

# **Assessing the Potential Use of TENACITY (mesotrione) Herbicide For use as a Control Agent for *Poa annua* In Conjunction With Fall Overseeding of Bermudagrass**

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## ***Abstract***

*Tenacity herbicide (mesotrione) was evaluated for use as both a pre-emergent and post-emergent herbicide in conjunction with fall overseeding of bermudagrass with perennial ryegrass. Tenacity herbicide, when applied @7 DBOS, 1 DBOS, at first mowing (2 WAOS) or 3 weeks after the first mowing (5 WAOS) did not cause a reduction in stand of perennial ryegrass compared to non-treated controls. There was essentially no difference in ryegrass emergence and cover for Tenacity when applied at the 2.0 oz. versus the 3.0 oz. AI/A rate. When applied at these rates at both 7 DBOS and at the first mowing, treatments 1, 3, and 6 produced similar results. Overseeding occurred on October 16, 2007. Intense *Poa annua* pressure dominated the overseed ryegrass by late December, causing a decline in existing ryegrass cover. Only the latter applied treatments (of Prograss, or tank mixes which contained Prograss with Tenacity) regained sizable amounts of ryegrass by the end of February and early March. Percent weed control was ineffective for treatments which did not include Prograss herbicide. The split application of Prograss of 0.75 lbs AI/a applied @ 8 WAOS and again @ 12 WAOS resulted in the greatest amount of *Poa annua* control, and the greatest amount of ryegrass. Tenacity (mesotrione), when applied at rates and timings observed here, was safe for perennial ryegrass emergence, but ineffective on *Poa annua* pre-emergence and as a post emergent agent based on the subsequent growth of *Poa annua*.*

## **Introduction**

*Poa annua*, (a.k.a) “annual bluegrass” and hereafter as (AB) is the most cosmopolitan winter weed in all of turfgrass management. Most people ignore its control, but all complain about it when it flowers in late winter and early spring.

Many pre-emergent products are available and effective for preventing seed germination, but the need to overseed bermudagrass with a cool season grass coincides directly with the biological time clock of *Poa annua* germination and most pre-emergent products negates overseeding

There are a few compounds commercially available which are used for pre-emergent control of (AB) in conjunction with overseeding. Rubigan (fenarimol) is a fungicide which has pre-emergence activity against AB. It has good to excellent turf safety, is highly effective (98-100% control), but is expensive. Barricade (proflumicafene) has special label directions for use in overseeding programs, calling for 0.38 to 0.65 lbs AI/A applied six to eight weeks prior to overseeding. There is typically root stunting for the first 4-6 weeks after emergence, and great care must be practiced in avoiding spray application overlaps, which doubles the applied rate. At label rates, percent control is about 90%. Tranxip (trifluralin) can be applied the day before overseeding, but only emerged (AB) is controlled. Dimension (dithiopyr) is also labeled for this use, but AB control has not been at adequate levels.

Tenacity (mesotrione) is a relatively new product which has good cool season grass tolerance, with a wide range of weed control. Mesotrione is both foliar and root absorbed by plants. With this in mind, a test was conducted to investigate a rate and timing application structure for Tenacity herbicide for use as an AB pre-emergent in an overseed-turf situation, and subsequently, for post emergent activity.

## **Materials and Methods**

A golf course fairway at the Silverbell Golf Course (City of Tucson) with a known history of AB was selected for the test site. There were ten herbicide treatments comprised of three rates of Tenacity herbicide, applied at any of four selected timings relative to overseeding, along with Prograss (ethofumesate). An untreated control area was also included. The description, timings, and application rates of the treatments are listed in Appendix Table A. The test site was established with treatment applications applied across an entire 6 x 6 plot, with one half of the plot being overseeded, while the other half was not overseeded. This was done to (1) determine the amount of AB pressure present, (2) evaluate the effect of treatments on (PA) without competition from perennial ryegrass, (3) determine the affect of overseeding alone on AB suppression, and (4) evaluate weed control on an overseeded turf

(intended use), as the primary objective. Since a turf cover x herbicide interaction is of no value to the end user, the data was analyzed as two separate tests (for overseeded and non-overseeded turfs).

