	6.3	5.3	6.3	6.3	5.0	5.0	5.0	5.7	6.3	5.6
A11-26	4.3	6.0	7.3	5.3	6.0	7.0	6.0	5.7	4.7	4.7	5.3	5.6
PST-K15-157	7.0	6.0	7.0	5.3	6.0	5.7	6.0	5.3	5.3	5.0	6.0	5.6
AKB3179	5.0	5.0	7.0	6.7	7.0	6.3	5.3	4.0	4.7	6.0	6.7	5.5
BAR PP 7K426	5.0	4.7	6.3	6.3	6.7	6.0	4.0	5.3	5.3	5.7	6.7	5.5

A15-6	6.3	6.0	5.7	6.0	6.7	6.0	4.7	5.3	5.0	6.0	6.0	5.5
AKB3241	4.3	6.3	5.7	6.0	5.7	6.3	4.7	5.0	5.0	6.0	5.7	5.4
PST-T14-39	6.7	7.0	7.0	5.7	7.0	5.3	5.0	5.0	5.0	6.0	6.3	5.4
BAR PP 7236V	6.7	4.7	6.7	6.3	7.0	5.3	4.7	5.0	5.3	6.3	5.7	5.4
PST-K15-172	5.3	5.7	6.0	6.3	6.0	5.7	5.3	5.7	4.7	5.3	5.7	5.4
DLFPS340/3494	3.7	6.0	5.7	5.0	5.0	5.7	5.0	6.3	5.3	4.7	5.0	5.3
DLFPS340/3549	6.0	5.0	6.0	5.7	5.7	6.3	5.7	4.3	5.0	5.0	5.3	5.3
Paloma (PST-K13-139)	6.0	5.0	6.3	6.3	5.0	5.7	5.3	4.7	5.0	5.7	5.3	5.3
DLFPS-340/3548	5.3	5.0	6.0	6.3	5.7	5.3	5.0	4.7	5.0	6.0	5.3	5.2
AKB3128	6.3	5.7	6.0	5.0	6.0	5.0	4.7	5.0	4.7	5.3	6.3	5.2
DLFPS-340/3455	7.0	5.0	6.3	6.0	6.0	5.3	4.3	5.0	4.7	5.7	6.0	5.2
A10-280	7.7	6.0	6.0	5.0	6.0	4.7	5.7	5.3	4.3	5.3	5.7	5.2
PST-K15-167	2.7	5.7	5.7	6.0	6.3	5.3	5.0	5.0	4.3	5.7	5.7	5.2
NAI-14-128	5.3	6.0	6.0	6.7	4.7	6.7	4.7	4.0	4.0	5.7	5.3	5.1
RAD 553	5.3	5.0	6.3	5.3	5.3	5.0	4.7	5.3	5.0	5.0	5.0	5.0
Barvette HGT®	8.0	4.7	7.0	6.7	6.3	4.7	5.0	4.7	4.0	5.7	5.7	4.9
NAI-14-132	5.3	6.0	6.3	6.7	5.7	6.7	4.3	4.3	3.7	5.0	5.3	4.9
PST-K13-141	6.0	5.3	6.7	5.3	5.0	5.7	4.7	5.0	4.7	4.7	4.7	4.9
Selway	5.3	6.3	8.3	7.0	5.3	4.7	4.0	4.7	5.0	5.0	5.3	4.8
NAI-14-122	5.7	6.3	6.3	6.0	5.7	6.7	4.0	4.0	4.0	4.3	5.3	4.7
A11-38	5.7	5.3	6.3	5.7	5.3	5.7	4.0	4.0	4.3	4.7	5.3	4.7
Amaze (NAI-14-133)	5.3	5.3	6.0	6.3	4.7	6.0	3.7	4.0	4.3	5.0	4.7	4.6
Heartland (NAI-14-187)	4.0	6.3	6.0	5.7	4.3	6.7	3.7	4.0	3.3	4.0	5.0	4.4
Comanche (NAI-14-176)	4.3	6.3	6.0	5.3	4.3	6.0	4.3	4.0	3.7	3.7	4.7	4.4
MVS-130	3.7	5.3	5.7	4.7	4.7	5.7	4.0	4.0	3.3	4.0	4.7	4.3
Kenblue	6.3	4.7	7.0	5.3	4.0	3.7	3.3	4.7	3.7	4.3	4.3	4.0
$LSD_{0.05}$	1.27	1.25	1.00	1.54	1.38	1.17	1.23	1.10	1.25	1.64	1.45	0.81
CV%	14.8	13.1	9.6	14.7	13.5	11.9	13.7	12.1	14.2	16.9	14.4	8.6

Acknowledgements: This project is funded by the National Turfgrass Evaluation Program

NATIONAL TURFGRASS EVALUATION PROGRAM (NTEP)
2016 PERENNIAL RYEGRASS TEST – 2020 RESULTS

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INTRODUCTION

Perennial ryegrass is one of the more popular cool season turfgrass species. Perennial ryegrasses are often mixed as blends with other perennial ryegrass cultivars or added to mixtures that contain other turfgrass species. Perennial ryegrass is utilized for many turfgrass areas including golf courses, athletic fields, home lawns, parks, and corporate lawns. Characteristics that make perennial ryegrass desirable are: its rapid germination and establishment rate, it maintains a dense, dark green color, it can be maintained at mowing heights as low as one half inch, it has good wear tolerance, and it is compatible with mixtures that also contain Kentucky bluegrass and fine leaf fescue. Limitations of perennial ryegrass are that it exhibits poor tolerance to cold temperatures, it does not tolerate prolonged drought, and it is susceptible to gray leafspot disease. Perennial ryegrass is best adapted to moist, moderately fertile soils.

The National Turfgrass Evaluation Program (NTEP) is sponsored by the Beltsville Agriculture Research Center and the National Turfgrass Federation Inc. NTEP works with breeders and testing sites throughout the United States in evaluating turfgrass species and cultivars. Results from turfgrass evaluations can aid professionals in their selection of turfgrass species/cultivars that best meet their needs. Results also aid breeders in selecting new cultivars that they may put into production, as well as helping in marketing their varieties. In 2016 NTEP selected thirteen standard testing sites and ten ancillary test locations for the 2016 National Perennial Ryegrass Test. The University of Connecticut, Plant Science Teaching and Research Facility in Storrs CT, was selected as a standard site for the 2016 Perennial Ryegrass Test. NTEP trials typically run for five years, The 2016 Perennial Ryegrass trial will run through the 2021 growing season.

MATERIALS AND METHODS

One hundred and fourteen Perennial ryegrass cultivars were seeded on September 9, 2016 in Storrs Connecticut. A complete randomized block design with 3 replicates of each cultivar was utilized for this study. Plot size is 3' X 5'. Sponsors and entries are listed in Table 1.

MANAGEMENT PRACTICES

Since establishment, all plots and cultivars received the same management protocol throughout the study. Management practices for 2020 were as follows:

Mowing - Plots were maintained at a mowing height of 2.25 inches and mowed two times per week. Clippings are returned.
Irrigation – Supplemental irrigation is applied only at times of severe drought.

Fertilizer and pesticide applications for 2020
Apr 17- Prodiamine @ .55 fl oz/m
May 5, - 1#N/m using 25-0-12 (60% SCU
May 25- Acelepryn @ .365 fl oz/m.
July 2- 1 #N/m using 25-0-12 (60% SCU)
Oct. 4 -1#N/m was applied using 25-0-12 (60% SCU).
Nov. 6- T Zone at a rate of 1.35 fl oz/m.

DATA COLLECTION

Spring Green-up Ratings - Spring green-up ratings were taken and recorded (Table 2) on April 7, 2020. Green-up measures the transition from winter dormancy to active spring growth. Ratings were based on a scale of 1-9, with 1 equaling brown turf and 9 equaling dark green turf.

Genetic Color Ratings - Genetic color ratings (Table 2) were taken in the late spring (June 25, 2020) while the grass was actively growing and not under stress conditions. Ratings were based on visual color with 1 being light green and 9 being dark green. Areas of plots that contained browning tissue (chlorosis or necrotic) from outside factors such as disease were not considered for genetic color (Table 2).

Quality Ratings - Turfgrass quality ratings were taken monthly for overall turf quality (color / leaf texture / density) during the 2019 growing season. Overall turfgrass quality was determined using a visual rating system of 1-9. A score of 1 illustrates the poorest quality turf and 9 the highest quality. Turf plots rated with a score of less than six are deemed unacceptable. Monthly quality and mean quality ratings are provided in table 2.

RESULTS & DISCUSSION

Results for spring green up, genetic color, and monthly quality ratings, are provided in Table 2.

General observations noted during the 2020 growing season were: mean quality values for overall quality continue to illustrate that there is little diversity between cultivars. Cultivar RRT had the highest mean quality rating at 7.2. For 2020 there were 10 cultivars that were not significantly different when compared to the top variety (RRT). A total of 42 cultivars had a mean quality score greater than 6. Linn exhibited the poorest overall turf quality.

Table 1- Sponsors and Entries 2016 NTEP Perennial Ryegrass Trial			
ENTRY	**SPONSOR**	**ENTRY**	**SPONSOR**
021	Scotts Miracle-GRO	Cayman (GO-143)	Grassland Oregon
Hatrick (BSP-17)	Bailey Seed and Grain	APR2612	ProSeeds Marketing
Fireball (BWH)	Bailey Seed and Grain	APR3060	Pennington
Tee-Me-Up (BSP-25)	Bailey Seed and Grain	Green Supreme+ (AMP-R1)	AMPAC Seed
Savant	Ledeboer Seed	DLFPS-236/3546	DLF Pickseed USA
LPB-SD-105	Ledeboer Seed	DLFPS-236/3547	DLF Pickseed USA
Saguaro	Ledeboer Seed	DLFPS-236/3548	DLF Pickseed USA
LPD-SD-104	Ledeboer Seed	PR-6-15	Columbia Seed
Mensa	Ledeboer Seed	DLFPS-236/3550	DLF Pickseed USA
LPD-SD-101	Ledeboer Seed	DLFPS-236/3552	DLF Pickseed USA
LPD-SD-102	Ledeboer Seed	023	Brett Young Seeds
LPD-SD-103	Ledeboer Seed	Paragon 2 GLR (FP2)	Turf Merchants
DLFPS-236/3540	DLF Pickseed USA	02BS2	Brett Young Seeds
DLFPS-236/3542	DLF Pickseed USA	Alloy (RRT)	Scotts Miracle-GRO
DLFPS-236/3544	DLF Pickseed USA	Slider LS (PPG-PR 241)	Mountain View Seeds
Intense	Landmark Turf and Native Seed	Fastball 3GL (PPG-PR 329	Mountain View Seeds
Xcelerator	Landmark Turf and Native Seed	Paradox GLR (PPG-PR 331)	Turf Merchants
Spike GLS (UF3)	Landmark Turf and Native Seed	Derby Extreme	Standard
JR123	Jacklin Seed by Simplot	Apple 3GL (PPG-PR 339)	Mountain View Seeds
JR747	Jacklin Seed by Simplot	Slugger 3GL (PPG-PR 343)	Mountain View Seeds
JR 888	Jacklin Seed by Simplot	PPG-PR 360	Integra Turf
AllStar Fore (DLFPS-236/3541)	DLF Pickseed USA	PPG-PR 367	Mountain View Seeds
SR 4700 (DLFPS-236/3543)	DLF Pickseed USA	PPG-PR 370	Lewis Seed
DLFPS-236/3545	DLF Pickseed USA	PPG-PR 371	Turf Merchants
Evolve	SiteOne Landscape	PPG-PR 372	Columbia Seeds
MRSL-PR16	SiteOne Landscape	PPG-PR 385	Mountain View Seeds
PL2	SiteOne Landscape	Homerun LS (PPG-PR 419)	Mountain View Seeds
MRSL-PR15	SiteOne Landscape	Superstar GL (PPG-PR 420)	Peak Plant Genetics
Nexus (SNX)	Smith Seed Services	PPG-PR 421	Proseeds Marketing
Signet	Smith Seed Services	PPG-PR 422	Columbia Seeds
Shield (02BS4)	Smith Seed Services	PPG-PR 423	Peak Plant Genetics
CS-6	Columbia Seed	Stellar 4GL (PPG-PR 424)	Peak Plant Genetics
DLFPS-236/3556	DLF Pickseed USA	Karma	Standard
ASP0116EXT	Allied Seed	SR 4650	Standard
ASP0117(A-PR15)	Allied Seed	DLFPS-236/3538	DLF Pickseed USA
ASP0118GL(A-4G)	Allied Seed	Grand Slam GLD	Standard
ASP0218 (A-6D)	Allied Seed	Furlong (LTP-FCB)	Lebanon Seaboard
NP-3	Pennington Seed	BAR LP 6117	Barenbrug USA

