The Potential Use of Sulfentrazone for Poa annua Pre-emergence Control at Overseeding

D.M. Kopec and J.J. Gilbert

Abstract

Sulfentrazone herbicide was applied to bermudagrass turf, prior to overseeding at 0.125, 0.250 and 0.375 lbs. AI/A. Sulfentrazone did not inhibit emergence of perennial ryegrass when applied two days before overseeding. Plots ranged from 92-100% cover (of perennial ryegrass) from December to the end of March (last evaluation). Turfgrass color was noticeably less at the 0.375 lb. AI/A rate, but not significantly different from that of the lower rate application treatments.

Pre-emergence weed control based on non-overseeded controls ranged from 51-100% across Sulfentrazone treated turfs, from December 1996 to late March, 1997. The percent reduction in Poa annua due to overseeding (comparison of non-overseed vs. overseed controls) was 90%, 61% 67% and 65% in December, January, February and March, respectively. Initial screening shows favorable activity for Poa annua control, especially at the 0.375 lb. AI/A rate. Further evaluation is needed to assess Poa annua suppression from Sulfentrazone and its potential interaction with overseeding, before cultural management programs can be devised for Poa annua control in an overseed program.

Introduction

Annual bluegrass (*Poa annua*) is the most troublesome and problematic winter annual weed in turfgrass. Pre-emergence control is the preferred method, but is severely limited when fall overseeding is part of the management program. Basically, Rubigan (fenarimol) is selectively used on tees and greens as a pre-emergence, applied at specific time internals before overseeding. While effective, there is a substantial cost for use of this product as a herbicide.

A test was devised and conducted to evaluate Sulfentrazone herbicide for (1) turfgrass tolerance at overseeding and (2) pre-emergence Poa annua control when applied at overseeding.

Materials and Methods

Sulfentrazone herbicide was applied to an overseeded bermudagrass turf with a known history of annual bluegrass infestation at the Country Club of Green Valley in Green Valley, Arizona. Sulfentrazone was applied at the following rates in lbs. AI/A; 0.125, 0.250, 0.375 and 0.250 + 0.250 as a sequential application. The test was scalped in preparation for overseeding on September 25 and Sulfentrazone was applied on September 27, 1997. The turf was overseeded on September 30 at the rate of 15 lbs. per 1000 ft^2 with a turf-type perennial ryegrass (Lolium perenne). Plot size was 5x10". Each treatment was replicated four times in a randomized complete block design. Four additional treatments (16 plots) were included at the initial test site for use as post emergence treatments (post emergence Poa annua control on established overseed ryegrass). The maintenance crew erroneously overseeded most of these plots, however three untreated control plots (no chemical applied, and no ryegrass overseed) remained and were used for percent weed control, based on weed population at the test site. Adequate replication was maintained for statistical procedures. An overseeded, non-treated check was included to measure the effect of overseed itself on Poa annua infestation levels (i.e., difference in weed population between overseeded and non-overseeded turf, both without Sulfentrazone).

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Treatments were applied using a Co_2 backpack sprayer with a 3 nozzle boom (20" spacing) using 8004 nozzles at 28 psi, delivering a final solution delivery rate of 56 gallons per acre.

Plots were evaluated for percent ryegrass cover (as a measure of overseed tolerance), turfgrass color and the number of Poa annua plants, per plot throughout the season. The end of March exhibited maximum expression of Poa annua infestation. Percent weed control was calculated as percent control, relative to the mean weed population of the three check plots, which received no Sulfentrazone. This was done for both a non-overseeded control and an overseeded control. All data were subjected to the analysis of variance technique using SAS software. Orthogonal contrasts were used to measure any rate responses of Sulfentrazone and to measure if there was a difference in performance for the single versus the double application at the 0.125 lb. AI/A rate treatments. Contrasts are included in the discussion, as appropriate.

Results and Discussion

Turfgrass Response

The percent plot cover (0-100%) was assigned on October 24, December 17, 1996 and on January 15, February 21 and March 30, 1997.

On October 24, total plot cover ranged from 64% to 93% among treated plots (Table 1). There was no significant differences in plot cover among Sulfentrazone treated plots however. Note that the repeat application was not made (0.125 + 0.125) until November 1. The difference in mean percent cover at this time [92% (0.125) vs. 64% for (0.125 + 0.125) not yet applied] was purely random (Table 1). Plot cover was high among the Sulfentrazone treated turfs and was not rate dependent (92%-93% plot cover)(Table 1). The overseeded check (no sulfentrazone) had 87% mean percent plot cover. This showed that Sulfentrazone did not affect the actual overseeding (emergence).

