TURFGRASS TRENDS

TIMING BERMUDAGRASS APPLICATIONS

Bermudagrass Control in Zoysiagrass Fairways

By James T. Brosnan, Ph.D. and Gregory K. Breeden

Zoysiagrasses (Zoysia spp.) are commonly used on golf course fairways throughout the United States transition zone. Zoysiagrass use has increased due to cultivars that offer high turf quality, low nitrogen fertility requirements, and improved drought, shade and cold tolerance compared to other warm-season species (8).

One of the most troublesome weeds to control in zoysiagrass is bermudagrass (Cynodon dactylon (L.) Pers.), as physiological similarities between these species often render them susceptible to similar herbicide chemistries (4). Several researchers have illustrated that mixtures of Fusilade II (fluazifop)(Syngenta Crop Protection) plus Turflon Ester (triclopyr)(Dow AgroSciences) applied sequentially during midsummer can provide bermudagrass suppression for up to four weeks without inducing significant zoysiagrass injury (5, 7). However, numerous applications are required over several years, rendering control of this species a struggle for superintendents.

Determining optimum timing of applications of Fusilade II plus Turflon Ester to control bermudagrass in zoysiagrass fairways would help superintendents. However, limited data have been published on this topic. Thus, the objective of this research was to determine points in the growing season in which bermudagrass was most susceptible to applications of Fusilade II plus Turflon Ester.

Materials and methods

Research was conducted from 2009 to 2011 on a mature stand of Zenith zoysiagrass (Zoysia japonica Steud) at the East Tennessee Research and Education Center (Knoxville, Tenn.). Turf was established on silt loam soil with a pH of 6.2 and 2.1 percent organic matter content. The stand was mowed at 0.6 inches with a reel mower, and irrigation was applied on an as-needed basis to prevent wilt. A 20-inch section of Riviera bermudagrass sod was installed in the center of each 10.8-sq.-ft. plot two years prior to initiating this research.

Four herbicide treatments were evaluated: (1) Fusilade II at 0.09 lbs. a.i. per acre plus Turflon Ester at 1.0 lbs. a.e. per acre; (2) Fusilade II at 0.19 lbs. a.i. per acre plus Turflon Ester at 1.0 lbs. a.e. per acre; (3) Fusilade II at 0.28 lbs. a.i. per acre plus Turflon Ester at 1.0 lbs. a.e. per acre; and (4) untreated control. The maximum-labeled use rate of Fusilade II is 0.09 lbs. a.i. per acre (1). Rates above this threshold

Continued on page 33

Editor's note: This research was previously published in *Weed Technology* and *USGA TERO*.

TABLE 1: SOIL AND AIR TEMPS

Soil and air temperature on dates which Fusilade II plus Turflon Ester was applied for bermudagrass suppression in 2009 and 2010 in Knoxville, TN.

2009		
DATE	Air temperature[a] at application	Soil temperature[b] at application
April 22	55	48
May 20	63	57
June 18	82	81
July 20	82	82
Aug. 24	81	81
Oct. 5	75	70

2010		
DATE	Air temperature[a] at application	Soil temperature[b] at application
April 28	55	64
May 24	82	81
June 17	90	90
July 13	88	82
Aug. 11	99	90
Sept. 9	75	79

[a] *Air temperature measured in fahrenheit using a hand held weather meter immediately following herbicide application*

[b] *Soil temperature measured in fahrenheit at 1.0 inch depth using a hand held digital soil thermometer immediately following herbicide application.*

TABLE 2: APPLICATION EFFECT

Effect of application timing on bermudagrass suppression with Fusilade II plus Turflon Ester in Knoxville, TN in 2009 and 2010.

	2009										2010								
	WEEKS AFTER TREATMENT																		
	1	2	3	4	5	6	7	8	9		1	2	3	4	5	6	7	8	9
DATE	% BERMUDAGRASS SUPPRESSION																		
April	52	73	97	98	91	68	39	11	4		89	99	96	98	96	86	23	0	0
May	36	69	72	54	31	8	2	0	0		91	97	96	86	74	3	0	0	0
June	31	71	71	59	7	16	0	0	0		89	95	61	84	82	57	0	0	0
July	57	89	93	89	63	4	3	4	9		93	91	94	83	57	0	0	0	0
Aug	69	81	90	97	95	91	91	87	91		66	89	93	92	78	76	0	0	0
Sep/Oct	50	81	92	91	91	—	—	—	—		68	89	92	95	95	—	—	—	—
$LSD_{0.05}$	13	NS	10	12	11	12	13	11	13		8	3	8	9	12	12	11	NS	NS

NS= *non-significant*

Continued from page 31

were evaluated to determine if higher rates of Fusilade II would increase bermudagrass suppression or zoysiagrass injury. All herbicide treatments were mixed with a non-ionic surfactant at 0.25 percent v/v and applied with a CO2-powered boom sprayer equipped with four 8002 flat-fan nozzles calibrated to deliver 30 gallons per acre of spray volume.