Table 1 (continued) - Sponsors and Entries			
ENTRY	**SPONSOR**	**ENTRY**	**SPONSOR**
NP-2	Pennington Seed	BAR LP 6131	Barenbrug USA
APR2616	Pennington Seed	BAR LP 6159	Barenbrug USA
GO-141	Grassland Oregon	BAR LP 6233	Barenbrug USA
GO-141	Grassland Oregon	PST-2Foxy	Pure Seed Testing
Silver Sport (PST-2CRP)	Rose Agri-Seed	BAR LP 6165	Barenbrug USA
PST-2EGAD	Pure Seed Testing	Overdrive 5G	Burlingham Seeds
Gray Hawk (PST-2Find)	Pure Seed Testing	02BS1	ProSeeds
PST-2EGAD	Pure Seed Testing	CPN	Columbia seeds
PST-2BDT	Grassland Oregon	JR-197	Jacklin Simplot
PST-2MAY	Pure Seed Testing	DLFPS-238/3014	DLF Pickseed USA
Gray Wolf (PST-2 GAL	Rose Agri-Seed	Pepper II RAD-PR 103)	Lewis Seed Company
PST-2PDA	Pure Seed Testing	RAD-PR 112	Baily Seed
PST-2A2	Pure Seed Testing	UMPQUA	Vista Seed Partners
DLFPS-236/3553	DLF Pickseed USA	Seabiscuit	Lebanon Seaboard
Fiesta Cinco (DLFPS-236/3554)	DLF Pickseed USA	Man O'War	Lebanon Seaboard
PR-5-16	Columbia Seeds	Pharaoh	Lebanon Seaboard
BAR LP 6158	Barenbrug USA	Allstar III	Standard
BAR LP 6162	Barenbrug USA	Brightstar SLT	Standard
BAR LP 6164	Barenbrug USA	Linn	Standard

Figure 1 – 2016 NTEP National Perennial Ryegrass Test, University of Connecticut

Table 2. Perennial Ryegrass NTEP results 2020 for spring green-up, genetic color (ratings 1-9, where 9 equals darker green), turfgrass quality (rating 1-9, where 9 equals the highest turf quality). Table is listed with highest mean quality cultivars listed first.

	Spring Green Up	Genetic color	Quality						
Entry	4/7	6/25	5/17	6/9	7/17	8/14	9/24	10/27	mean
RRT	6.3	7.7	7.3	6.7	7.3	6.7	8.0	7.0	7.2
NP-3	6.3	7.7	7.3	6.3	7.3	6.7	7.0	7.0	6.9
Stellar 4GL (PPG-PR 424)	7.0	7.0	7.3	7.3	6.3	6.7	6.0	7.3	6.8
DLFPS-236-3546	5.7	7.3	7.3	6.7	6.7	7.0	5.7	7.3	6.8
Superstar GL (PPG-PR 420)	5.7	7.3	7.3	6.7	6.0	6.7	6.3	7.3	6.7
DLFPS-236/3538	6.3	7.3	7.0	6.0	7.0	6.7	6.3	7.0	6.7
Savant	4.7	6.0	8.0	7.7	6.7	6.3	5.0	6.3	6.7
JR-197	6.7	8.0	7.0	6.3	6.0	6.7	6.0	7.7	6.6
UMPQUA	6.3	6.7	7.3	6.3	6.7	5.7	6.3	7.3	6.6
DLFPS-236/3545	6.3	7.3	6.7	5.7	7.0	7.3	6.0	6.7	6.6
DLFPS-236-3552	6.3	7.7	6.7	6.7	5.7	7.0	6.3	7.0	6.6
Homerun 419 (PPG-PR 419)	6.3	7.0	7.3	7.0	6.3	6.7	5.7	6.3	6.6
DLFPS-236-3547	6.3	7.0	7.0	6.7	6.0	6.3	6.3	6.7	6.5
DLFPS-236-3548	5.0	7.0	6.7	6.7	6.0	6.0	5.7	7.3	6.4
Shield (02BS4)	6.7	7.0	7.3	6.3	6.0	6.3	5.3	6.7	6.3
Fiesta Cinco (DLFPS-236/3554)	4.7	6.7	6.7	6.0	6.7	6.7	5.3	6.7	6.3
Mensa	5.0	6.7	7.0	7.0	6.0	6.3	5.0	6.7	6.3
PL2	7.0	7.3	7.3	6.7	5.7	5.7	6.0	6.7	6.3
02BS2	7.0	6.7	6.3	6.3	5.3	6.3	6.0	7.3	6.3
CPN	6.7	6.7	7.3	5.7	6.0	5.7	6.0	7.0	6.3
DLFPS-236/3540	6.0	7.0	6.3	6.3	6.3	6.7	5.0	7.0	6.3
PPG-PR 360	6.3	7.3	6.7	6.3	6.7	6.0	6.0	6.0	6.3
PPG-PR 370	5.0	7.3	6.7	5.7	6.3	6.0	6.3	6.7	6.3
PPG-PR 421	6.7	7.3	6.3	6.7	7.0	6.3	5.3	6.0	6.3
PR-6-15	5.3	7.3	6.0	6.7	6.7	6.3	5.3	6.7	6.3
JR-123	7.3	7.0	7.3	5.7	6.3	5.7	5.7	6.7	6.2
LPB-SD-102	4.0	7.7	6.0	6.3	6.7	6.0	6.0	6.3	6.2
23	6.0	6.7	7.0	6.3	6.3	6.3	5.0	6.0	6.2
DLFPS-236/3553	5.7	6.7	6.3	6.0	6.3	6.3	6.0	6.0	6.2
Man O"War	6.7	6.3	6.7	5.3	6.0	5.7	6.7	6.7	6.2
Slider LS (PPG-PR 241)	6.3	7.3	6.3	6.3	6.3	5.7	5.7	6.7	6.2
PPG-PR 371	5.7	7.0	6.7	6.0	6.0	5.3	6.0	7.0	6.2
Pharaoh	7.7	7.0	6.3	6.3	5.7	6.3	5.3	6.7	6.1
PST-2A2	6.0	6.3	6.7	6.3	6.0	6.0	5.7	6.0	6.1
SR 4700 (DLFPS-236/3543)	6.3	7.7	6.3	6.0	5.7	6.7	5.0	6.7	6.1
PR-5-16	6.0	6.7	6.7	6.3	6.0	6.0	5.3	6.0	6.1
LPB-SD-101	4.3	7.0	6.3	6.7	6.7	5.7	5.0	5.7	6.0
PPG-PR 367	7.0	7.0	6.0	5.3	5.3	6.0	6.7	6.7	6.0
PPG-PR 372	6.3	7.7	6.7	6.0	5.7	5.7	5.3	6.7	6.0

PPG-PR 423	5.7	7.3	6.3	6.3	6.3	5.3	6.0	5.7	6.0
PST-2FOXY	5.7	7.7	6.7	6.3	5.7	6.0	5.7	5.7	6.0
Signet	6.7	7.0	7.0	5.7	6.0	5.7	5.3	6.3	6.0
DLFPS-236/3544	6.0	6.3	6.0	6.0	5.7	5.3	5.3	7.3	5.9
DLFPS-236-3556	6.0	6.3	6.7	6.0	5.7	5.7	5.7	6.0	5.9
Grand Slam GLD	5.7	7.0	6.3	6.0	5.7	5.7	5.3	6.7	5.9
Paradox GLR (PPG-PR 331)	6.7	7.0	6.7	6.7	5.7	5.7	4.7	6.3	5.9
DLFPS-236-3550	5.7	7.0	7.0	6.0	5.3	5.7	5.0	6.3	5.9
JR-747	4.0	6.3	5.7	6.7	6.0	6.0	4.7	6.3	5.9
JR-888	5.0	6.3	7.3	7.0	6.3	5.0	4.7	5.0	5.9
Karma	5.0	6.7	6.3	6.0	5.3	5.3	6.0	6.3	5.9
Furlong FCB (LTP-FCB)	6.3	7.7	6.3	6.3	6.0	5.3	5.0	6.3	5.9
DLFPS-236/3542	5.3	7.3	6.3	6.3	5.0	5.7	5.7	6.0	5.8
Overdrive 5G	6.7	6.7	6.3	6.0	5.7	5.0	5.3	6.7	5.8
Apple 3GL (PPG-PR 339)	6.3	7.3	6.7	5.7	6.0	5.0	5.3	6.3	5.8
PST-2GTD	6.3	6.7	6.0	6.0	5.3	5.7	5.7	6.3	5.8
PST-2MAY	6.3	7.3	6.3	5.7	5.3	5.3	5.7	6.7	5.8
APR2616	5.7	7.0	5.7	5.7	5.3	5.7	6.3	6.0	5.8
Slugger 3GL (PPG-PR 343)	6.3	7.0	6.7	6.0	5.3	5.7	5.7	5.3	5.8
PPG-PR 422	6.0	7.3	6.0	6.0	6.3	5.3	5.3	5.7	5.8
SR4650	5.3	6.7	6.3	6.0	5.3	5.0	5.0	6.7	5.7
Derby Xtreme	5.3	6.7	6.0	5.7	5.7	5.7	5.3	5.7	5.7
AllStar Fore (DLFPS-236/3541)	5.7	7.0	6.3	5.7	5.0	5.7	5.3	6.0	5.7
LPB-SD-104	3.3	6.3	5.7	7.0	5.7	5.0	4.7	6.0	5.7
LPB-SD-105	4.3	6.7	6.7	7.0	6.0	5.3	4.0	5.0	5.7
NP-2	6.3	7.3	6.7	5.7	5.3	5.0	5.3	6.0	5.7
Fastball 3GL (PPG-PR 329)	6.0	7.0	6.7	5.0	5.7	5.7	5.3	5.7	5.7
PPG-PR 385	6.3	6.7	6.3	6.0	5.7	5.3	4.7	6.0	5.7
Xcelerator	6.3	6.7	6.3	6.0	5.3	5.7	4.7	6.0	5.7
Gray Wolf (PST-2GAL)	6.0	7.0	6.3	6.0	5.3	5.3	5.3	5.3	5.6
Intense	6.3	7.3	6.0	5.3	5.3	5.3	5.3	6.0	5.6
02BS1	6.3	7.0	5.7	6.0	5.3	5.0	5.0	6.0	5.5
ASP0118GL (A-4G)	5.0	7.3	6.0	5.7	5.3	5.7	5.0	5.3	5.5
ASP0218 (A-6D)	5.3	7.3	6.0	5.3	5.0	5.7	5.0	6.0	5.5
PST-2BDT	6.0	6.7	6.0	5.3	4.3	5.0	5.3	7.0	5.5
Saguaro	4.3	6.7	6.7	5.7	5.0	5.3	4.7	5.7	5.5
Spike (UF3)	5.7	7.3	5.3	5.3	6.0	5.3	5.3	5.7	5.5
ASP0117 (A-PR15)	6.0	7.7	6.3	5.7	5.0	5.7	5.0	5.0	5.4
Seabisquit	7.0	6.3	6.0	5.3	5.3	4.7	5.3	6.0	5.4
Allstar III	5.0	6.3	5.3	5.3	5.0	5.0	5.3	6.3	5.4
BAR LP 6164	6.7	6.0	6.0	5.3	5.0	5.0	5.7	5.3	5.4
BAR LP 6165	6.0	4.7	5.0	5.3	5.0	5.7	6.0	5.3	5.4
Belize (GO-142)	4.7	6.7	5.7	6.0	4.7	5.3	5.3	5.3	5.4
21	6.3	6.3	5.7	5.3	5.7	5.0	5.0	5.3	5.3

