

Summer Applied Pre-Emergence Herbicides to Prevent *Poa Annua* Emergence on Fall Overseeded Turf

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Abstract

Ronstar and Barricade herbicides were applied to bermudagrass prior to overseeding with perennial ryegrass. For the initial establishment of fall overseeded bermudagrass with perennial ryegrass, Barricade and Ronstar both showed decrease in establishment at thirty days after overseeding (October 26) when compared to the controls. Reductions in turfgrass density after overseeding were realized by all pre-emergence treatments in the mid to late fall, depending on the specific treatment. Ronstar applied in one application at 2.0 lbs AI/A noticeably reduced visual density at 30 and 65 days after overseeding, regardless of the application timing (6 vs. 8 weeks) before overseeding. Reductions in turfgrass quality paralleled the reduction in density. Barricade applied at 0.75 lbs AI/A at 6 WBOS showed decreased quality at 30 and 65 days after overseeding. This same treatment caused a noticeable decrease in overall plot density at thirty days after overseeding. At 65 days after overseeding (November 30), quality was not quite fully acceptable (quality mean = 5.8), but acceptable density was achieved (mean density = 6.3). Poa annua (PA) established itself quickly. By November 30 (65 days after overseeding) overseeded- untreated control plots had between 67%-77% Poa annua present. The maximum rate of PA control for Ronstar in March was 74% (showing 15% Poa plot cover) and 61% in April (34% Poa plot cover). This occurred for the 2.0 lb AI/A at 8 WBOS treatment, which was similar to the same rate applied 6 WBOS. Split sequence applications (pre and post) of Ronstar produced low PA control (28%-50%) over the season as measured, when compared to single applications which achieved the same 2 lbs AI/A rate. The greatest amount of PA control was achieved by Barricade applied at 0.75 lb AI/A at 6 WAOS (86%-94% control). No treatment achieved 95% control of PA on a season long basis. Poa pressure at the test site was uniform and heavy.

Introduction

There are at least two major management events associated with desert turfgrass golf course maintenance, fall overseeding and control of Poa annua.

Overseeding is practiced to supply a year-round green surface for golf. The overseed requires a successful fall emergence of the ryegrass, which often lasts until late June or longer. Poa annua (hereafter referred to as PA) is the most troublesome grassy weed in turf and is capable of infesting all turfed areas regardless of mowing height. Late winter and early spring flower production degrades turf conditions and assures a never ending supply of future offspring.

Overseeding operations and the germination of both ryegrass and PA unfortunately occur at optimal times for each other. This makes pre-emergence control of PA extremely problematic. Fenarimol (Rubigan) fungicide is used as a pre-

emergence for PA control at overseeding. Two or three applications are required. The cost is roughly \$1000 per acre. Those not fortunate enough to budget for this option can either treat post emergence with ethofumesate (Prograss) in the early winter when bermuda is dormant, or live with PA in the overseeded bermudagrass. Seed head reduction is possible with mefluidide (Embark), but this may enhance persistence of the PA.

A pre-emergence trial was conducted to evaluate two commercially available pre-emergence herbicides for efficacy and turf safety in a pre-emergence program for PA control in conjunction with overseeding bermudagrass with perennial ryegrass. Weed control was compared to post emergence applications of Prograss and split applications (pre/post) of Ronstar.

Materials and Methods

A golf course rough known to have a historical stand of PA was used for this test. The herbicides oxadiazon (Ronstar) and proflaminate (Barricade) were applied as pre-emergence herbicides. Barricade was applied strictly as a pre-emergent, while Ronstar was applied both as a pre-emergence, and as a pre/post emergence combination treatment. The second applications (post) were devised to control later germinating PA plots in the late fall. Treatments were as follows.