Treatments were applied on April 22, May 20, June 18, July 20, Aug. 24 and Oct. 5, 2009 and April 28, May 24, June 17, July 13, Aug. 11 and Sep. 9, 2010. Air and soil temperature at application are shown in Table 1. Zoysiagrass reached 100 percent green-up when treatments were initiated, while bermudagrass green-up measured ~85 percent.

Bermudagrass suppression and zoysiagrass injury were visually evaluated on a 0 (no suppression or turf injury) to 100 percent (complete suppression/kill of all turf) scale relative to the untreated control weekly until suppression subsided.

The experimental design was a 4 by 6 factorial randomized complete block with three replications. Data were subjected to ANOVA with main effects and all possible interactions tested using the appropriate expected mean square values. Significant year-by-treatment interactions were detected; thus, data from each year were analyzed and presented individually with Fisher's protected least significant difference (LSD) values used to separate treatment means at the 0.05 level.

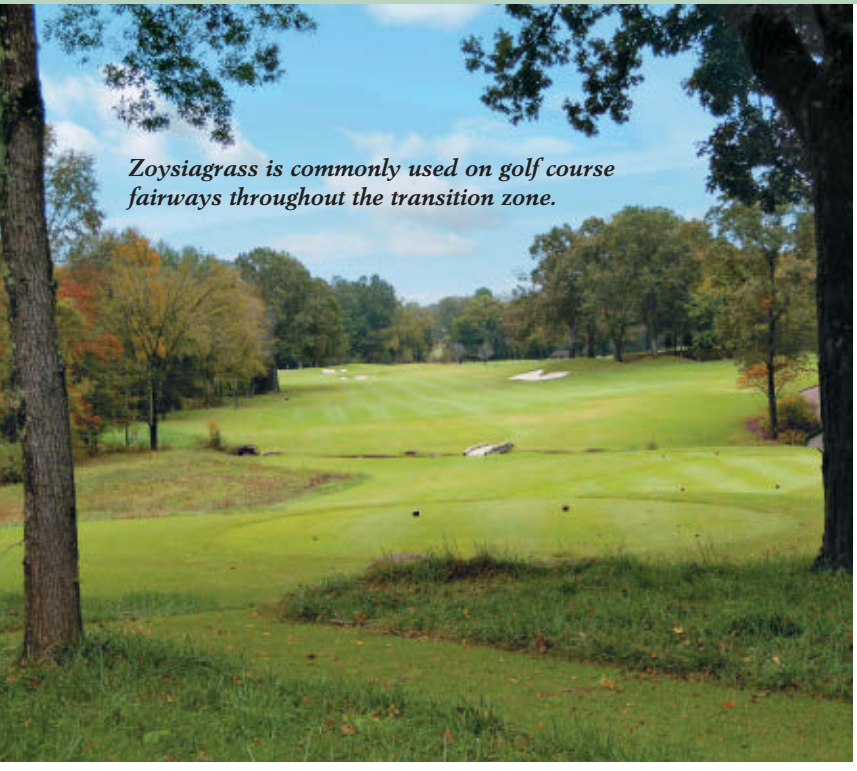
Results and Discussion

Few differences in bermudagrass suppression were detected among treatments one to two weeks after treatment. Bermudagrass suppression ranged from 69 to 89 percent at two weeks after treatment in 2009 and 66 to 93 percent one week after treatment in 2010 (Table 2).

Application date affected the length of

Continued on page 34

Herbicide applications at timings in which increased bermudagrass suppression was observed also resulted in the highest degree of zoysiagrass injury.



Zoysiagrass is commonly used on golf course fairways throughout the transition zone.

PHOTO COURTESY: JIM BROSNAN

Continued from page 33

effective bermudagrass suppression following treatment with Fusilade II plus Turflon Ester. Application on April 22, 2009 and April 28, 2010 suppressed bermudagrass ≥ 90 percent at 5 weeks after treatment each year (Table 2). Application on October 5, 2009 and September 9, 2010 also provided ≥ 90 percent bermudagrass suppression at 5 weeks after treatment. Comparatively, late spring and mid-summer applications (May 20, June 18 and July 20, 2009 and May 24, June 17 and July 13, 2010) only suppressed bermudagrass 7 to 63 percent in 2009 and 57 to 82 percent in 2010 at five weeks after treatment (Table 2).

Growing conditions at these late spring and mid-summer timings may have allowed bermudagrass to more quickly recover from herbicide injury than following spring and fall applications. Daily high air temperatures following these mid-summer applications were in the range for optimal bermudagrass shoot growth (6).