BAR LP 6117	4.7	5.7	5.7	5.0	5.0	5.0	5.7	5.7	5.3
BAR LP 6131	4.7	5.3	6.3	6.0	4.7	4.7	5.3	5.0	5.3
BAR LP 6233	6.7	6.0	5.3	5.3	5.3	5.7	4.7	5.3	5.3
Evolve	6.0	6.0	6.0	5.3	4.7	4.7	5.3	5.3	5.2
GO-141	5.7	7.0	6.0	5.0	4.7	4.3	5.0	6.3	5.2
MRSL-PR15	5.3	7.7	5.7	5.0	5.0	5.0	5.0	5.7	5.2
Hatrick (BSP-17)	5.0	8.7	5.3	5.3	5.0	5.0	5.3	5.0	5.2
Paragon ll GLR (FP2)	6.3	6.7	6.3	5.0	4.7	5.0	4.7	5.3	5.2
PST-2EGAD	5.7	7.3	5.3	5.0	5.0	4.3	5.7	5.7	5.2
Green Supreme + (AMP-R1)	5.7	7.3	5.3	5.0	5.0	4.7	5.3	5.3	5.1
APR2612	5.3	6.7	5.0	5.0	5.0	4.7	5.0	5.7	5.1
BAR LP 6159	6.0	5.7	5.0	4.7	5.0	5.0	5.0	5.7	5.1
Brightstar SLT	4.7	5.7	5.3	4.7	4.7	4.7	5.0	5.7	5.0
LPB-SD-103	5.0	6.7	5.7	5.0	4.7	5.7	4.3	4.7	5.0
PST-2PDA	6.3	6.0	5.3	5.0	5.0	4.7	4.7	5.3	5.0
Gray Hawk (PST-2FIND)	5.7	7.3	5.0	5.0	4.7	4.3	4.7	6.0	4.9
Fireball (BWH)	5.3	8.0	5.0	5.0	5.0	4.3	5.0	5.0	4.9
Nexus GT (SNX)	5.7	7.3	5.0	5.0	4.7	4.7	5.0	5.0	4.9
Tee-Me-Up (BSP-25)	4.3	8.0	5.3	5.0	5.0	4.3	4.0	5.3	4.8
Silver Sport (PST-2CRP)	5.3	7.0	5.7	5.0	5.3	4.0	4.0	5.0	4.8
BAR LP 6158	5.0	6.0	5.0	4.3	4.7	4.7	5.0	5.0	4.8
Cayman (GO-143)	5.3	7.7	5.3	4.7	4.7	4.3	4.7	5.0	4.8
APR3060	5.3	7.3	5.3	5.0	4.3	4.7	4.3	4.7	4.7
CS-6	5.3	6.3	5.0	4.7	4.3	4.3	5.0	5.0	4.7
DLFPS-238/3014	5.7	6.0	4.7	4.7	4.3	4.3	5.3	5.0	4.7
RAD-PR-112	4.3	7.0	4.7	4.7	4.3	3.7	5.3	5.3	4.7
MRSL-PR16	5.3	6.7	5.3	5.0	4.0	4.0	4.7	4.7	4.6
Pepper ll (RAD-PR-103)	6.0	7.7	4.7	4.3	4.7	4.3	5.0	4.3	4.6
ASP0116EXT	4.3	7.7	4.7	5.0	4.3	4.0	4.0	5.0	4.5
BAR LP 6162	4.3	5.7	5.0	4.3	4.0	4.3	4.7	4.7	4.5
Linn	5.3	3.0	3.0	3.0	3.0	2.0	2.7	3.0	2.8
$LSD_{0.05}$	1.32	1.08	1.13	1.05	1.05	1.28	1.31	1.44	0.75
CV%	14.3	9.8	11.4	11.4	11.8	14.6	15.2	15.0	8.2

Acknowledgements: This project is funded by the National Turfgrass Evaluation Program

NATIONAL TURFGRASS EVALUATION PROGRAM (NTEP)
2015 STANDARD AND ANCILLARY LOW INPUT COOL SEASON TEST – 2020 RESULTS

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INTRODUCTION

There has been increased interest to develop new plant management strategies, or to investigate new plant systems that require less input such as water, fertilizer, and pesticides. Overall quality and functionality are still desired. This trial is unique because after the establishment period, maintenance has been minimal. No supplemental water, fertilizer or pesticides have been applied. The only exception is with the ancillary trial, where one preemergent application was made in the first year of the study. Also unique about this trial is that it not only includes single turfgrass cultivars, but it also includes, blends, mixtures and mixtures with grass and non-grass species.

In 2015, the National Turfgrass Evaluation Program (NTEP) selected thirteen standard testing locations and thirteen ancillary test locations for their 2015 Low Input Cool-Season Trials. The University of Connecticut, Plant Science Teaching and Research Facility in Storrs CT, was selected for both a Standard and Ancillary site. The duration of this study is five years and concluded this past fall (2020).
The National Turfgrass Evaluation Program (NTEP) is sponsored by the Beltsville Agriculture Research Center and the National Turfgrass Federation Inc. NTEP works with breeders and testing sites throughout the United States in evaluating turfgrass species and cultivars. This low input study differs from conventional NTEP trials in two ways. One is that many of the entries are not single cultivars or varieties being evaluated, they contain mixtures. The second difference is that many of the entries contain non-turfgrass species. Results from this trail may aid homeowners and professionals in their selection of low input species and mixtures that provide a suitable ground cover that will require less water, fertility, and mowing.

MATERIALS AND METHODS

Two low-input trials were seeded on September 14, 2015 in Storrs Connecticut. One trial was a "standard" test while the second trial was an "ancillary" test. Each test consisted of thirty-two entries (Table 1) containing different species, different mixtures, and different compositions. Both, the ancillary and standard trial contained the same entries and received the same maintenance regimes. The only difference between the two trials was that the ancillary trial received a preemergent application for weeds in the spring of 2016. Sponsors and entries are listed in Table 1. A complete randomized block design with three replicates of each cultivar was utilized for each study. Plot size is 5' X 5'.

ESTABLISHMENT MANAGEMENT PRACTICES

After seeding, plots were covered to aid in germination and to reduce any chances of seed migration. All plots for each study received the same management protocol since establishment.

Mowing (Standard and Ancillary trials) - Plots are maintained at a mowing height of 3.5" inches and mowed when no more than 1/3 of the leaf is removed.

Irrigation Regime (Standard and Ancillary trials) - No irrigation

Fertilizer and pesticide applications (2015/2016)

- Standard and Ancillary trials - Plots received a total of 1 pound of nitrogen. 4/22/16
- Standard trial – No Preemergent applied
- Ancillary Trial – Preemergent applied on 4/29/16 (Prodiamine® 4L at .5oz./1000 ft^2)

DATA COLLECTION

Quality Ratings- Quality ratings are taken on a monthly basis throughout the growing season for overall quality (color/density). Overall quality is determined using a visual rating system of 1-9. A score of 1 illustrates the poorest quality and 9 the highest quality. Plots rated with a score of less than six are deemed unacceptable (Table 2 standard test and Table 3 ancillary test).

Percent Living Ground Cover of the Planted Species- Percent living cover ratings were taken after the growing season on September 24, 2020. (Table 2 standard test and Table 3 ancillary test).

Percent grassy and broadleaf weed encroachment Ratings – Weed encroachment ratings are taken twice per year, once in the spring and once in the fall. In 2020, ratings were done on July 17th and September 9th. (Table 2 standard test and Table 3 ancillary test).

RESULTS & DISCUSSION

Evaluating the different species and grasses for visual quality was challenging. This is especially true when comparing broadleaf entries such as clover with straight grass entries or grass and clover mixes. Visual ratings were most influenced by plant density of the original planted species. Many of the plots had a high level of weed encroachment from non-seeded species which negatively impacted their quality ratings. The top entry for quality in both the Standard and ancillary trials was CRS Mix #3 (Tables 2 and 3).
CRS Mix #3, DLFPS-TFAM, and DLFPS ChCrM, and MNHD-15 were the top performers in the standard trial while CRS Mix #3, DLFPS-TFAM, CRS Mix #2, DLFPS ChCrM, and Vitality Low Maintenance Mix were the top entries in the Ancillary trail. (Tables 2 and 3). While Yaak (100% a western yarrow) performed well in the first three years, overall quality was not as good in 2019 or 2020. For the fourth year in a row (2017-2020) Kenblue Kentucky bluegrass and 100% Dutch White Clover had the poorest rating in both trials. Visual

differences between ancillary trial plots (receiving one preemergent application in 2016) and non-ancillary plots (not receiving preemergent applications) have been minimal since the study was established in 2015.

Density ratings indicated that many of the original species planted had died off.

In 2018 -2020 there has been an extremely high level of weed encroachment in many of the plots. Clover is the predominate weed. Interestingly, plots that were seeded with 100% white clover were almost clover free, while plots seeded with mixtures that did not contain clover in the original seed mix were almost completely overtaken by clover. An example was the Kenblue plots. The predominant plant species in the planted Kenblue plots at the end of the 2020 season was clover. A complete population shift. One possible explanation for clover encroachment in many of the plots may be because plots have not received any supplemental nitrogen fertilization since establishment. Encroachment may also be occurring from neighboring plots that had clover in the original seed mix.