1. Ronstar	2 lbs AI/A	8 weeks before overseed
2. Ronstar	1 lb AI/A	8 weeks before overseed and 1 lb AI/A 8 weeks after
3. Ronstar	2 lbs AI/A	6 weeks before overseed
4. Ronstar	1 lb AI/A	6 weeks before overseed and 1 lb AI/A 6 weeks after
5. Prograss	2 lbs AI/A	2 applications in January (1 lb AI/A per each application)
6. Barricade	0.75 lbs AI/A	8 weeks before overseeding
7. Barricade	0.50 lbs AI/A	8 weeks before overseeding
8. Barricade	0.75 lbs AI/I	6 weeks before overseeding
9. Barricade	0.50 lb AI/I	6 weeks before overseeding

The turf was comprised of common bermudagrass which was overseeded September 28, 1998 at the rate of 600 lbs. of perennial ryegrass per acre. Treatments 1, 2, 6 and 7 (8 weeks before overseeding) were applied on August 6, 1998. Treatments 3, 4, 8 and 9 (6 weeks before overseed) were applied on August 18, 1998. Treatment 4 (6 weeks after overseeding) was applied on November 9, 1998. Treatment 2 (1.0 lb AI/A Ronstar sequential) was applied on November 23, 8 WAOS. The split applications of Prograss (#5) were applied on January 15 and January 28, 1999 (10, 12 weeks after overseeding, respectively).

Plots were rated from October 26, 1998 to April 7, 1999. Individual plot ratings (when applicable) included emergence and condition of the ryegrass overseed, turfgrass performance (color, quality, density, % straw) using NTEP visual scales of 1-9. PA infestation was assessed visually as the percent plot Poa (0-100%) for the treated and control half of each plot on November 13, January 11, March 12 and April 7. PA plot percentages are included when discussing total plot composition dynamics. Actual percent Poa control was expressed as $1 - (\text{treatment/control}) * 100$ for November 13, January 11, March 12 and finally on April 17, 1999. Means of the untreated control half-plots are included for observation, but not included in any statistical analysis.

The test design was a RCBD with eight replications. Eight plots bordering the west side of the test showed poor growth and asymptomatic treatment responses. This data was entered as missing data points in SAS GLM, which iterates a valid mean data point for each plot based on treatment and replication effects. PA control in November and early January did not include Prograss treatments as they were not yet applied.

All data was subjected to the analysis of variance and Bonferroni protected LSD values were calculated as a mean separation statistic. Polynomial contrasts were used to compare logical treatment comparisons between and within chemical treatments, and are included when warranted in the discussion only.

Plots were mowed twice weekly with clippings returned at 1.0 inch with a triplex reel mower. The turf received 3.0 lbs of -N-/1000 ft² from November to May and was irrigated to prevent stress.

Results and Discussions

Initial Emergence and Plot Composition and turf response.

October 26, 1998

Plots were rated for total percent plot cover, percent bermuda, percent bare ground and percent rye on October 26, 1998. This provided insight as to the overall composition of the plots immediately after overseeding. Density, color and quality scores were also assigned. The same response variables were assigned to plots on November 30.

Mean percent plot cover scores among treated plots (percent green grass regardless of species) ranged from 83%-95% on October 26 (30 days after overseeding) (Table 1). Ronstar applied at 2.0 lbs AI/A @ 6 WBOS had the lowest total plot grass cover (mean = 83%), followed closely by Barricade applied at 0.75 lb AI/A 6 WBOS (mean = 85%) (Table 1). The yet to be treated Prograss plot had 99% cover. Ronstar at 1.0 lb AI/A applied at 8 WBOS (before post treatment later) had 95% plot total cover, the highest among treated plots to date (Table 1). Both Ronstar treatments which received the 1.0 lb AI/A application (first of a split application) had the greatest amount of percent ryegrass (87%)(Table 1). Plots which ranked the lowest in ryegrass cover were all Barricade treated plots (ranging from 61% to 81% mean ryegrass cover) as well as both Ronstar treatments which received 2 lbs AI/A at 8 WBOS and at 6 WBOS (71%, 68% ryegrass cover, respectfully) (Table 1).

The Barricade treatment of 0.75 lb AI/A applied at 6 WBOS had 25% bermuda visible and 14% bare ground. This was the highest application rate of Barricade applied closest to the overseed date. Both 2.0 lb AI/A Ronstar treatments had 14-10% bare cover (Table 1). Ten percent or less bare ground would be the most tolerable response at four weeks after overseeding.