The physical percent plot Poa coverage (0 – 100%) was assigned to plots on 22 December 2007, and on 15 January, 20 February, 7 March, and 4 April 2008. Both actual AB amounts and percent AB weed control were analyzed for treatment effects using SAS software for both overseed and non-overseeded data sets using the mean of the four NTC plots for percent weed control. Percent weed control was determined by the formula,  $(1 - (TRT/NTC)) \times 100$ .

Other variables assigned to plots included visual assessments of seed head suppression, the percent of the plot in flowering mode (0 – 100%), injury to Poa annua (% plot basis and degree of injury) and percent plot surface compositional elements (% ryegrass, % Poa annua, % straw). Visual assessments of turfgrass density, quality and whole plot uniformity scores were assigned when applicable. All data was subjected to the analysis of variance techniques. Since designated treatments were pre-selected as fixed structure treatments, LSD values were calculated as the treatment mean separation statistic, only if and when the F ratio for the treatment mean squares was significant when the P value for the treatment mean squares was 0.05, or less.

## **Results and Discussion**

For purposes of logical expression of results, note that treatments 7, 8 and 9 received no treatments until 8 weeks after overseeding, while treatment number 10 had one component applied at the “first mow” timing. Therefore, data taken prior to January 10<sup>th</sup> applied to treatments 1, 2, 3, 4, 5, 6, and 10. Note that treatments 7, 8, and 9 were applied on December 13, 2007, and January 10, 2008, and therefore relevant data responses being most applicable for these treatments would occur on the evaluation dates of January 15, February 20, March 7, and April 4, 2008.

### *Turfgrass Performance:*

#### Overseeded turfgrass –

The percent plot cover from ryegrass overseed averaged 41%, 67%, and 70% cover for November 1, November 13, and December 13, 2007, respectively (Table 1). There was no significant effect of the treatments for ryegrass cover from November 1 2007, to February 20, 2008. Note the decline in ryegrass which occurred after mid December, as (AB) pressure developed strongly. Note the high levels of (AB) infestation in the accompanying non-overseeded turfs (Table 2). On each of the first three evaluation dates, all treatments were essentially within 10% plot cover values of each other, which ranged from 33% to 49% plot ryegrass cover on 1 November, from 60-85% on 13 November, and from 65 to 76% rye cover on 13 December, respectively (Table 1). Most treated turfs had somewhat greater perennial ryegrass cover than that of the NTC early on (Table 1), noting that the (AB) was present in what would soon become large amounts (Table 2).

For overseeded turfs, the percent plot straw (from old bermudagrass leaves still present after overseed preparation, from cold night temperatures, or both) was greatest at the beginning of November (25% straw plot cover, on average), and decreased to 10% by 13 November, and then increased afterwards from heavy frosts on 13 and 22 December (38% and 29% straw cover, respectively) (Table 3). The percent plot straw decreased with the return of warmer weather, and the overwhelming growth of the *Poa annua* (Table 3). Only on 24 February and 7 March was the treatment mean square significant for the “% straw” variable, as the application of Prograss at the high rate of 0.75 lbs AI/A (applied initially on 13 December, 2007) caused necrotic (straw) on the (AB) (Table 3). This necrotic (AB) from PROGRASS eventually was replaced by the underlying perennial ryegrass, as this treatment had 81% ryegrass on March 7, 2008 (Table 1).

Turfgrass color scores were “light” throughout the test, due to the predominance of *Poa annua* in the turf. On 7 March, only treatment #7 had a mean color score of 6.0 (Table color) (Table 4). This was due to the response of the underlying ryegrass after the Prograss application. Visual assessment of whole plot density, (15 January, 7 March), uniformity (13 November), and turfgrass quality (1 November, 13 December) showed no response to treatments (Table 4).

Turfgrass quality was related to herbicide treatments only on 13 November. Note that at that time, plots with the largest mean quality scores (5.3 – 5.8) belonged to treatments 7-9, which had the bulk of their applications made after this specific evaluation date. Also on 13 November, turfs with the lowest ranking quality scores include treatments 1, 2, and 3, which were applied before overseeding, and again at first mowing (Table 4). While these three treatments had 60% - 72% ryegrass cover, their quality was lower than that of the NTC (6.3 quality on 13 November), noting that the NTC averaged 59% *Poa* on 22 December (Table 2). Prior to late December, it was not possible to discern the difference between (AB) and the young ryegrass with any degree of certainty.