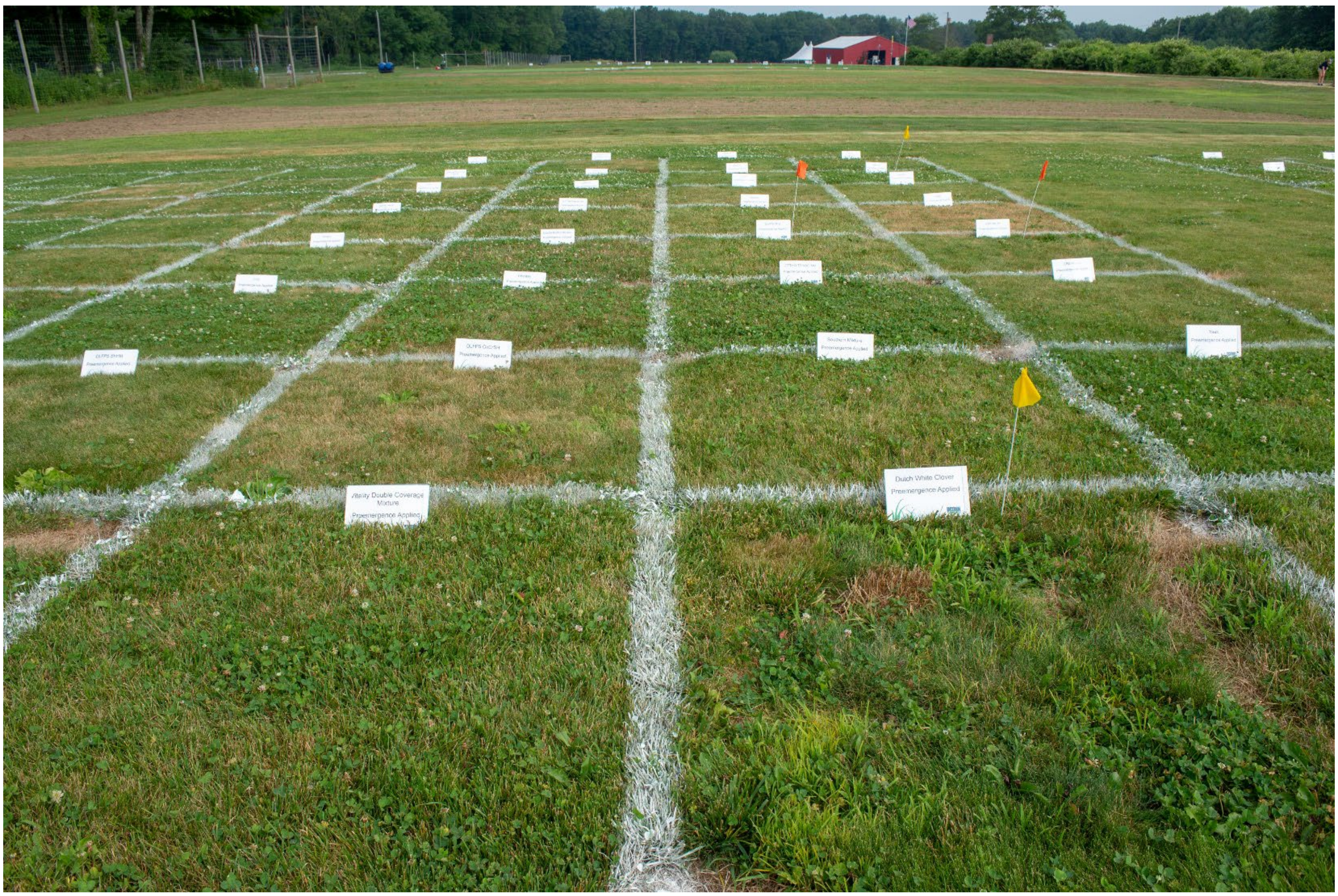

Figure 1- 2015 NTEP Low Input Cool Season Trials University of Connecticut
Photo taken July 2018

Table 1 Entries, Species, and Composition of the 2015 Standard and Ancillary Low Input Cool-Season Tests

PLOT	ENTRY	SPECIES/COMPOSITION	SPONSOR
1	Natural Knit® PRG Mix	50% Mensa perennial ryegrass 50% Savant perennial ryegrass	Ledeboer Seed LLC
2	Bullseye	100% Bullseye tall fescue	Standard entry
3	Bewitched	100% Bewitched Ky. Bluegrass	Standard entry
4	BGR-TF3	100% BGR-TF3 tall fescue	Berger International LLC
5	MNHD-15	100% MNHD-15 hard fescue	University of Minnesota
6	DLFPS TF-A	33% Mustang tall fescue 33% Grande 3 tall fescue 34% Fayette tall fescue	DLF/Pickseed/Seed Research of Oregon
7	DLFPS ChCrM	24% Longfellow 3 chewings fescue 24% Windward chewings fescue 24% Chantilly strong creeping red fescue 25% Ruddy strong creeping red fescue (CRF) 3% Microclover™	DLF/Pickseed/Seed Research of Oregon
8	DLFPS ShHM	32% Quatro sheep fescue 32% Spartan II hard fescue 33% Eureka II hard fescue 3% Microclover™	DLF/Pickseed/Seed Research of Oregon
9	DLFPS TFAM	33% Mustang tall fescue 33% Grande 3 tall fescue 34% Fayette tall fescue 3% Microclover™	DLF/Pickseed/Seed Research of Oregon
10	Vitality Low Maintenance Mixture	80% VNS hard fescue 20% VNS chewings fescue	Landmark Turf & Native Seed
11	Vitality Double Coverage Mixture	90% VNS tall fescue 10% VNS Kentucky bluegrass	Landmark Turf & Native Seed
12	Chantilly	100% Chantilly strong creeping red fescue (CRF)	Standard entry
13	Dutch White Clover	100% Dutch White Clover	Standard entry
14	DLFPS TFAStC	32% Mustang tall fescue 32% Grande 3 tall fescue 33% Fayette tall fescue 3% Strawberry clover	DLF/Pickseed/Seed Research of Oregon
15	DLFPS ChCrSH	14% Longfellow 3 chewings fescue 14% Windward chewings fescue 14% Chantilly strong CRF 14% Ruddy strong CRF	DLF/Pickseed/Seed Research of Oregon
16	Spartan II	100% Spartan II hard fescue	Standard entry
17	Quatro	100% Quatro sheep fescue	Standard entry
18	Ky-31E+	100% Ky-31 tall fescue w/endophyte	Standard entry
19	CRS Mix #1	55% Gladiator hard fescue 45% 4GUD hard fescue	Columbia River Seed
20	CRS Mix #2	67% Gladiator hard fescue 33% NA13-14 Kentucky bluegrass	Columbia River Seed
21	CRS Mix #3	45% Gladiator hard fescue 45% Sword hard fescue 10% Dutch White Clover	Columbia River Seed
22	DTT Tall Fescue Mix	50% DTT20 tall fescue 50% DTT43 tall fescue	Allied Seed

PLOT	ENTRY	SPECIES/COMPOSITION	SPONSOR
23	DTTHO TF/KBG Mix	45% DTT20 tall fescue 45% DTT43 tall fescue 10% Holiday lawn Ky. Bluegrass	Allied Seed
24	A-SFT	100% A-SFT tall fescue	Allied Seed
25	Kingdom	100% Kingdom tall fescue	SiteOne Landscape Supply
26	Resolute (7H7)	100% 7H7 hard fescue	SiteOne Landscape Supply
27	Northern Mixture	40% VNS perennial ryegrass 20% VNS Kentucky bluegrass 20% VNS chewings fescue 20% VNS creeping red fescue	Proseeds Marketing
28	Southern Mixture	70% VNS tall fescue 10% VNS perennial ryegrass 10% VNS Kentucky bluegrass 10% VNS chewings fescue	Proseeds Marketing
29	CS Mix	40% Castle chewings fescue 40% Sword hard fescue 10% Kent creeping red fescue 10% B-15.2415 sheep fescue	Columbia Seeds LLC
30	Yaak	100% Yaak western yarrow	Pacific NW Natives
31	Radar	100% Radar chewings fescue	Standard entry
32	Kenblue	100% Kenblue Kentucky bluegrass	Standard entry

Table 2. NTEP Low Input Standard Test results 2020 spring green-up, percent Living cover for fall, percent weed coverage for summer and fall, and monthly visual quality (rating 1-9, where 9 equals the highest turf quality)

	Spring green up	Percent Living cover planted species	Percent weed coverage			Quality						
Entry	4/7	9/24	7/17	9/28	Mean	5/17	6/9	7/17	8/14	9/24	10/27	Mean
CRS Mix #3	4.7	94.3	5.3	3.3	4.3	6.3	6.0	6.7	7.0	7.3	7.3	6.8
DLFPS-ChCrM	5.3	96.0	21.7	4.3	13.0	5.7	6.0	6.0	5.3	6.0	6.7	5.9
DLFPS-TFAM	6.0	91.0	34.3	7.0	20.7	4.7	5.7	6.0	6.7	6.7	6.0	5.9
MNHD-15	4.0	97.0	20.0	6.7	13.3	5.0	5.7	5.7	6.7	6.7	6.0	5.9
Bullseye	5.7	87.7	25.0	15.0	20.0	5.3	4.7	4.7	6.3	7.0	6.3	5.7
CRS Mix #1	4.3	89.3	30.0	11.7	20.8	5.7	5.7	5.3	5.7	6.0	6.0	5.7
DLFPS TFAStC	6.0	85.0	28.3	21.0	24.7	4.0	6.0	5.3	6.3	6.7	5.7	5.7
Vitality Low Maintenance Mix	5.7	88.3	25.0	19.3	22.2	5.0	5.3	5.3	5.7	6.3	6.0	5.6
7H7	5.3	81.7	18.3	26.7	22.5	4.3	5.7	5.7	5.0	6.0	5.7	5.4
DLFPS ChCrSH	5.0	76.7	31.7	7.7	19.7	5.3	5.7	5.0	5.0	5.0	6.3	5.4
DLFPS-ShHM	4.3	70.0	18.3	15.0	16.7	5.3	6.0	5.0	5.3	5.0	5.7	5.4
CRS Mix #2	5.7	91.7	31.7	11.7	21.7	5.3	4.7	4.7	5.7	5.7	5.3	5.2
CS Mix	4.7	88.3	55.0	18.3	36.7	5.3	5.3	4.3	5.7	5.3	5.3	5.2
BGR-TF3	5.0	66.7	33.3	25.0	29.2	5.0	5.3	5.0	5.0	5.0	5.3	5.1
Ky-31 E+	5.7	80.0	45.0	8.3	26.7	5.0	3.7	5.3	5.7	5.3	5.7	5.1
DLFPS TF-A	5.3	70.0	38.3	31.7	35.0	5.0	5.7	5.0	4.3	4.7	5.7	5.1
Spartan II	4.3	86.7	51.7	23.3	37.5	3.7	5.7	4.7	5.3	5.7	5.3	5.1
Vitality Double Coverage Mix	5.0	53.3	31.7	30.0	30.8	5.0	5.0	4.3	5.3	5.0	4.7	4.9
DTT Tall Fescue Mix	6.0	73.3	61.7	36.7	49.2	3.3	5.0	4.7	5.7	6.0	4.3	4.8
Chantilly	6.7	73.3	66.7	43.3	55.0	4.0	5.0	4.3	4.7	4.7	5.0	4.6
DTTHO TF/KBG Mix	5.3	75.0	51.7	33.3	42.5	3.7	4.3	4.7	5.3	5.3	4.0	4.6
Kingdom	5.0	73.3	61.7	30.0	45.8	3.0	4.3	4.0	5.3	5.3	5.0	4.5
Radar	5.3	80.0	53.3	30.0	41.7	4.7	4.7	4.3	4.3	4.7	4.3	4.5
A-SFT	5.3	75.0	50.0	25.0	37.5	3.3	4.0	4.3	5.3	4.7	5.0	4.4
Northern Mixture	5.7	58.3	66.7	45.0	55.8	4.0	5.0	4.0	4.7	5.0	3.3	4.3
Southern Mixture	5.3	51.7	48.3	36.7	42.5	4.3	5.3	3.7	4.7	4.0	4.0	4.3
Quatro	3.3	65.0	80.0	38.3	59.2	3.7	4.7	3.3	4.3	4.7	4.0	4.1
Natural Knit®PRG Mix	6.3	38.3	76.7	60.0	68.3	3.3	5.7	3.3	4.3	3.7	4.0	4.1
Yaak	6.0	41.7	70.0	66.7	68.3	2.3	4.0	3.7	4.7	3.3	3.3	3.6
Bewitched	5.3	21.7	86.7	65.0	75.8	2.7	3.3	3.0	4.0	3.7	2.7	3.2
Kenblue	5.0	23.3	81.7	63.3	72.5	1.7	3.7	3.3	3.3	2.7	2.7	2.9
Dutch White Clover	4.3	12.7	65.0	61.7	63.3	2.0	3.7	3.0	2.3	1.7	1.7	2.4
$LSD_{0.05}$	1.57	29.31	42.45	29.00	29.90	1.40	1.47	1.35	1.71	1.70	1.29	0.94
CV%	20.5	32.9	59.8	41.9	42.6	15.8	19.8	17.9	29.0	22.6	17.1	12.6