Likewise, treatments with the least total cover scored lower overall in turfgrass quality on October 26 (Table 2). Both Ronstar treatments which received 2.0 lbs AI/A scored 5.5 and 5.1 respectively for quality (8 WBOS, 6 WBOS, respectively). Barricade at 0.75 lb AI/A 6 WBOS had a quality mean score of 5.5. Plots with marginal density at this time included Barricade 0.75 lb AI/A (5.3), Ronstar 2 lbs AI/A 6 WBOS (5.3) and Ronstar at the 2 lbs. AI/A rate applied 8 WBOS (mean = 5.6). All other plots produced an acceptable visible turf density (Table 2).

November 30, 1998

On November 30, all plots had 95% or greater total turf cover, with the exception of the Ronstar treated plots which received the single 2.0 lb AI/A application, which produced 82%-86% total cover (Table 1). These same plots tended to have the greatest amount of visible bermudagrass present, as well (Table 1). By November 30, overall plot color scores ranged from 5.4 to 6.4 with Ronstar treatments showing a lighter color turf. This response was most likely due to the six and eight WAOS applications of Ronstar at the 1.0 lb rate, which were applied close to this evaluation date (Table 2).

All Barricade plots had color scores of 6.0 or greater. Ronstar treated plots had mean color scores of 5.4 to 5.9 (Table 2). The overall quality scores ranged from 4.6 to 6.9. Ronstar at 2.0 lbs AI/A applied 6 WBOS exhibited lower quality turf than other plots in general (mean = 4.6) The 1.0 + 1.0 lb AI/A applications of Ronstar had better quality than the Ronstar plots which received the single 2.0 lb AI/A application (Table 2).

The same trends occurred for visual density on November 30. The Ronstar 2.0 lb AI/A applied 6 WBOS exhibited a lower plot density than other plots (Table 2).

January 11, 1999

On January 11 plot composition scores were assigned to all plots as percent ryegrass, percent straw turf and percent plot PA. The straw turf was from necrotic leaf tips on perennial ryegrass or from blades or sheaths from dormant bermudagrass which were very much apparent from cold temperatures. Both Ronstar treated turfs which received the 2.0 lb AI/A from a single application, and the Barricade plots which were applied at six weeks before seeding (regardless of rate) had the greatest amounts of visible plot straw (Table 3). All plots exhibited 100% grass cover (no bare ground)(Table 3).

At this time, Ronstar treated plots which received the split 1.0 lb. AI/A applications (both pre and post emergence of the ryegrass overseed) had significantly more (twice the amount of) PA than those treated with a single pre-emergence application at the 2.0 lb AI/A rate (Table 3). Both of the Barricade treatments which were applied 6 WBOS had less

visible Poa than those Barricade plots treated 8 WBOS, regardless of the application rate. Prograss plots, which would be treated in four days (January 15) were now on average 77% PA (Table 3). Control plots now averaged 67% PA.

March 12, 1999

On March 12, 1999 all plots were rated for turfgrass color, quality, density, percent ryegrass cover and percent plot PA. At this time, both Prograss treatments were applied (January 15 and 28). Mean color scores among treated plots ranged from 6.9 to 7.9 as all plots exhibited very good late winter color (Table 4). Prograss treated plots showed a fully acceptable color response (mean = 6.9), despite the large amount of PA which was still in the non-flowering stage (Table 4).

Quality scores for March ranged from 6.0 to 7.5 among treated turfs. Barricade plots applied at the 0.75 lb AI/A rates ranked highest in overall quality (7.2-7.5)(Table 4). Barricade applied 0.75 lb AI/A 8 WBOS exhibited a high visual density rating (mean = 7.8). The Prograss treated turf had the lowest visual density at this time (mean = 5.2), due to PA thinning (Table 4).