On December 17, percent plot cover scores were lower for all treatments. This was because the underlying bermudagrass was now completely dormant (tan/straw) which affected the visual estimates of green plot cover. The difference between all Sulfentrazone treatments was only 10% in actual plot cover (70%-80%)(Table 1).

By mid-January, green plot cover now increased from 95%-99% for treated plots. The overseeded control had 93% mean plot cover. Similar results occurred in February (Table 1).

On March 30, the single application treatments of Sulfentrazone ranged between 96%-100% cover, which was now estimated to be purely ryegrass. The Poa annua at the test site was now most detectable in color, texture and seed head formation. The non-overseeded check had 10% ryegrass cover from either trace wind blown seed (at overseeding) or from perennating plants from a previous overseeding. Sulfentrazone applied at the rates and timing sequence as tested was safe on perennial ryegrass overseed (Table 1). This is encouraging, since well over 98% of the commercially available pre-emergence products on the market would be detrimental to the emerging perennial ryegrass.

Turfgrass color scores were assigned to plots on the same dates. Color scores were significant among all turf treatments on all but the last date (March 30), mainly due to the fact that the non-overseeded check was included in the analysis (as a measure of actual turf performance).

On October 24, mean treatment color scores ranged from 4.7 to 6.0 on regularly mowed golf course (rough turf). All Sulfentrazone treated turfs had mean color scores of 6.0, except for that of the 0.375 lb. AI/A treatment (Table 2). At the high rate (0.375 lb. AI/A), Sulfentrazone had a lower mean color score of 4.7, which would be noticeably lighter in color to the lay person (Table 2).

Mean color scores ranged from 5.3 to 6.3 among treated turf on December 17, 1997. Again, no statistically significant differences occurred between the Sulfentrazone treated turfs, however, the lowest application rate (0.125 lb. AI/A) had the highest numerical score (6.3), while the highest application rate (0.375 lb. AI/A) had the lowest score (5.3) among treated turfs (Table 2). This was identical to the performance of the overseed check (ryegrass, no Sulfentrazone). It is not unusual for turfgrass to respond with enhanced turfgrass color following application of herbicides, or plant growth regulators anywhere from 3-10 weeks after treatment. This subtle reaction appeared for the low and medium rate treatments of Sulfentrazone (Table 2).

On January 15, 1997, overall turfgrass color improved, as treated plots ranged in mean color performance from 6.0 to 7.3.

Sulfentrazone at the low rate of 0.125 lb. AI/A had a mean color score of 7.3, followed by the 0.250 lb. AI/A rate and the overseed check, which had mean color responses of 6.5 and 6.3, respectively. Both the 0.125 + 0.125 lbs. AI/A and the single application treatment of 0.375 lb. AI/A had mean color scores of 6.0 (Table 2).

On February 21, mean color scores ranged from 6.0 to 7.0 among treated turfs. Again, there was no statistical difference among Sulfentrazone treated turfs, although the lowest rate did have the darker looking color. These difference would be subtle and generally not noticeable to the lay person or average golfer (Table 2).

Final color scores were assigned on March 30, 1997 and values were low due to decreased fertility. All Sulfentrazone plots had mean color score values of 5.3 to 5.7 (Table 2).

Basically, at the rates and timings tested here, Sulfentrazone was acceptable in terms of turfgrass color maintenance. The high application rate (0.375 lb. AI/A) did however, show decreased color on October 24 (27 DAT) and was similar to the overseeded check for color on December 17, 1997 (81 DAT).

Weed Control

As previously stated, weed control was measured in relation to both *non-overseeded* and to *overseeded control* plots. This allowed for (1) weed control efficiency and (2) an estimate of the effect of actual overseeding on Poa annua expression. It does not allow for measuring the interaction of overseed and herbicide treatment, however.

Percent weed control based on non-overseeded and on overseeded check plots are listed in Table 3. Also listed along with percent weed control, are the mean numbers of Poa annua plants, per treatment. By comparing the number of plots in the overseeded control, one can see the general effect of overseeding. On each of the four evaluation dates, there was an increase in actual amounts of Poa annua in both types of control plots (Table 3).

In relative terms, the effect of suppression from overseeding [1 - (overseeded control/non-overseed control) x 100] which occurred by overseeding alone was on average 90% (December), 61% (January), 67% (February) and 65% (March). This reduction is based on the average of each of three plot values, on each date. It is not a comparison statistic, but shows on average, the effect that overseeding alone had on general suppression.