Table 3. NTEP Low Input Ancillary Test results 2020. Ratings for spring green-up, percent living cover for fall, percent weed coverage for summer and fall, and monthly visual quality (rating 1-9, where 9 equals the highest turf quality)

	Spring green up	Percent Living cover planted species	Percent weed coverage			Quality						
Entry	4/7	9/24	7/17	9/28	Mean	5/17	6/9	7/17	8/14	9/24	10/27	Mean
CRS Mix #3	4.0	94.3	14.3	5.7	10.0	5.7	6.3	6.7	7.0	7.3	6.7	6.6
DLFPS-TFAM	5.3	85.0	11.7	15.0	13.3	5.3	6.0	6.7	7.7	7.0	6.0	6.4
CRS Mix #2	4.0	86.7	21.7	23.3	22.5	6.0	5.7	5.7	6.0	6.7	6.0	6.0
DLFPS-ChCrM	5.3	88.3	13.3	5.7	9.5	5.7	6.0	6.3	5.7	6.3	6.0	6.0
Vitality Low Maintenance Mix	4.7	95.3	25.0	8.3	16.7	4.7	6.0	5.7	6.3	6.7	6.7	6.0
CRS Mix #1	5.0	86.7	25.0	13.3	19.2	5.0	5.7	5.7	6.3	6.7	6.3	5.9
DLFPS TFAStC	5.0	86.7	25.0	23.3	24.2	5.3	6.0	5.3	6.3	6.0	5.7	5.8
Vitality Double Coverage Mix	5.0	88.3	21.7	35.0	28.3	5.7	5.7	5.7	6.7	6.0	5.0	5.8
MNHD-15	4.3	86.7	35.0	21.7	28.3	4.7	5.3	6.0	6.0	6.3	5.7	5.7
DLFPS TF-A	6.0	80.0	48.3	28.3	38.3	4.7	4.7	4.7	5.7	6.3	5.7	5.3
DLFPS-ShHM	4.3	80.0	41.7	33.3	37.5	4.0	4.7	6.0	6.0	5.0	5.7	5.2
7H7	3.7	83.3	35.0	26.7	30.8	4.7	4.3	5.3	5.7	6.0	4.7	5.1
CS Mix	4.0	80.0	35.0	30.0	32.5	4.3	5.3	5.0	5.7	5.3	5.0	5.1
Radar	5.3	58.3	33.3	38.3	35.8	4.3	5.7	5.0	5.3	4.7	4.7	4.9
Bullseye	5.7	78.3	36.7	26.7	31.7	4.3	4.7	4.7	5.0	5.3	4.7	4.8
Northern Mixture	5.7	61.7	41.7	51.7	46.7	4.3	5.0	5.0	4.7	5.0	4.7	4.8
Spartan II	3.0	71.7	31.7	33.3	32.5	3.3	4.7	5.7	4.7	5.0	5.0	4.7
BGR-TF3	4.7	66.7	51.7	41.7	46.7	3.0	4.7	4.7	4.7	5.7	5.3	4.7
Ky-31 E+	5.7	65.0	51.7	40.0	45.8	4.3	4.3	4.7	5.3	4.3	4.7	4.6
DLFPS ChCrSH	5.0	55.0	56.7	58.3	57.5	3.7	5.3	4.7	4.7	4.3	4.0	4.4
Kingdom	3.7	50.0	63.3	40.0	51.7	2.7	5.0	4.3	4.7	4.7	5.0	4.4
Southern Mixture	5.0	28.3	41.7	45.0	43.3	4.3	5.3	4.7	4.0	4.7	3.3	4.4
DTTHO TF/KBG Mix	4.0	43.3	66.7	45.0	55.8	3.7	4.3	4.7	5.7	4.3	3.3	4.3
Chantilly	6.7	35.0	60.0	56.7	58.3	4.0	4.7	4.3	4.7	4.0	4.0	4.3
A-SFT	3.7	43.3	63.3	61.7	62.5	3.3	4.7	3.7	5.3	4.7	3.7	4.2
DTT Tall Fescue Mix	4.3	56.7	61.7	45.0	53.3	2.3	4.7	4.7	4.3	4.7	4.7	4.2
Natural Knit®PRG Mix	6.3	18.3	63.3	80.0	71.7	2.3	4.3	3.3	4.0	3.7	2.3	3.3
Quatro	2.7	60.0	66.7	60.0	63.3	3.0	3.7	3.7	3.3	3.3	2.3	3.2
Yaak	3.7	16.7	70.0	85.0	77.5	1.7	3.3	4.0	5.0	2.7	2.3	3.2
Bewitched	4.0	20.0	80.0	85.0	82.5	1.7	4.3	3.0	3.3	3.0	2.3	2.9
Kenblue	5.0	3.7	90.0	90.0	90.0	2.0	2.7	2.7	2.7	2.0	2.0	2.3
Dutch White Clover	2.3	5.3	83.3	91.7	87.5	1.0	1.7	2.0	2.3	1.7	1.0	1.6
$LSD_{0.05}$	1.29	26.41	26.31	29.60	23.42	1.67	1.03	1.30	1.31	1.39	1.38	0.83
CV%	17.2	26.4	35.2	43.2	32.7	26.2	13.1	16.6	15.6	17.1	18.7	10.8

Acknowledgements: The National Turfgrass Evaluation Program funds this project

NATIONAL TURFGRASS EVALUATION PROGRAM (NTEP)
2018 NATIONAL TALL FESCUE TEST – 2020 RESULTS

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INTRODUCTION

Turf-type tall fescue has become a significant turfgrass species of golf, sod, sports turf, and landscapes. Characteristics that make turf-type tall fescue desirable are: improved wear tolerance, shade tolerance, improved dark green color, and lower fertility requirements compared to Kentucky bluegrass and perennial ryegrass. Turf-type tall fescue also exhibits excellent drought avoidance characteristics. When developing turfgrass seed mixtures that are more environmentally sustainable in order to reduce inputs, such as fertilizer and water, turf-type tall fescue can be a beneficial component.

The National Turfgrass Evaluation Program (NTEP) is sponsored by the Beltsville Agriculture Research Center and the National Turfgrass Federation Inc. NTEP works with turfgrass breeders and has designated evaluation sites throughout the United States to assess and rate turfgrass species and cultivars. Results from turfgrass evaluations can aid professionals in their selection of turfgrass species/cultivars that best meet their needs. Evaluation results also aid breeders and seed companies in the development, selection, and marketing of new turfgrass cultivars. In 2018, NTEP selected eighteen standard testing sites and ten ancillary test locations for their 2018 Turf-type Tall Fescue Test. The University of Connecticut, Plant Science Teaching and Research Facility in Storrs CT, was selected as a standard site for the 2018 Turf-type Tall Fescue Test. This NTEP evaluation trial will continue for five years. 2020 was the second year of data collection for the 2018 NTEP Turf-Type Tall Fescue test.

MATERIALS AND METHODS

One hundred thirty-two cultivars of turf-type tall fescue were seeded on September 21, 2018 at the Plant Science Research and Education Facility in Storrs, CT. A complete randomized block design with 3 replicates of each cultivar was utilized for this study. Plot size is 3’ X 5’. Sponsors and entries are listed in Table 1.

Management Practices

Once established, all plots and cultivars received the same management protocol throughout the study. Due to the COVID-19 pandemic, the ability to resume research activities at the UConn Plant Science Research facility was impacted and, therefore, 2020 proved a challenging year for maintenance of the NTEP plots. Resumption of turfgrass evaluation and routine maintenance did not begin until mid-May 2020. Limited farm staff support and the inability to hire undergraduate students also challenged data collection and maintenance of the plots. Management practices for 2020 were as follows:

Mowing - Plots were maintained at a mowing height of 2.75 in and mowed two times per week. Clippings were returned.
Irrigation – In 2020, supplemental irrigation was applied as needed.

Fertilizer and Pesticide Applications for 2020

Pre-emergent (Prodiamine) was applied on 4/17/20 at a rate of .5 fl oz/m.
Broadleaf control (Speedzone) was applied on 6/15/20 at a rate of 1.8 fl oz/m.
Acelepryn (Chlorantraniliprole) was applied on 5/25/20 at a rate of .37 fl oz/m.

Fertilizer
5/9/20 - 1# N/1,000 ft^2, 30-0-6, 50% SCU
10/20/20 – 1#N/1,000 ft^2, 25-0-12, 30% SCU

2020 was the second year of recording data for the Turf-Type Tall Fescue Test. Ratings taken and recorded were:

Quality Ratings

Turfgrass quality ratings were taken on a monthly basis for overall turf quality (color / leaf texture / density) during the 2020 growing season. Overall turfgrass quality was determined using a visual rating system of 1-9. A score of 1 illustrates the poorest quality turf and 9 the highest quality. Monthly quality and mean quality ratings are provided in table 2.

RESULTS & DISCUSSION

Results for monthly quality ratings are provided in Table 2.

A few general observations noted: mean quality values for overall quality continue to illustrate that there is little diversity between cultivars. AH2, (Brett Young Seeds) had the highest quality ratings for the 2020 growing season with a visual rating system of 1-9, with 9 being the highest turfgrass quality. However, when comparing the mean values for overall quality, there were no significant differences between AH2 and 51 other cultivars with a rating above 6.3. Kentucky 31 exhibited the poorest overall turf quality.

PPG-TF-267, GO-RH20, DLF-321-3693, RC4, AH1 exhibited the highest density, with a visual rating system of 1-9, with 9 being the highest density. K-31 exhibited the poorest density.

RC4, PPG-TF-337, DLF-321-3693, RADT105, DLF-321-3701, PPG-Tf-312, PPg-TF-306, RHL2, SETF104 exhibited the finest texture with a visual rating system of 1-9, with 9 being of finest texture. K-31 exhibited the poorest texture.
DLF-321-3699, RADTF0.0, PPG-TF-315, TMT1, RC4, DLF-321-3705, DLF-321-3708, RADTF105, AH1 exhibited the highest color rating, with 9 being of darkest color. K-31 exhibited the poorest color rating.