The composition of the plots at this time was perennial ryegrass and PA. No visible bermudagrass was evident. Among Ronstar treated turfs, the 1.0 lb AI/A 8 WBOS/8 WAS showed the highest density (Table 4). This was from the high percentage of PA competing vigorously with the ryegrass. Barricade at 0.75 lb AI/A applied at 8 WBOS was also equal in density, having somewhat less PA present. Those treatments with the least amount of visual Poa included Barricade at 0.75 lbs AI/A applied at 6 WBOS (highest rate, closest to overseeding date). The mean percent plot Poa was 9% for that treatment (Table 4). Barricade applied at the same rate at 8 WBOS had over twice the amount of Poa versus the 6 WBOS timing (21% vs. 9% Poa, respectively) (Table 4). Ronstar plots treated at 2.0 lbs at 8 WBOS had the least amount of Poa for this chemical (15%), which was less than the same rate at 6 WBOS (19%). This may be a latent expression of Poa in the canopy or just a random effect (Table 4). It would be desirable to have 5% Poa or less at this point. No treatment achieved this level of control. Note that the PA weed pressure was very strong at this site.

April 7, 1999

Field observations were concluded on April 7, 1999. Data values were assigned to all plots for turfgrass color, quality, percent plot cover ryegrass and percent PA.

Mean color scores were overall lower on April than in March. This was in part due to the explosion of PA which occurred by the first week in April. The lighter color turf (with seed heads) from PA influenced the overall color scores of each plot individually (Table 5).

Only one treatment showed color and quality performance of 6.0 or greater. This occurred for the Barricade 0.75 lb AI/A at 6 WBOS treatment. This plot had mean overall quality, color and percent Poa plot infestation scores of 6.1, 6.3 and 9%, respectively. All other treatments had lower quality scores and a large amount of PA (Table 5). No treatment provided long term PA control. Interestingly, the Prograss treated turf reversed itself back to essentially a 50%/50% PA/ryegrass composition. The Prograss should have most likely been applied sooner, but warmer temperatures in early December showed green leaf tissue in mid December on nearby non-overseeded roughs. An application the week of December 25 and again between January 10-15 may have yielded better results.

On average, the Ronstar plots which received the single application at the 2.0 lb AI/A rate had less actual amounts of PA than those that received the 1.0 lb AI/A, both before and after overseeding (Table 5). Still, PA control was not adequate (Table 6), and visible plot Poa was quite high (Table 5).

Weed Control

Percent weed control was calculated as the percent of PA present in treated plots, as a percent of that off the respective control plot. Percent weed control was thus determined for the dates of November 30, 1998, January 11, March 12 and April 7, 1999 (Table 6).

Barricade plots on average produced better weed control than Ronstar noting that no applications of Barricade were made after overseeding (Table 6). The Barricade plots still yielded appreciable amounts of Poa by April. When applied at the highest rate and closest to overseeding, Barricade produced the best results for weed control in April (9% actual percent plot Poa, and 90% Poa control)(Tables 5, 6). Barricade did allow for adequate germination, equal to or slightly better than that of Ronstar. However, it was a field observation that vigor may be lacking from Barricade treated turfs.

Barricade turf appeared “shorter” in stature than Ronstar in October through the end of November (in full). However, it was not possible to assess this (through clipping weights or other quantitative measurements) on a active golf course.

Ronstar

Initial mid season and late season weed control among Ronstar treated turf was low for the split application treatments which received 1.0 lb AI/A before overseeding, followed with a 1.0 lb AI/A again after overseeding. This was true regardless of timing application sequences (Table 6). Better and more consistent weed control was achieved among Ronstar treated turfs by applying the full 2.0 lbs AI/A as a single pre-emergence application. These plots had good early to mid season control (November-January) but decreased significantly in late season control (March, April). Overall, there was large amounts of visible PA from March on to the end of the season.

Prograss

Prograss produced 77% control for one month (March) and ended with 46% control in April. This may be due to the fact that the Prograss may have been applied in middle and late January. Applications were based on bermudagrass safety as opposed to early season infestation of PA.