Increased bermudagrass suppression with spring and fall applications may also be related to herbicide absorption and translocation. As bermudagrass emerges from winter dormancy, young leaves are produced at apical meristems. Fusilade II is more readily absorbed in younger leaves with a thinner cuticle and accumulates primarily in apical meristems (2). This could explain increased efficacy of spring applications. Enhanced efficacy of late-season applications may be due to Fusilade II translocation being concomitant with phloem-translocation of carbohydrates to rhizomes and stolons as bermudagrass transitions into winter dormancy (3). In both years, late-season applications were most successful when average daily air temperatures measured < 72 F on several dates prior to treatment.

Cooler temperatures may be a signal to turf managers that plants are beginning to transition into winter dormancy before visual signs of this transition are apparent and thus plants are more susceptible to herbicide treatment. However, further research is needed to explore this hypothesis in detail.

Significant application date-by-application rate interactions were detected each year (data not shown). However, no statistically significant differences in bermudagrass suppression were detected among the 0.09, 0.18 and 0.28 lb. a.i. per acre rates of Fusilade II applied on April 22, 2009 and April 28, 2010 as well as October 5, 2009 and September 9, 2010, suggesting that bermudagrass susceptibility to Fusilade II plus Turflon Ester may be greatest at these timings. When applied during late spring and mid-summer (May, June, July 2009 and 2010), increasing Fusilade II application rate tended to improve bermudagrass suppression four to six weeks after treatment.

Zoysiagrass injury (< 25 percent) was observed until 5 weeks after treatment each year. Herbicide applications at timings in which increased bermudagrass suppression was observed (April 22 and October 5, 2009 and April 28 and September 9, 2010) also resulted in the highest degree of zoysiagrass injury. However, injury at these timings measured <10 percent by 2 weeks after treatment each year. Except for the May 24, 2010 application, zoysiagrass injury with Fusilade II plus Turflon Ester at labeled rates (0.09 lbs. a.i. per acre and 1.0 lbs. a.e. per acre, respectively) never exceeded 5 percent, which supports the findings of other researchers (5, 7).

Conclusions

■ Bermudagrass susceptibility to applications

Ad Index

Advertiser	Page
The Andersons	5
Arysta	26-27
B A S F Corp	7, 15, 20
Bayer Environmental	3,29,CV4
Greenleaf Technologies	33
John Deere	CV3
Nufarm	22-23, 25, 35
Petro Canada	CV2
Richway Industries	2
Smithco	Insert
Solu-Cal USA	38
Toro	11
Trojan Battery	37
Turfco Mfg	2

of Fusilade II plus Turflon Ester varied during the growing season.

- Spring and fall applications of Fusilade II plus Turflon Ester resulted in improved bermudagrass suppression compared to applications made during mid-summer. Bermudagrass was most susceptible to applications when transitioning in or out of winter dormancy.
- Applications made when average daily air temperature fell below 72 F provided the greatest suppression each year, provided that both the zoysiagrass and bermudagrass were substantially green at the time of the application.
- Increasing the rate of Fusilade II above 0.09 lbs. a.i. per acre did not improve bermudagrass suppression when applied at optimal timings.

Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the University of Tennessee Institute of Agriculture.

Jim Brosnan (jbrosnan@utk.edu) is an assistant professor of turfgrass science and Greg Breeden is an Extension Specialist 1 in the Department of Plant Sciences at the University of Tennessee.

FUNDING SOURCES

This research was funded in part by a grant from the USGA Turfgrass and Environmental Research Program.

REFERENCES

1. Anonymous. 2009. Fusilade II product label. Syngenta Crop Protection. Greensboro, NC. pp. 1-37.

2. Carr, J. E., L. G. Davies, A. H. Cobb and K. E. Pallett. 1986. Uptake, translocation and metabolism of fluazifop-p-butyl in Setaria viridis. Ann. Appl. Biol. 108:115-123.

3. Dunn, J. H. and C. J. Nelson. 1974. Chemical changes occurring in three bermudagrass turf cultivars in relation to cold hardiness. Agron. J. 66: 28-31.

4. Johnson, B. J. 1987. Turfgrass species response to herbicides applied postemergence. *Weed Technol.* 1:305-311.

5. Lewis, D. F., J. S. McElroy, J. C. Sorochan, T. C. Mueller, T. J. Samples, and G. K. Breeden. 2010. Efficacy and safening of aryloxyphenoxypropionate herbicides when tank-mixed with triclopyr for bermudagrass control in zoysiagrass turf. *Weed Technol.* 24:489-494.

6. McCarty, L.B. and G. Miller. 2002. Managing bermudagrass turf: selection, construction, cultural practices, and pest management strategies. Chelsea, MI: Ann Arbor Press. p. 3-8.

7. McElroy, J. S. and G. K. Breeden. 2006. Triclopyr safens the use of fluazifop and fenoxaprop on zoysiagrass while maintaining bermudagrass suppression. Online. *Appl. Turf. Sci.* doi:10.1094/ATS-2006-0502-01-RS.

8. Patton, A. J. 2010. Selecting zoysiagrass cultivars: turf quality and stress tolerance. *Golf Course Mgmt.* 78: 90-95.