Table 1- Sponsors and Entries			
SPONSOR	**ENTRY**	**SPONSOR**	**ENTRY**
Allied Seed LLC	AST8118LM	DLF Pickseed USA	DLFPS-321/3702
Allied Seed LLC	AST8218LM	DLF Pickseed USA	DLFPS-321/3703
Allied Seed LLC	A-TF31	DLF Pickseed USA	DLFPS-321/3705
Barenbrug Research	BAR 9FE MAS	DLF Pickseed USA	DLFPS-321/3706
Barenbrug Research	BAR FA 8228	DLF Pickseed USA	DLFPS-321/3707
Barenbrug Research	BAR-TF-134	DLF Pickseed USA	DLFPS-321/3708
Barenbrug Research	BAR-FA8230	Grassland Oregon Seed	GO-RH20
Berger International	BGR-TF3	Grassland Oregon Seed	Burmingham
Brett Young	BY-TF-169	Grassland Oregon Seed	GO-AOMK
Brett Young	PST-5BYOB	Integra Turf, Inc.	PPG-TF 244
Brett Young Seeds	AH2	Integra Turf, Inc.	PPG-TF 305
Burlingham Seeds	Firehawk SLT	Integrated Seed Growers	ProGold
Burlingham Seeds	Bullseye LTZ	Integrated Seed Growers	Moondance
Burlingham Seeds	Turbo SS	Jacklin Seed by Simplot	JT-517
Burlingham Seeds	Dragster	Jacklin Seed by Simplot	JS-DTT
Carlton Seed Co.	Naturally Green	Jacklin Seed by Simplot	JT 233
Columbia Seeds	COL-TF-148	Jacklin Seed by Simplot	JT 268
Columbia Seeds	NAI-3N2	Lakeside Ag. Ventures	NAI-FQZ-17
Columbia Seeds	NAI-TUE	Landmark Turf & Native Seed	AH1
Columbia Seeds	PPG-TF-313	Landmark Turf & Native Seed	PPG-TF-249
Columbia Seeds	PPG-TF-323	Landmark Turf & Native Seed	PPG-TF-262
Columbia Seeds	PPG-TF-338	Landmark Turf & Native Seed	PPG-TF-267
Criadero El Concerro SA	FC15-01P	Landmark Turf & Native Seed	NAI-ROS4
DLF Pickseed USA	DLFPS-321/3693	Landmark Turf & Native Seed	NAI-ST5
DLF Pickseed USA	DLFPS-321/3694	Lebanon Seaboard Corp.	LTP-TF-122
DLF Pickseed USA	DLFPS-321/3695	Lebanon Seaboard Corp.	LTP-TF-111
DLF Pickseed USA	TMT1	Lewis Seed Co.	PPG-TF 316
DLF Pickseed USA	RS1	Mountain View Seeds	PPG-TF-238
DLF Pickseed USA	DLFPS-TF/3550	Mountain View Seeds	PPG-TF-254

Table 1 (continued) - Sponsors and Entries			
SPONSOR	**ENTRY**	**SPONSOR**	**ENTRY**
DLF Pickseed USA	DLFPS-TF/3552	Mountain View Seeds	PPG-TF-308
DLF Pickseed USA	DLFPS-TF/3553	Mountain View Seeds	PPG-TF-255
DLF Pickseed USA	DLFPS-321/3679	Mountain View Seeds	PPG-TF-312
DLF Pickseed USA	DLFPS-321/3696	Mountain View Seeds	PPG-TF-315
DLF Pickseed USA	DLFPS-321/3699	Mountain View Seeds	PPG-TF-336
DLF Pickseed USA	Grande 3	Mountain View Seeds	PPG-TF-337
DLF Pickseed USA	DLFPS-321/3701	Oregro Seed	Palomar
Oregro Seed	Escalade	Scotts Co.	K18-NSE
Oregro Seed	OG-WALK	Semillas Dalmau	RHF
Peak Plant Genetics LLC	PPG-TF-320	Semillas Fito	RC4
Peak Plant Genetics LLC	PPG-TF-231	Semillas Fito	RHL2
Peak Plant Genetics LLC	PPG-TF-306	Semillas Fito	Estrena
Peak Plant Genetics LLC	PPG-TF-318	Site One Land. Supply	Tango
Pennington Seed	ATF2116	Site One Land. Supply	3N1
Pennington Seed	NT-3	Site One Land. Supply	Bandit
Pennington Seed	ATF 1768	Site One Land. Supply	Copious TF
Pennington Seed	TD2	Site One Land. Supply	Padre 2
ProSeeds Marketing, Inc.	3B2	Site One Land. Supply	Bravo 2
ProSeeds Marketing, Inc.	RH1	Smith Seed Services	TF445
ProSeeds Marketing, Inc.	RH3	Smith Seed Services	TF456
Pure Seed (Rose Agri)	Lifeguard	Smith Seed Services, LLC	SE5302
Pure Seed (Rose Agri)	PST-5DART	Smith Seed Services, LLC	SE5STAR
Pure Seed (Rose Agri)	PST-5DC24	Smith Seed Services, LLC	SE5CR1
Pure Seed Testing	5LSS	Smith Seed Services, LLC	SETF104
Pure Seed Testing	PST-5TRN	Smith Seed Services, LLC	SETFM2
Pure Seed Testing	PST-5GQ	Smith Seed Services, LLC	SETFM3
Pure Seed Testing	PST-5MCMO	Standard	Paramount
Pure Seed Testing	PST-5E6	Standard	Fayette
Pure Seed Testing	PST-5THM	Standard	Bullseye
Pure Seed Testing	PST-5MINK	Standard	Hemi

Table 1** (continued)* ***- Sponsors and Entries			
SPONSOR	**ENTRY**	**SPONSOR**	**ENTRY**
Pure Seed Testing	PST-5SQB	Standard	Raptor III
Pure Seed Testing	PST-5DZM	Standard	Kentucky-31
Pure Seed Testing	PST-5GLBS	The Scotts Miracle Gro Co	K18-RS6
Radix Research	RAD--TF105	The Scotts Miracle Gro Co	K18-WB1
Radix Research	RAD-TF0.0	Tualatin Valley Seeds	LBF
Rutgers University	RDC	Vista Seed Partners	PPG-TF-257
Scotts Co.	K18-ROE	Z Seeds	ZRC1

Figure 1 –Turf-Type Tall Fescue NTEP Trial, University of Connecticut (photo-October 2019)

Table 2. Tall Fescue NTEP results 2020 for percent establishment and turfgrass quality (rating 1-9, where 9 equals the highest turf quality). Table is listed with highest mean quality cultivars listed first.

Entry Num.	Entry	Quality							
		05/14/20	06/15/20	07/13/20	08/10/20	09/16/20	10/14/20	11/06/20	**Mean**
69	AH2	5.7	6.7	7.0	7.7	7.0	6.7	7.0	**6.8**
18	TD2	6.0	7.0	6.3	7.3	7.0	6.7	7.0	**6.8**
24	JS-DTT	5.7	6.0	7.3	7.3	7.3	7.0	6.7	**6.8**
68	PPG-TF-267	5.3	6.7	6.7	7.3	7.0	7.0	7.0	**6.7**
86	PPG-TF-315	5.7	6.7	6.7	7.0	6.7	7.0	7.3	**6.7**
99	GO-RH20	5.7	6.7	6.3	7.0	7.0	7.0	7.0	**6.7**
89	ZRC1	6.0	6.3	6.3	6.7	7.0	7.3	7.0	**6.7**
75	JT 268	5.3	6.3	6.7	7.0	7.0	7.0	7.0	**6.6**
25	RDC	6.0	6.3	6.0	7.0	7.0	7.0	7.0	**6.6**
10	5LSS	5.7	6.3	6.0	7.0	7.3	7.0	7.0	**6.6**
3	DLFPS-321/3693	5.3	6.7	6.0	7.0	7.3	7.0	7.0	**6.6**
90	PPG-TF-231	5.7	6.7	6.3	6.7	7.0	7.0	7.0	**6.6**
84	PPG-TF-255	5.7	6.3	6.7	7.0	6.7	6.7	7.0	**6.6**
70	K18-RS6	5.7	6.3	6.3	6.7	7.0	7.3	6.7	**6.6**
67	PPG-TF-262	5.3	6.3	7.0	7.0	6.7	6.7	7.0	**6.6**
6	TMT1	5.7	6.3	6.3	6.7	7.0	7.0	7.0	**6.6**
96	Bullseye LTZ	5.3	6.3	6.3	7.0	6.7	7.0	7.0	**6.5**
61	DLFPS-321/3707	5.7	6.0	6.3	6.7	7.0	7.0	7.0	**6.5**
87	PPG-TF-336	6.0	6.7	6.0	6.7	7.0	6.3	7.0	**6.5**
8	NT-3	5.3	6.0	6.7	6.7	7.0	7.0	6.7	**6.5**
79	RC4	5.3	6.7	6.3	6.7	7.0	6.7	6.7	**6.5**
59	DLFPS-321/3705	6.0	6.3	5.7	6.7	6.7	7.0	7.0	**6.5**
62	DLFPS-321/3708	5.0	6.3	6.0	7.0	7.0	7.0	7.0	**6.5**
76	PPG-TF 244	5.7	6.3	6.7	6.7	6.7	6.3	7.0	**6.5**
118	PPG-TF-313	5.7	5.7	6.3	6.7	7.0	7.0	7.0	**6.5**
121	PPG-TF-338	5.3	6.3	6.3	7.0	6.7	7.0	6.7	**6.5**
102	NAI-3N2	5.7	6.3	6.0	6.7	6.7	6.7	7.0	**6.4**
82	PPG-TF-254	5.3	6.0	6.0	7.0	6.7	7.0	7.0	**6.4**
113	RAD--TF105	5.7	6.3	6.0	7.0	6.7	6.7	6.7	**6.4**
73	RH3	5.3	6.0	6.7	6.7	7.0	6.7	6.7	**6.4**
28	COL-TF-148	5.7	6.0	6.3	6.7	6.7	6.7	6.7	**6.4**
5	DLFPS-321/3695	5.3	6.0	6.3	6.3	7.0	7.0	7.0	**6.4**
34	DLFPS-321/3701	5.7	6.3	6.0	6.7	6.7	6.7	6.7	**6.4**
13	DLFPS-TF/3550	5.0	6.3	6.0	7.0	6.7	6.7	7.0	**6.4**
71	K18-WB1	5.7	6.0	6.0	6.7	7.0	7.0	6.7	**6.4**
2	Paramount	5.3	6.0	5.7	7.0	7.0	7.0	6.7	**6.4**
81	PPG-TF-238	5.0	6.3	6.3	6.7	6.7	7.0	7.0	**6.4**
83	PPG-TF-308	5.3	6.7	6.3	6.7	7.0	6.7	6.3	**6.4**
85	PPG-TF-312	5.7	6.3	5.7	6.7	7.0	6.7	6.7	**6.4**
112	3B2	5.7	5.7	6.3	6.3	6.7	7.0	6.7	**6.4**
55	Copious TF	5.3	6.0	6.3	6.7	6.7	7.0	6.7	**6.4**
94	Firehawk SLT	5.0	6.7	6.3	6.3	7.0	7.0	6.3	**6.4**
103	NAI-ROS4	5.7	6.3	6.3	6.3	6.7	6.7	6.7	**6.4**
104	NAI-TUE	5.0	6.0	6.7	6.3	7.0	6.7	7.0	**6.4**