Barricade

Barricade weed control of PA ranged from 32%-94% across all months and treatments (Table 6). Control was moderate at best for either the 0.75 or 0.50 lb AI/A rates when applied at 8 WBOS. Superior control was achieved for Barricade when applied 6 WBOS. Over the course of the season, the high rate applied closest to overseeding (0.75 lb AI/A at 6 WBOS) produced consistent results in PA control (Table 6). This treatment maintained PA control at 94%, 92%, 86% and 90% for November, January, March and April, respectively. This treatment did produce a lower quality turf, initially.

Conclusion

1. For the initial establishment of fall overseeded bermudagrass with perennial ryegrass, Barricade and Ronstar both showed decreases in establishment by thirty days after overseeding, October 26, when compared to the controls.
2. With 85% total plot cover, Barricade applied at the rate of 0.75 lb AI/A at 6 WBOS had the least amount of ryegrass (61%), the most bermudagrass (25%) and 14% bare ground at thirty days after overseeding.
3. Similar results were observed for Ronstar treated turf, when applied at 2.0 lbs AI/A at 6 WBOS. This treatment yielded 83% total plot cover, comprised of 68% ryegrass, 16% bermuda and 16% bare ground.
4. All other Ronstar and Barricade treatments (applied before overseeding) yielded 86%-93% total cover, with ryegrass averaging 79%-87% at thirty days after overseeding (October 26).
5. Yet to be treated Prograss turf exhibited 99% cover (95% ryegrass, 4% bermuda, 1% bare ground) at thirty days after overseeding. These plots quickly subsided to 70% Poa by November 30 (approximately 65 days after overseeding).
6. Reductions of visual estimates of turfgrass density after overseed were realized by all pre-emergence treatments in the mid to late fall, depending on the specific treatment.
7. Ronstar applied at 2.0 lbs AI/A noticeably reduced visual density at 30 and 65 days after overseeding, regardless of the application timing (6 vs. 8 weeks) before overseeding. Reductions in turfgrass quality paralleled the reduction in density.
8. Barricade applied at 0.75 lbs AI/A at 6 WBOS showed decreased quality at 30 and 65 days after overseeding. This same treatment caused a noticeable decrease in overall plot density at thirty days after overseeding. At 65 days after overseeding (November 30), quality was not quite fully acceptable (quality mean = 5.8), but acceptable density was achieved (mean density = 6.3).
9. Turfgrass color was slightly better for Barricade versus Ronstar treated turfs in October, November and January. Both Barricade and Ronstar produced similar turf color scores in March.
10. Poa annua established itself quickly. By November 30 (65 days after overseeding) overseeded untreated control plots had between 67%-77% Poa annua present.
11. Turfgrass quality was generally better among Barricade plots versus Ronstar plots in January 1999. The same trend for density occurred in January with Barricade treatments yielding slightly denser plots.

12. As a post emergence treatment, Prograss designated turf plots had 70% Poa by November 30 and 77% by January 11, four days before the first of two applications of Prograss made in January.
13. Turfgrass quality decreased greatly from March into April, mostly from the vast amount of PA that invaded the plots.
14. The maximum rate of PA control for Ronstar in March was 74% (showing 15% Poa plot cover) and 61% in April (34% Poa plot cover). This occurred for the 2.0 lb AI/A at 8 WBOS treatment, which was similar to the same rate applied 6 WBOS.
15. Split sequence applications (pre and post) of Ronstar applied each at 1.0 lb. AI/A, produced low PA control (28%-64%) over the season as measured, when compared to single applications at 2 lbs AI/A rate (49%-86%).
16. The greatest amount of PA control was achieved by Barricade applied at 0.75 lb AI/A at 6 WAOS (86%-94% control).
17. Barricade applied at 0.50 lbs AI/A at 6 WAOS, had the second greatest degree of control. This treatment provided greater control than the 0.75 lb AI/A rate applied at 8 WBOS.
18. Plot performance attributes for the perennial ryegrass were more acceptable for the 0.50 lb AI/A versus the 0.75 lb AI/A among Barricade treated turfs.
19. No treatment achieved 95% control of PA on a season long basis. Poa pressure at the test site was uniform and heavy.
20. No planned overlap rates were tested here. It is logical and necessary to test for turf product safety, especially when using a pre-emergent herbicide linked to a seedling establishment (overseed) program.
21. Selected rates and timing treatment combinations should be tested under different irrigation or soil moisture levels as this may affect efficacy and turf safety relative to irrigation uniformity on large turf areas.