It should be noted that at higher mowing heights (test was maintained at 1.50 inches), Poa annua is less competitive. Cutting height effects were not tested here.

Based on weed populations from non-overseeded check plots, percent weed control among Sulfentrazone treated turfs ranged from 51-100% on December 17, from 90% to 100% on January 15, from 82% to 95% on February 21, and from 94% to 98% on March 30 (Table 3).

During the December rating, note that the percent weed control varied between the 0.125 and 0.125 + 0.125 lb. AI/A treatments. One would expect some increased control from the tandem treatment, but this was not the case. In fact, the tandem treatment means are slightly lower on two of four dates, than the single 0.125 lb. AI/A treatment, alone. This is due to random Poa annua pressure, small bias on evaluation dates, or both.

Poa annua control was generally good, and was numerically best (in rank) for the 0.375 lb. AI/A treatments. Note again, that the herbicide rate effect was not significantly different.

Weed control based on the overseed controls (non-chemically treated-but overseeded turf) appears in Table 3, as well. These values are lower because there were lesser numbers of Poa annua plants in the overseeded check than the non-overseeded checks. Therefore, the values in Table 3 represent actual control levels of treated turf, compared to overseeded turf and not that of a non-overseeded (dormant winter) turf.

The percent weed control (based on overseeded controls) was not biologically discernable for December 1997, as "negative control" was achieved on two of the four treatments. This resulted (numerically) from the fact that random plots had more Poa annua plants emerging "among treated plots" at the beginning of the season, than that of the overseeded control. Note that the mean number of plants/overseeded check equal 4.0 plants. This percent weed control in early December (based on overseeded control means) is meaningless. A comparative and realistic interpretation of Table 3, *when comparing percent weed control based on the overseeded controls*, is to note the actual number of Poa annua plants per treatment. Adjustments of treatment means based on the percent Poa annua reduction "between checks" was not calculated, since there is no way to determine if there is an overseeding by herbicide rate interaction. Additional experimentation is necessary to investigate this important possibility, and to again determine the effect of Sulfentrazone

on Poa annua weed control when applied as a post emergence herbicide.

Conclusions

1. Sulfentrazone did not inhibit emergence of perennial ryegrass when applied two days before overseeding.

2. Plots ranged from 92-100% cover of perennial ryegrass from December to the end of March (last evaluation).

3. Turfgrass color was noticeably less at the 0.375 lb. AI/A rate, but not significantly different from that of the lower rate application treatments.

4. Pre-emergence weed control based on non-overseeded controls ranged from 51-100% across Sulfentrazone treated turfs, from December 1996 to late March, 1997.

5. The percent reduction in Poa annua due to overseeding (comparison of non-overseed vs. overseed controls) was 90%, 61% 67% and 65% in December, January, February and March, respectively.

6. Further evaluation is needed to asses the effect of overseeding on Poa annua suppression, the efficiency of Sulfentrazone and the interaction of the two before a cultural management program can be developed for turf.

7. Sulfentrazone at the 0.375 lb. AI/A rate showed the best results for Poa annua pre-emergence control, with no significant affect on overseeded turf performance.

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Table 1. Percent ground cover turf[1] of overseeded turfgrass after select treatments of Sulfentrazone herbicide. University of Arizona, 1996-1997.

TREATMENT	RATE[2] LBS. AI/A	OCT 24[3] (27DAT)	DEC 17[4] (81DAT)	JAN 15[4] (110DAT)	FEB 21[4] (147DAT)	MAR 30[4] (185DAT)
Sulfentrazone	0.125	92%	80%	99%	98%	96%
Sulfentrazone	0.250	92%	75%	96%	93%	96%
Sulfentrazone	0.375	93%	77%	96%	96%	100%
Sulfentrazone	0.250+0.250	64%	70%	95%	95%	92%
Non-overseeded Check[5]	--	0%	5%	5%	10%	10%
Overseed Check[6]	--	87%	72%	93%	93%	91%
Test Mean[7]		72%	64%	81%	82%	82%
LSD Value[8]		40%	16%	6%	8%	8%

[1]Percent turf covering the ground = (0-100%). Values are means of three replications.
[2]All treatments applied, September 27, 1996. 0.250 + 0.250 tandem applied, November 1, 1996.
[3]Percent turf cover = ryegrass and bermudagrass (0-100%).
[4]Percent ryegrass cover only = (0-100%).
[5]Non-overseed check = received no herbicide, no overseed.
[6]Overseed check = received no herbicide, overseeded.
[7]Test Mean = mean of all treatments on each evaluation date.
[8]LSD value = Mean separation statistic. Values between two treatment means must be greater than the LSD value for statistical differences to occur between means.