77	PPG-TF 305	5.3	6.7	6.0	6.7	6.7	6.7	6.7	**6.4**
91	PPG-TF-306	5.0	6.7	5.3	6.7	6.7	7.3	6.7	**6.4**
119	PPG-TF-320	5.7	6.0	6.3	6.7	6.7	6.7	6.7	**6.4**
120	PPG-TF-323	5.0	5.7	6.0	7.0	7.0	7.0	6.7	**6.4**
88	PPG-TF-337	5.0	6.3	6.0	7.0	6.7	6.7	7.0	**6.4**
108	SE5CR1	5.7	6.0	6.3	6.7	6.7	7.0	6.3	**6.4**
93	Bullseye	5.0	6.0	6.0	6.7	6.7	7.0	7.0	**6.3**
60	DLFPS-321/3706	5.0	6.0	6.0	6.7	6.7	7.0	7.0	**6.3**
95	Hemi	5.3	6.0	6.0	6.7	7.0	7.0	6.3	**6.3**
32	K18-NSE	5.3	6.0	6.7	6.7	6.3	6.7	6.7	**6.3**
78	PPG-TF 316	5.0	6.3	6.3	6.7	6.7	6.7	6.7	**6.3**
92	PPG-TF-318	5.3	6.0	5.7	6.7	7.0	6.7	7.0	**6.3**
115	RHL2	5.0	6.3	6.0	6.3	6.7	7.0	7.0	**6.3**
109	SETF104	5.7	6.0	6.3	5.7	6.3	7.0	7.3	**6.3**
31	K18-ROE	6.0	6.0	6.3	6.7	6.3	6.7	6.3	**6.3**
30	LTP-TF-111	5.3	6.0	6.0	6.7	6.7	7.0	6.7	**6.3**
29	LTP-TF-122	5.0	6.0	6.0	7.0	6.3	7.0	7.0	**6.3**
130	TF456	5.3	6.0	6.0	6.3	7.0	6.3	7.0	**6.3**
65	AH1	5.0	6.0	5.3	6.7	7.0	7.0	7.0	**6.3**
16	DLFPS-321/3679	5.3	6.0	5.7	6.3	7.0	6.7	6.7	**6.3**
98	Dragster	5.3	6.0	5.7	6.3	6.7	7.0	7.0	**6.3**
46	Moondance	5.3	6.0	6.0	6.7	6.3	7.0	6.7	**6.3**
47	PST-5SQB	5.3	6.0	6.0	6.3	6.7	7.0	6.7	**6.3**
42	PST-5THM	5.3	6.0	5.7	6.7	6.3	7.0	7.0	**6.3**
116	Raptor III	5.3	6.0	6.3	6.3	7.0	6.7	6.3	**6.3**
9	RS1	5.3	6.0	6.3	6.7	6.7	6.7	6.3	**6.3**
111	SETFM3	5.3	6.0	6.0	6.0	7.0	7.0	6.7	**6.3**
53	3N1	5.0	6.0	6.0	6.3	6.7	7.0	6.7	**6.2**
63	BAR-TF-134	5.3	5.7	6.0	6.7	6.3	7.0	6.7	**6.2**
4	DLFPS-321/3694	5.3	6.0	6.0	6.0	7.0	6.7	6.7	**6.2**
80	PPG-TF-257	5.3	6.0	6.0	6.3	6.7	6.7	6.7	**6.2**
117	RHF	5.3	6.0	6.3	6.3	6.7	6.7	6.3	**6.2**
106	SE5302	5.3	6.3	6.3	6.3	6.7	6.3	6.3	**6.2**
129	TF445	5.3	5.7	5.7	6.7	6.7	6.7	7.0	**6.2**
14	DLFPS-TF/3552	5.0	6.0	6.3	6.3	6.3	7.0	6.3	**6.2**
15	DLFPS-TF/3553	5.3	5.7	6.0	6.3	6.7	6.7	6.7	**6.2**
22	Fayette	5.0	6.0	5.7	6.3	6.7	7.0	6.7	**6.2**
21	Grande 3	5.3	5.7	6.0	6.3	6.3	7.0	6.7	**6.2**
1	Naturally Green	5.7	5.7	5.7	6.0	6.7	7.0	6.7	**6.2**
66	PPG-TF-249	5.0	6.0	6.0	7.0	6.7	6.7	6.3	**6.2**
48	PST-5DZM	5.3	6.0	5.3	6.3	6.7	7.0	6.7	**6.2**
33	BY-TF-169	5.0	6.0	6.0	6.7	6.3	6.7	6.7	**6.2**
19	DLFPS-321/3696	5.0	6.0	6.0	6.3	6.3	6.7	6.7	**6.2**
20	DLFPS-321/3699	5.0	6.0	5.3	6.7	6.7	6.7	7.0	**6.2**
58	NAI-FQZ-17	5.0	6.0	6.0	6.7	6.3	6.7	6.7	**6.2**
105	NAI-ST5	5.7	6.0	5.7	6.3	6.3	6.3	7.0	**6.2**
40	ProGold	5.7	6.0	5.7	6.7	6.3	6.7	6.3	**6.2**
72	RH1	5.7	6.0	6.0	6.3	6.7	6.3	6.3	**6.2**

44	Lifeguard	5.3	5.7	5.3	6.3	6.7	6.7	6.7	**6.1**
50	PST-5DART	5.3	6.0	5.7	6.3	6.7	6.7	6.0	**6.1**
49	PST-5GLBS	5.3	5.7	5.3	6.7	6.3	7.0	6.7	**6.1**
107	SE5STAR	5.0	6.3	5.7	6.3	6.3	6.7	6.7	**6.1**
97	Turbo SS	5.0	6.3	5.3	6.3	6.7	7.0	6.3	**6.1**
35	DLFPS-321/3702	5.0	6.0	6.0	6.0	6.7	6.7	6.3	**6.1**
122	Estrena	5.7	6.3	5.3	6.7	6.3	6.0	6.3	**6.1**
74	JT 233	5.0	6.0	5.7	6.3	6.7	6.3	6.7	**6.1**
56	Padre 2	5.3	5.7	6.0	6.3	6.3	6.7	6.3	**6.1**
51	PST-5DC24	5.3	6.3	5.3	6.3	6.0	6.7	6.7	**6.1**
39	PST-5MCMO	5.3	6.0	5.7	6.0	6.7	6.7	6.3	**6.1**
37	PST-5TRN	5.0	5.7	6.0	6.3	6.3	6.7	6.7	**6.1**
125	A-TF31	5.0	6.0	5.0	6.3	6.7	7.0	6.3	**6.1**
54	Bandit	5.0	6.0	6.0	6.0	6.3	6.7	6.3	**6.1**
100	Burmingham	5.3	6.0	6.0	5.7	6.0	7.0	6.3	**6.1**
36	DLFPS-321/3703	5.0	6.0	5.3	6.3	6.7	6.7	6.7	**6.1**
23	JT-517	5.3	6.0	5.7	5.7	6.7	6.7	6.3	**6.1**
45	PST-5MINK	5.7	6.0	5.0	6.0	6.7	6.7	6.3	**6.1**
27	BAR FA 8228	5.0	6.0	6.0	6.0	6.0	6.7	6.7	**6.0**
43	PST-5BYOB	5.3	6.0	6.0	6.0	6.0	6.7	6.3	**6.0**
38	PST-5GQ	5.0	6.0	5.7	6.3	6.3	6.3	6.7	**6.0**
114	RAD-TF0.0	5.0	6.0	5.3	5.7	6.7	7.0	6.7	**6.0**
124	AST8218LM	5.3	6.0	5.3	6.0	6.3	6.7	6.3	**6.0**
64	BAR-FA8230	5.0	6.0	6.0	5.7	6.0	6.7	6.7	**6.0**
110	SETFM2	5.0	5.3	5.3	6.3	6.7	7.0	6.3	**6.0**
26	BAR 9FE MAS	5.0	5.3	5.0	6.0	6.3	7.0	7.0	**6.0**
127	Escalade	5.3	5.7	5.3	5.7	6.0	7.0	6.7	**6.0**
128	OG-WALK	5.0	6.0	5.7	6.0	6.0	6.7	6.3	**6.0**
41	PST-5E6	5.0	6.0	5.3	6.3	6.3	6.7	6.0	**6.0**
123	AST8118LM	5.0	6.0	5.7	6.0	6.3	6.3	6.3	**5.9**
12	ATF 1768	5.0	5.7	5.7	6.0	6.3	6.3	6.3	**5.9**
7	ATF2116	5.0	6.0	5.7	6.0	6.0	6.7	6.3	**5.9**
11	BGR-TF3	5.3	6.0	5.3	6.0	6.3	6.7	6.0	**5.9**
101	GO-AOMK	5.0	6.0	5.3	6.0	6.0	6.7	6.3	**5.9**
52	Tango	5.0	6.0	5.7	5.7	6.0	6.7	6.3	**5.9**
57	Bravo 2	5.3	5.7	6.0	5.7	6.0	6.0	6.3	**5.9**
17	LBF	5.0	6.0	5.0	5.7	6.3	6.3	6.3	**5.8**
126	Palomar	5.0	6.0	5.0	5.7	6.0	6.3	6.0	**5.7**
131	FC15-01P	5.0	5.3	4.7	5.7	6.0	6.7	6.0	**5.6**
132	Kentucky-31	4.0	4.0	4.0	5.0	5.3	6.7	5.7	**4.9**
	$LSD_{0.05}$	**0.71**	**0.61**	**1.05**	**0.94**	**0.72**	**0.75**	**0.77**	**0.44**
	CV%	**8.3**	**6.2**	**11.0**	**9.1**	**6.8**	**6.9**	**7.2**	**4.4**

Acknowledgements: This project is funded by the National Turfgrass Evaluation Program.

2020

ALLIANCE FOR LOW INPUT SUSTAINABLE TURFGRASSES (ALIST) – KENTUCKY BLUEGRASS

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INTRODUCTION

The Alliance for Low Input Sustainable Turf (ALIST) is a non-profit organization that seeks to develop guidelines for sustainable turfgrass growth. The variety evaluation trial program was initiated by turfgrass breeders of independent commercial seed companies to support evaluation of both experimental and commercial cultivars, both of high turf quality and low-input performance. The following companies contributed germplasm for evaluation: Mountain View Seeds, Lebanon Turf Products, Landmark Turf & Native Seed, and DLF Pickseed USA. The University of Connecticut is one of the universities that serves as an ALIST Cooperator. Cultivars are evaluated for two years from the date of establishment. UConn was requested to extend the evaluation trial for an additional season through 2020. Data was collected on visual turf quality and digital image analysis.

MATERIALS AND METHODS

Twenty-four cultivars of Kentucky bluegrass were established on September 21, 2017 at the Plant Science Research and Education Facility in Storrs, CT. A complete randomized block design with four replicates of each cultivar was utilized for this study. Plot size was 3' X 5'. Cultivars, species, and sponsors are listed in Table 1.

All cultivars received the same management protocol during establishment and during the first year of evaluation. Plots were seeded on 9/21/2017 and were fertilized at the time of seeding at the rate of 1 pound of nitrogen per 1,000 ft^2. Once seeding was completed, the plots were protected with a Remay turf cover until germination was evident. Plots were seeded at a rate of 2.2 lb. seed per 1,000 ft^2. 'Benchmark' perennial ryegrass was seeded around the perimeter of the trial.

Plots were managed under a low maintenance regime that consisted of a mowing height of 2.5 in, mown twice per week with clippings returned. The plots were fertilized on May 9, 2020 and received 1#N/1,000 ft^2 of a 50% slow 30-0-6, applied in 2 directions. Prodiamine was applied on 4/17/20 at the rate of .5 fl oz/m. Supplemental irrigation was applied as needed during establishment in 2017 and in the spring of 2018. No supplemental irrigation was required in 2020.

All plots were visually rated each month throughout the growing season (May-November) on a scale of 1-9, where a score of 1 represented the poorest quality and 9 represented the most desirable turf quality. A subjective visual rating for turf quality included observations on overall turf performance, turf density, texture, color, as well as any impacts of weed, disease and insect pressure. The monthly quality and green cover ratings are provided in Tables 2 and 3.

Additionally, digital image analysis (DIA) was captured **7** times during the growing season (5/14/20, 6/15/20, 7/13/20, 8/10/20, 9/16/20, 10/14/20, 11/6/20) and was used to quantify dark green color and percent green cover (Karcher and Richardson, 2005). The digital images were scanned by Sigma Scan software (Cranes Software International Ltd. Chicago, IL. 1991).