Table 1. Turfgrass plot composition as affected by the application of Ronstar, Barricade and Prograss herbicides. University of Arizona, 1998-1999.

----- OCTOBER 26 ----- NOVEMBER 30 -----

Treatment	Rate lb AI/A	WBOS ¹	WAOS ²	Percent Cover ³	Percent Rye ⁴	Percent Bermuda ⁵	Percent Bare Turf ⁶	Percent Cover ³	Percent Rye ⁴	Percent Bermuda ⁵	Percent Bare Turf ⁶	Percent Poa ⁷
Ronstar	2	8	--	86	71	15	14	86	65	18	14	7
Ronstar	1	8	8	95	87	9	4	98	56	8	2	36
Ronstar	2	6	--	83	68	16	16	87	65	16	13	10
Ronstar	1	6	6	94	87	7	6	96	62	7	3	30
Prograss	NA	NA	NA	99	95	4	1	99	28	3	1	70
Barricade	0.75	8	--	93	81	13	6	97	70	10	3	18
Barricade	0.50	8	--	93	77	15	8	95	72	11	5	14
Barricade	0.75	6	--	85	61	25	14	96	82	12	4	4
Barricade	0.50	6	--	93	79	14	6	95	77	13	5	5
Control ⁸				99	95	4	1	99	88	4	1	55
Test Mean ⁹				92	78	13	9	95	64	11	5	21
LSD Value ¹⁰				7	14	9	7	6	18	5	6	NA

¹Number of weeks treatment applied before overseeding.

²Number of weeks treatment applied after overseeding.

³Total percent plot cover, all grasses (0-100%).

⁴Percent plot ryegrass overseed (0-100%). Mean of eight replications.

⁵Percent plot bermudagrass (0-100%). Mean of eight replications.

⁶Percent bare ground (0-100%). Mean of eight replications.

⁷Percent *Poa annua* in plot (0-100%). Mean of eight replications. See Table 6 for percent control PA.

⁸Mean of non-treated half plots. Mean of seventy-two observations.

⁹Mean of all treated plots (N=72).

¹⁰Mean separation statistic. Numerical differences between treatment means must be larger than the LSD value to be significantly different from each other.

Table 2. Mean turfgrass color, quality and density scores of overseeded turf after application or pre-emergence and post emergence herbicides. University of Arizona, 1998-1999.

Treatment	Rate lb AI/A	WBOS ¹	WAOS ²	----- OCTOBER 26 -----			----- NOVEMBER 30 -----		
				Color ³	Quality ⁴	Density ⁵	Color ³	Quality ⁴	Density ⁵
Ronstar	2	8	--	6.0	5.5	5.6	5.8	5.1	5.4
Ronstar	1	8	8	6.5	6.9	6.9	5.4	6.3	6.9
Ronstar	2	6	--	5.4	5.1	5.3	5.9	4.6	5.4
Ronstar	1	6	6	6.0	6.8	7.4	5.6	6.9	7.6
Progress	NA	NA	NA	6.1	7.6	8.3	4.4	7.6	8.4
Barricade	0.75	8	--	7.3	6.8	6.3	6.0	6.9	7.0
Barricade	0.50	8	--	6.9	6.5	6.8	6.0	6.6	7.5
Barricade	0.75	6	--	7.1	5.5	5.3	6.4	5.8	6.3
Barricade	0.50	6	--	7.4	6.5	6.9	6.0	6.6	6.6
Control ⁶				5.9	7.4	8.0	4.3	7.3	8.4
Test Mean ⁷				6.5	6.4	6.5	5.7	6.3	6.8
LSD Value ⁸				0.9	1.1	1.2	0.7	0.8	0.9

¹Number of weeks treatment applied before overseeding.