Table 2. Mean turfgrass color[1] mean scores of overseeded turfgrass after select treatments of Sulfentrazone herbicide. University of Arizona, 1996-1997.

TREATMENT	RATE[2] LBS. AI/A	OCT 24 (27DAT)	DEC 17 (81DAT)	JAN 15 (110DAT)	FEB 21 (147DAT)	MAR 30 (185DAT)
Sulfentrazone	0.125	6.0	6.3	7.3	7.0	5.3
Sulfentrazone	0.250	6.0	6.0	6.5	6.0	5.5
Sulfentrazone	0.375	4.7	5.3	6.0	6.3	5.7
Sulfentrazone	0.250+0.250	6.0	6.0	6.0	6.7	5.7
Non-overseeded Check[3]	--	3.0	1.0	2.0	2.0	3.3
Overseed Check[4]	--	5.3	5.3	6.3	6.3	5.7
Test Mean[5]		5.2	5.1	5.7	5.8	5.2
LSD Value[6]		1.3	1.5	1.6	1.9	1.8

[1]Color Scores = (1-9). 1 = dead, 9 = dark green. Values are means of three replications.
[2]All treatments applied, September 27, 1996. Second tandem treatment (0.250 + 0.250) applied November 1, 1996.
[3]Non-overseed check = received no herbicide, no overseed.
[4]Overseed check = received no herbicide, overseeded.
[5]Test Mean = mean of all treatments on each evaluation date.
[6]LSD value = Mean separation statistic. Values between two treatment means must be greater than the LSD value for statistical differences to occur between means.

Table 3. Percent weed control of annual bluegrass using Sulfentrazone herbicide, 1996-1997 overseed season. University of Arizona.

			DECEMBER 17, 1996			JANUARY 15, 1997		
TREATMENT	**RATE[1] LBS. AI/A**	**OVERSEED Y/N**	**% CONTROL[2] NO OVERSEED**	**% CONTROL[3] WITH OVERSEED**	**NO PLANTS[4] PER TRT**	**% CONTROL NO OVERSEED**	**% CONTROL WITH OVERSEED**	**NO PLANTS PER TRT**
Sulfentrazone	0.125	Y	98%	81%	(1)	100%	100%	(0)
Sulfentrazone	0.250	Y	83%	-93%	(7)	95%	88%	(4)
Sulfentrazone	0.375	Y	100%	100%	(0)	100%	100%	(0)
Sulfentrazone	0.250+0.250	Y	51%	-442%	(19)	90%	76%	(8)
Non-overseed control	--	N	--	--	(39)	--	--	(85)
Overseed control	--	Y	--	--	(4)	--	--	(33)
Effect of overseed					-90%			-61%
Test Mean[5]			83%	-89%	--	96%	91%	--
LSD Value[6]			NA	NA	--	NA	NA	--

Table 3. (cont.)

			FEBRUARY 21, 1997			MARCH 30, 1997		
TREATMENT	**RATE[1] LBS. AI/A**	**OVERSEED Y/N**	**% CONTROL[2] NO OVERSEED**	**% CONTROL[3] WITH OVERSEED**	**NO PLANTS[4] PER TRT**	**% CONTROL NO OVERSEED**	**% CONTROL WITH OVERSEED**	**NO PLANTS PER TRT**
Sulfentrazone	0.125	Y	95%	85%	(5)	94%	81%	(14)
Sulfentrazone	0.250	Y	93%	80%	(7)	92%	75%	(19)
Sulfentrazone	0.375	Y	98 %	93%	(2)	98%	93%	(5)
Sulfentrazone	0.250+0.250	Y	82%	44%	(18)	94%	84%	(12)
Blank control	--	N	--	--	(102)	--	--	(219)
Overseed control	--	Y	--	--	(33)	--	--	(75)
Effect of overseed					-67%			-65%
Test Mean[5]			92%	76%	--	94%	83%	--
LSD Value[6]			NA	NA	--	NA	NA	--

[1]Treatments applied September 27, 1996. Second split application (0.250 + 0.250) applied November 1, 1996.
[2]Percent control based on non-overseeded turf, no chemical treatment. Values are the mean of three replications.
[3]Percent control based on overseeded control turf, no chemical treatment. Values are the mean of three replications.
[4]Average number of Poa annua plants per plot, per treatment. Values are the mean of three replications.
[5]Test Mean = mean of all treatments on each evaluation date.
[6]LSD value = Mean separation statistic. Values between two treatment means must be greater than the LSD value for statistical differences to occur between means.