RESULTS & DISCUSSION

Overall data for turfgrass quality ratings and percent green color are presented in Tables 2 and 3. Turfgrass quality ratings were impacted by drought stress, disease, and broadleaf weed pressure that increased as the growing season progressed. Turf quality means for 2020 Kentucky bluegrass ALIST test ranged from 6.8 – 5.1 with LSD of .37.

5321 exhibited the highest mean of turf quality, with the next tier of turf quality evident between the cultivars that included A11-40, Zinfandel, Martha (A06-46), SRX-466, Fullback, A11-38, Hampton, Jackrabbit, LTP-11-41, and Legend**.** Bordeaux exhibited the poorest turf quality.

The top statistical group of cultivars with the highest mean percent green cover included Martha (A06-46) and Zinfandel, followed by cultivars in the next statistical group: Legend, Hampton, PPG-KB-1131, SRX-466, NAI-13-14, Bluebank, Champagne, 5321, and A11-40. A11-38 exhibited the poorest mean for percent green cover.

Table 1. Kentucky Bluegrass, Cultivars and Sponsors

PLOT	CULTIVAR	SPONSOR
1	Champagne	Lebanon Turf Products
2	Hampton	Landmark Turf & Native Seed
3	PPG-KB 1131	Mountain View Seeds
4	Keeneland	DLF Pickseed USA
5	Bordeaux	Lebanon Turf Products
6	Bluebank	Landmark Turf & Native Seed
7	A12-34	Mountain View Seeds
8	SRX-2758	DLF Pickseed USA
9	Zinfandel	Lebanon Turf Products
10	Fullback	Landmark Turf & Native Seed
11	A11-38	Mountain View Seeds
12	5321	DLF Pickseed USA
13	Merlot	Lebanon Turf Products
14	NAI-13-14	Landmark Turf & Native Seed
15	MVS-130	Mountain View Seeds
16	Jackrabbit	DLF Pickseed USA
17	LTP-11-41	Lebanon Turf Products
18	A12-7	Landmark Turf & Native Seed
19	PPG-KB 1320	Mountain View Seeds
20	SRX-466	DLF Pickseed USA
21	A11-40	Landmark Turf & Native Seed
22	Legend	Mountain View Seeds
23	Martha	DLF Pickseed USA
24	Control	

Table 2. ALIST Results 2020: KBG Sorted by Highest Mean Quality

Entry no.	Entry	05/22	06/27	07/19	08/14	09/16	10/16	11/06	Mean Quality
12	5321	5.3	6.5	7.0	7.5	7.8	6.8	7.0	**6.8**
21	A11-40	5.8	6.0	6.5	7.0	6.5	6.0	6.3	**6.3**
9	Zinfandel	5.5	6.0	6.8	6.5	6.3	6.3	6.3	**6.2**
23	Martha (A06-46)	5.3	5.8	7.0	6.5	6.3	6.0	6.5	**6.2**
20	SRX-466	5.3	6.0	7.0	6.5	6.0	6.3	6.0	**6.1**
10	Fullback	5.5	6.0	6.5	6.0	6.0	6.0	6.0	**6.0**
11	A11-38	5.3	7.0	6.5	5.3	5.5	5.8	6.8	**6.0**
2	Hampton	5.0	5.8	6.5	6.5	6.3	5.8	6.0	**6.0**
16	Jackrabbit	5.3	5.8	6.8	6.0	6.0	6.0	6.0	**6.0**
17	LTP-11-41	5.5	6.3	6.3	5.5	6.3	6.0	6.3	**6.0**
22	Legend	5.0	5.8	6.3	6.3	6.3	6.0	6.0	**6.0**
8	SRX-2758	5.5	6.3	6.3	5.5	6.0	6.0	6.0	**5.9**
18	A12-7	5.5	6.3	5.5	5.3	6.3	6.0	6.5	**5.9**
7	A12-34	5.0	6.0	6.8	6.0	5.8	5.5	5.8	**5.8**
6	Bluebank	5.0	5.3	5.8	5.8	6.5	6.0	6.3	**5.8**
13	Merlot	5.5	5.8	6.3	5.5	6.0	5.8	5.5	**5.8**
19	PPG-KB 1320	5.3	5.8	6.5	5.3	5.5	6.0	6.0	**5.8**
1	Champagne	5.3	5.5	5.8	6.0	5.8	5.8	6.3	**5.8**
14	NAI-13-14	5.0	5.3	5.8	5.3	6.3	6.0	6.3	**5.7**
3	PPG-KB 1131	5.0	5.3	6.0	5.5	6.0	6.0	5.8	**5.6**
15	MVS-130	5.5	5.5	5.8	6.3	6.0	5.3	5.0	**5.6**
4	Keeneland	5.0	6.0	6.0	5.0	5.5	5.5	6.0	**5.6**
5	Bordeaux	4.8	5.0	5.5	5.0	5.8	5.0	5.0	**5.1**
	LSD0.05	**0.63**	**0.76**	**0.83**	**0.86**	**0.68**	**0.57**	**0.57**	**0.37**
	CV%	**8.5**	**9.2**	**9.3**	**10.3**	**7.9**	**6.9**	**6.7**	**4.5**

Acknowledgements: This project is funded by the Alliance for Low Input Sustainable Turf (ALIST).

Table 3. ALIST Results 2020: KBG Sorted by Highest Mean Green Cover

Entry no.	Entry	05/22	06/27	07/19	08/14	09/16	10/16	11/06	**Mean Green Cover**
23	Martha (A06-46)	82.8	85.4	75.0	49.8	50.4	55.0	74.0	**67.5**
9	Zinfandel	76.3	80.7	71.4	44.5	46.8	48.2	71.2	**62.7**
22	Legend	73.7	77.6	62.5	41.0	51.0	49.6	70.2	**60.8**
2	Hampton	77.3	83.7	72.2	38.7	45.4	44.1	63.3	**60.6**
3	PPG-KB 1131	73.1	77.9	68.7	30.0	49.1	52.2	73.1	**60.6**
20	SRX-466	90.5	78.4	61.3	33.5	39.7	45.2	65.4	**59.2**
14	NAI-13-14	74.3	72.2	63.2	24.8	49.0	52.9	77.6	**59.1**
6	Bluebank	73.1	73.1	70.5	30.4	43.8	49.7	71.6	**58.9**
1	Champagne	87.1	66.5	57.6	44.4	44.2	45.3	61.2	**58.0**
12	5321	71.0	68.8	64.0	45.5	44.6	44.8	65.8	**57.8**
21	A11-40	88.9	64.6	66.3	46.3	38.9	35.3	59.3	**57.1**
4	Keeneland	75.9	76.3	65.5	33.8	33.0	40.6	67.3	**56.1**
7	A12-34	76.8	77.2	70.6	35.8	39.5	33.4	52.5	**55.1**
10	Fullback	77.8	64.3	62.7	39.9	33.3	39.6	60.4	**54.0**
5	Bordeaux	81.2	59.1	54.0	38.7	47.4	39.8	52.4	**53.2**
13	Merlot	75.6	65.6	62.7	29.4	36.2	40.3	61.4	**53.0**
16	Jackrabbit	84.1	74.8	56.0	27.5	28.9	36.7	62.1	**52.9**
19	PPG-KB 1320	65.1	73.9	63.0	29.9	32.3	41.2	62.7	**52.6**
8	SRX-2758	81.0	66.2	58.3	17.6	34.1	41.4	67.6	**52.3**
18	A12-7	78.4	69.3	57.2	21.0	24.0	38.9	58.3	**49.6**
17	LTP-11-41	67.6	62.9	51.7	22.4	30.2	39.9	61.8	**48.1**
15	MVS-130	73.2	62.5	57.2	25.8	24.2	24.5	41.7	**44.2**
11	A11-38	74.5	62.4	55.6	19.3	23.3	24.4	47.3	**43.8**
	LSD0.05	**8.31**	**14.64**	**9.77**	**10.83**	**8.83**	**9.50**	**8.06**	**5.29**
	CV%	**7.6**	**14.5**	**11.0**	**22.9**	**16.2**	**16.1**	**9.1**	**6.8**

Acknowledgements: This project is funded by the Alliance for Low Input Sustainable Turf (ALIST).

ADDING A LATE FALL APPLICATION OF PROXY (ETHEPHON) BEFORE TWO TRADITIONAL SPRING APPLICATIONS IMPROVES SEEDHEAD CONTROL OF ANNUAL BLUEGRASS

Reicher, Zachary J.; Sousek, Matthew D.; Patton, Aaron J.; Van Dyke, Adam; Kreuser, William C.; Inguagiato, John C.; Miele, Kevin M.; Brewer, John; Askew, Shawn D.; Hathaway, Aaron; Nikolai, Thomas A.; Kowalewski, Alec; McDonald, Brian. 2020. Crop, Forage and Turfgrass Management. 6(1): p. [1-9]. http://dx.doi.org/10.1002/cft2.20031

ABSTRACT

Annual bluegrass (ABG) (*Poa annua L.*) is a prolific seed producer in the spring on golf courses that in turn decreases aesthetic quality and trueness of ball roll on cool-season putting greens. Proxy (ethephon) applied twice in the spring after green-up is the current industry standard after the loss of Embark (mefluidide) from the turf and ornamental market. However, plant growth regulators including Proxy have been used for years to help suppress ABG seedheads with inconsistent success. The primary objective of this study was to determine if ABG seedhead suppression is improved by adding a late fall application of Proxy to the two traditional spring applications of plant growth regulators at nine locations with diverse environments. A second objective was to determine the importance of including Primo Maxx (trinexapac-ethyl) in fall and spring applications. Adding a late fall application of Proxy prior to the two spring applications (F+S+S) improved control of ABG seedheads over the traditional two spring applications (S+S), but the magnitude of improvement varied among locations. When treatments were applied F+S+S, the industry standard tank mixture of Proxy + Primo Maxx provided consistent ABG seedhead control and turf quality, similar to Proxy + Fiata (phosphonate + proprietary pigment) and equal to or better than Proxy alone.

AWARENESS, SUPPORT, AND PERCEIVED IMPACT OF THE CONNECTICUT PESTICIDE BAN

Campbell, Julie H.; Wallace, Victoria H. 2020. HortTechnology. February. 30(1): p. 96-101.
https://doi.org/10.21273/HORTTECH04493-19

ABSTRACT

Concern over the use of pesticides in public areas, such as schools, daycare centers, and parks, has prompted some state and local governments to severely restrict or ban pesticides in these locations. Connecticut currently has bans for daycare centers, school grounds with kindergarten through eighth grade classes, and playgrounds in municipal parks. This study was designed to understand general public awareness of these bans and the public sentiment for these additional bans. An online survey was conducted in late 2016 asking Connecticut residents about their levels of awareness of the current pesticide bans, and whether they supported the current ban or would support additional bans. Demographics and other individual characteristics/perceptions are used to explain whether a respondent knows there is a pesticide ban and if the respondent thinks there should be a pesticide ban. Only 7% of the respondents could correctly identify where pesticide bans are currently in place, with most respondents being unsure (74%) if a ban was, in fact, in place. No respondents correctly identified the location of the ban without also identifying an incorrect location as well. A large percentage of respondents indicated the state should have a pesticide ban, with those respondents supporting a ban across all locations listed. Pesticide bans on school grounds and athletic fields from kindergarten to 12th grade were strongly supported, with scores ranging from 85.9 to 86.6 on a 100-point scale, with 100 representing extreme support for pesticide bans. The results indicate that general awareness of the current pesticide ban, as well as knowledge of where current bans are in place, is low. Most respondents support a statewide ban that exceeds current Connecticut law.