On 13 November, there was a noticeable difference in overall plot uniformity, as treatment #4 (2.0 ounce/1DBOS & @ first mow) was most uniform (6.5) (Table 4), due to its high ryegrass cover of 85% (Table 1). For bermudagrass cover remaining after overseeding, percent plot cover ranged from 26% to 43% bermuda on 12 November, and from 16 to 33% on 13 November (Table 3).

The treatments had no effect on bermudagrass cover in November 2007, but of interest to note is that treatment #4 had the least amount of bermudagrass present on both dates. Again, this treatment was comprised of 2 ounces ai/a of Tenacity applied one day before overseeding and again at first mowing. Treatment #6 had the same timing structure, but at a higher (3 oz.) application rate, which should have caused perhaps more injury to bermudagrass, and a resultant lesser coverage amount (Table 3). However, the amount of ryegrass coverage was less for treatment (6) (39% and 60%) than for treatment #4, (48% and 85%) on 1 and 13 November, respectively, showing that the Tenacity at the 2 ounce rate was more favorable to the ryegrass, than the 3 ounce rate was antagonistic to the bermudagrass.

Lastly, all overseed treated turfs had acceptable density scores, regardless of the high amounts of *Poa annua*, and density was not related to treatments (Table 4). The loss of (AB) from the high rate of Prograss, caused lower ranking density scores for treatment #7, than for most other treatments on March 7, 2008 (Table 4).

Overall, Tenacity did not affect negatively the emergence of perennial ryegrass, but the lack of pre-emergence control of *Poa annua* soon became overwhelming, with (AB) on average being over 80% of the turf by the end of December, 2007 (Table 2).

Non-overseed –

With the emergence of the (AB) by November (from November 1 – November 13), actual percent plot coverage of (AB) on *non-overseeded* turf ranged from 45% - 65% on 13 November, and from 64% - 76% by 13 December, 2007 (Table 2). The amount of (AB) in the treated plots was high, and generally was not related to applied treatments which were essentially within 10% – 15% of the actual amount of (AB) in the NTC turf. Of importance is the fact that the actual percent plot (AB) cover was most similar to that of the overseed turfs, across treatments, with similar test mean scores occurring between overseed and non-overseeded turfs on 13 November, 13 December, 22 December and 15 January (Table 2).

With high (AB) plant establishment, turfgrass quality was similar to that of the overseeded turfs on 13 December as test means for overseed and non-overseed turfs averaged 5.9 and 5.8, respectively (Table 4). Uniformity scores on 13 November were low, but not affected by treatments (4.1 = test mean) (Table 4). In cold weather, non-overseeded turfs had good densities, similar to that of overseeded turfs, noting again that the high rate of Prograss herbicide produced low densities since so much (AB) was affected by Prograss after it was applied.

*Poa annua* and Percent Weed Control –

As noted previously, the rapid increase in (AB) cover from December 15 and December 22 2007, had an overwhelming effect on the ryegrass, which offered little competition. As a result, the percent plot *Poa* levels were extremely high on both overseeded and non-overseeded plot halves. (Table 2).

Actual percent plot *Poa* cover ranged from 59% to 90% on either 22 December or 15 January, regardless of the overseeding or not. Likewise, percent (AB) control (based on NTC infestation levels) were non-significant for the treatment mean squares (Table 2). “Negative” control values were achieved, as some of the treated turfs had more (AB) than the NTC turfs exhibited. The greatest amount of *Poa annua* control took place on 20 February, which was 69% control on non-overseeded turf for treatment 7, from Prograss applied at the high rate of 0.75 lbs. AI/A applied eight weeks after overseeding (Table 2).

For overseeded turfs, percent weed control was 55% for treatment #7 on 20 February (Table 2). The amount of actual *Poa annua* cover for treatment #7 was 28% and 44% on 2 February and 7 March, respectively for non-overseeded turfs: and 33% and 6% *Poa annua* cover on overseeded turfs on 2 February and 7 March, respectively (Table 2).

On 4 April, this same treatment averaged 66% weed control when overseeded, and only 15% control when not overseeded. This showed the competitive enhancement of the “returned ryegrass” which developed after the initial Prograss application, followed by the second application on January 10, 2008. All other treatments of Tenacity afforded essentially no *Poa annua* control.