²Number of weeks treatment applied after overseeding.

³Color 1-9, 1 = dead turf, 9 = darkest green possible.

⁴Quality 1-9, 1 = dead turf, 6 = acceptable, 9 = best possible.

⁵Density 1-9, 1 = no turf, 6 = acceptable, 9 = best possible.

⁶Mean of untreated plot halves. N=72.

⁷Mean of all herbicide treated plots. Values are mean of eight replications.

⁸Mean separation statistic. Numerical differences between treatment means must be larger than the LSD value to be significantly different from each other.

Table 3. Mean turfgrass performance and plot canopy compositions of overseeded turf after select applications of pre and post emergence herbicides. University of Arizona, 1998-1999.

----- JANUARY 11 -----

Treatment	Rate lb A/A	WBOS ¹	WAOS ²	Color ³	Quality ⁴	Density ⁵	Percent Plot Cover ⁶	Percent Straw ⁷	Percent Rye ⁸	Percent Poa ⁹
Ronstar	2	8	--	4.8	4.8	5.8	100	14	89	11
Ronstar	1	8	8	5.1	5.9	7.6	100	9	74	26
Ronstar	2	6	--	4.9	4.6	5.6	100	16	90	10
Ronstar	1	6	6	4.6	5.5	6.6	100	7	70	30
Progress	NA	NA	NA	3.6	7.1	8.4	100	4	22	77
Barricade	0.75	8	--	6.0	7.0	7.9	100	8	81	19
Barricade	0.50	8	--	5.3	6.4	7.4	100	8	83	17
Barricade	0.75	6	--	6.0	5.4	6.6	100	13	94	7
Barricade	0.50	6	--	5.6	6.3	7.0	100	13	92	6
Control ¹⁰				3.9	6.5	8.3	100	5	33	67
Test Mean ¹¹				5.1	5.9	7.0	100	10	77	22
LSD Value ¹²				0.8	1.0	1.0	NA	5	20	NA

¹Number of weeks treatment applied before overseeding.

²Number of weeks treatment applied after overseeding.

³Color 1-9, 1 = dead turf, 9 = darkest green possible.

⁴Quality 1-9, 1 = dead turf, 6 = acceptable, 9 = best possible.

⁵Density 1-9, 1 = no turf, 6 = acceptable, 9 = best possible.

⁶Percent plot cover, all grasses (0-100%). Values are the mean of eight replications.

⁷Percent plot straw as either dead sheaths of leaves (0-100%). Values are mean of eight replications.

⁸Percent ryegrass (0-100%). Values are mean of eight replications.

⁹Percent Poa annua per plot (0-100%). Values are mean of eight replications. See Table 6 for percent PA control.

¹⁰Mean of untreated plot halves. N=72.

¹¹Mean of all herbicide treated plots. Values are mean of eight replications.

¹²Mean separation statistic. Numerical differences between treatment means must be larger than the LSD value to be significantly different from each other.

Table 4. Response of overseeded turf to pre and post applications of herbicides. University of Arizona, 1998-1999.

----- March 12 -----

Treatment	Rate lb AI/A	WBOS ¹	WAOS ²	Color ³	Quality ⁴	Density ⁵	Percent Rye ⁶	Percent Poa ⁷
Ronstar	2	8	--	7.3	6.8	6.9	85	15
Ronstar	1	8	8	7.0	6.4	7.8	74	25
Ronstar	2	6	--	7.1	6.4	6.5	81	19
Ronstar	1	6	6	7.1	6.0	7.5	77	23
Progress	2	--	(10+12)	6.9	6.3	5.2	84	16
Barricade	0.75	8	--	7.4	7.2	7.8	79	21
Barricade	0.50	8	--	7.1	6.8	7.3	87	13
Barricade	0.75	6	--	7.9	7.5	7.3	91	9
Barricade	0.50	6	--	7.9	6.8	7.0	84	16
Control ⁸				6.4	6.6	7.7	33	52
Test Mean ⁹				7.3	6.6	7.0	82	18
LSD Value ¹⁰				0.7	0.9	0.8	NS	NA

¹Number of weeks treatment applied before overseeding.