While percent plot infestation and percent weed control levels were not satisfactory from Tenacity, there was some activity on flower head suppression, although not as pronounced as that of Prograss.

On 7 March 2008, treatment #2, (Tenacity @ 2.0 ounces / 7 DBOS / First Mow / 3 weeks had slight-moderate seed head suppression (2.5) on both overseeded and non-overseeded turfs (Table 4). Seed head suppression was greatest for treatment #7, as the high rate of Prograss almost eliminated all seed heads in non-overseeded turfs (5.8), with full seed head suppression occurring in the overseeded turf (6.0) on 7 March 2008 (Table 5). There was no real difference between treatments #8 and #9 for seed head suppression, showing that the application of Tenacity starting late in the season had minimal affect, with Prograss most likely having a greater effect when sprayed at 8 and 12 weeks after overseeding. This was generally the case, regardless of the overseeded practice. The percent of the plot surface “in flower” ranged from 2% of the plot to 55% for non-overseeded turfs, and from 1 % to 58% of the plot surface for overseeded turfs, respectively on 7 March (Table 5). Again, treatments 7, 8 and 9 had the least amount of the plot “in flower” on 7 March, for both overseeded and non overseeded surfaces. Again, the inclusion of Prograss in treatments #7, 8, and 9 produced the least amount of flowering (AB), while for treatment #10, the application of Tenacity (at first mowing) had no carry over affect on *Poa* activity, as the Prograss component had the greatest effect.

On 15 January 2008, percent plot injury ranged from 10% to 84% of the existing *Poa* cover on non-overseeded turfs, and from 8% to 83% on overseeded turf, respectively (Table 6). Again the Prograss herbicide alone, and when included with Tenacity caused visible injury to the greatest extent and amount (Table 6). The Prograss treated turfs displayed the most visible damage to the (AB), with loss of color, necrosis, and subsequent loss of stand, which afterwards generally allowed the return of the ryegrass.

At the end of the test on 4 April, the *Poa* was essentially through its life cycle, and was largely spent, more so on the non-overseeded than on the overseeded turf.

## Conclusions

- 1) Tenacity herbicide when applied @7 DBOS, 1 DBOS, at first mowing (2 WAOS) or 3 weeks after the first mowing (5 WAOS) did not cause a reduction in stand of perennial ryegrass compared to non-treated controls. Overseeding occurred on October 16, 2007.
- 2) There was essentially no difference in ryegrass emergence and cover for Tenacity when applied at the 2.0 oz. versus the 3.0 oz AI/A rate. When applied at these rates at both 7 DBOS and at the first mowing, treatments 1, 3, and 6 produced similar results.
- 3) Intense *Poa annua* pressure dominated the overseed ryegrass by late December, causing a decline in existing ryegrass cover.
- 4) Only latter applied treatments (of Prograss, or tank mixes which contained Prograss with Tenacity) regained sizable amounts of ryegrass, by the end of February and early March.
- 5) Percent weed control was ineffective for treatments which did not include Prograss herbicide.
- 6) The split application of Prograss of 0.75 lbs AI @ 8 WAOS and again @ 12 WAOS resulted in the greatest amount of *Poa annua* control, and the greatest amount of ryegrass.
- 7) Tenacity (mesotrione), when applied at rates and timings observed here, was safe for perennial ryegrass emergence, but ineffective on *Poa annua* emergence and against subsequent growth of the *Poa annua*.

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**Table 1. Percent Plot ryegrass after overseeding and select treatments of Tenacity and Prograss herbicides.  
University of Arizona. Fall 2007, Winter / Spring 2008.**