²Number of weeks treatment applied after overseeding.

³Color 1-9, 1 = dead turf, 9 = darkest green possible.

⁴Quality 1-9, 1 = dead turf, 6 = acceptable, 9 = best possible.

⁵Density 1-9, 1 = no turf, 6 = acceptable, 9 = best possible.

⁶Percent plot ryegrass overseed (0-100%). Mean of eight replications.

⁷Percent *Poa annua* in plot (0-100%). Mean of eight replications. See Table 6 for percent PA control.

⁸Mean of untreated plot halves. N=72.

⁹Mean of all herbicide treated plots. Values are mean of eight replications.

¹⁰Mean separation statistic. Numerical differences between treatment means must be larger than the LSD value to be significantly different from each other.

Table 5. Mean turfgrass color, quality and plot composition of overseeded turf after treatment with select herbicides. University of Arizona, 1998-1999.

----- April 7 -----

Treatment	Rate lb AI/A	WBOS ¹	WAOS ²	Color ³	Quality ⁴	Percent Rye ⁵	Percent Poa ⁶
Ronstar	2	8	--	5.4	4.8	66	34
Ronstar	1	8	8	4.4	4.0	43	58
Ronstar	2	6	--	5.2	4.5	61	39
Ronstar	1	6	6	4.8	3.9	54	46
Progress	2	--	(10+12)	5.8	5.5	52	49
Barricade	0.75	8	--	5.5	5.5	77	23
Barricade	0.50	8	--	5.3	5.0	75	25
Barricade	0.75	6	--	6.3	6.1	91	9
Barricade	0.50	6	--	5.8	5.1	80	20
Control ⁷				3.5	3.3	48	77
Test Mean ⁸				5.3	4.9	66	33
LSD Value ⁹				0.8	1.0	22	NA

¹Number of weeks treatment applied before overseeding.

²Number of weeks treatment applied after overseeding.

³Color 1-9, 1 = dead turf, 9 = darkest green possible. Values are the mean of eight replications.

⁴Quality 1-9, 1 = dead turf, 9 = best possible. Values are the mean of eight replications.

⁵Percent plot ryegrass overseed (0-100%). Values are the mean of eight replications.

⁶Percent Poa annua in plot (0-100%). Values are the mean of eight replications. See Table 6 for percent PA control.

⁷Mean of untreated plot halves. N=72.

⁸Mean of all herbicide treated plots. Values are mean of eight replications.

⁹Mean separation statistic. Numerical differences between treatment means must be larger than the LSD value to be significantly different from each other.

Table 6. Mean percent Poa annua control in overseeded turf after application of Ronstar, Barricade and Progress herbicides. University of Arizona, 1998-1999.

----- Percent Control³ -----

Treatment	Rate lb AI/A	WBOS ¹	WAOS ²	November 30	January 11	March 12	April 7
Ronstar	2	8	--	87	85	74	61
Ronstar	1	8	8	32	64	30	28
Ronstar	2	6	--	80	86	67	49
Ronstar	1	6	6	38	43	51	33
Progress	2	--	(10+12)	NA	NA	77	46
Barricade	0.75	8	--	66	49	24	67
Barricade	0.50	8	--	48	65	32	62
Barricade	0.75	6	--	94	92	86	90
Barricade	0.50	6	--	85	84	71	74
Control ⁴				NA	NA	NA	NA
Test Mean ⁵				65	71	57	56
LSD Value ⁶				31	38	39	26

¹Number of weeks treatment applied before overseeding.

²Number of weeks treatment applied after overseeding.

³Percent Poa annua control. Treated turf infestation versus control turf infestation (0-100%). Values are the mean of eight replications.

⁴Mean of non-treated half plots. Mean of seventy-two observations.

⁵Mean of all treated plots (N=72).

⁶Mean separation statistic. Numerical differences between treatment means must be larger than the LSD value to be significantly different from each other.