Treatment	<i>Non-overseeded turf.</i>	Date							
		11/1/2007	11/13/2007	12/13/2007	12/22/2007	1/15/2008	2/20/2008	3/7/2008	4/4/2008
		<u>%-rye</u>	<u>%-rye</u>	<u>%-rye</u>	<u>%-rye</u>	<u>%-rye</u>	<u>%-rye</u>	<u>%-rye</u>	<u>%-rye</u>
1	Tenacity@2oz 7dbos&1st_mow	.	.	.	.	.	.	.	.
2	Tenacity@2oz 7dbos&1st_mow&3wks	.	.	.	.	.	.	.	.
3	Tenacity@3oz 7dbos&1st_mow	.	.	.	.	.	.	.	.
4	Tenacity@2oz 1dbos&1st_mow	.	.	.	.	.	.	.	.
5	Tenacity@2oz 1dbos&1st_mow&3wks	.	.	.	.	.	.	.	.
6	Tenacity@3oz 1dbos&1st_mow	.	.	.	.	.	.	.	.
7	Prograss@0.75# 8wks&12wks	.	.	.	.	.	.	.	.
8	Tenacity@1.5+Prograss@.38 8wks&12wks	.	.	.	.	.	.	.	.
9	Tenacity@2oz 8wks&Tenacity@2+Prograss@.38 12wks	.	.	.	.	.	.	.	.
10	Tenacity@3oz 1st_mow&Tenacity@1.5+Prograss@.38 8wks	.	.	.	.	.	.	.	.
11	NTC	.	.	.	.	.	.	.	.
Test Mean		.	.	.	.	.	.	.	.
LSD		na	na	na	na	na	na	na	na
Treatment	<i>Overseeded turf.</i>	Date							
		11/1/2007	11/13/2007	12/13/2007	12/22/2007	1/15/2008	2/20/2008	3/7/2008	4/4/2008
		<u>%-rye</u>	<u>%-rye</u>	<u>%-rye</u>	<u>%-rye</u>	<u>%-rye</u>	<u>%-rye</u>	<u>%-rye</u>	<u>%-rye</u>
1	Tenacity@2oz 7dbos&1st_mow	40	71	65	9	15	13	16	20
2	Tenacity@2oz 7dbos&1st_mow&3wks	33	60	70	13	19	25	29	32
3	Tenacity@3oz 7dbos&1st_mow	35	64	76	17	19	12	13	21
4	Tenacity@2oz 1dbos&1st_mow	48	85	70	7	12	11	13	13
5	Tenacity@2oz 1dbos&1st_mow&3wks	46	65	65	9	6	11	10	19
6	Tenacity@3oz 1dbos&1st_mow	39	60	75	6	9	9	10	11
7	Prograss@0.75# 8wks&12wks	41	76	65	13	21	33	81	78
8	Tenacity@1.5+Prograss@.38 8wks&12wks	39	66	71	6	13	31	50	36
9	Tenacity@2oz 8wks&Tenacity@2+Prograss@.38 12wks	44	70	75	8	10	10	14	15
10	Tenacity@3oz 1st_mow&Tenacity@1.5+Prograss@.38 8wks	49	63	76	6	9	15	18	21
11	NTC	38	55	63	13	14	19	20	25
Test Mean		41	67	70	10	13	17	25	26
LSD		ns	ns	ns	ns	ns	ns	22	28

Application rates for Tenacity are in Ounces, AI/A. Prograss in Lbs., A/A.  
Percent ryegrass cover (0-100%). Values are the mean of four replications.

Test mean = mean of all treatments and Non-treated controls on that date.

LSD = Least significant difference treatment mean separation statistic.

Treatments which differ in value greater than the LSD value are significantly different from each other.



**Table 2. Poa annua plot cover cover and percent Poa annua control after select treatments of Tenacity and Prograss herbicides. Univ.Arizona, Fall 2007, Winter / Spring 2008.**

Treatment	Non-overseeded turf.	Date									
		12/22/2007	12/22/2007	1/15/2008	1/15/2008	2/20/2008	2/20/2008	3/7/2008	3/7/2008	4/4/2008	4/4/2008
		%-poa	%-poa control	%-poa	%-poa control	%-poa	%-poa control	%-poa	%-poa control	%-poa	%-poa control
1	Tenacity@2oz 7dbos&1st_mow	74	18	70	13	84	9	91	-2	91	1
2	Tenacity@2oz 7dbos&1st_mow&3wks	73	14	83	-6	88	3	91	0	90	2
3	Tenacity@3oz 7dbos&1st_mow	90	-11	80	-4	90	1	92	-2	91	0
4	Tenacity@2oz 1dbos&1st_mow	76	11	83	-6	91	1	92	1	96	-4
5	Tenacity@2oz 1dbos&1st_mow&3wks	74	18	76	4	89	4	90	3	93	0
6	Tenacity@3oz 1dbos&1st_mow	83	4	87	-10	92	0	94	-2	96	-4
7	Prograss@0.75# 8wks&12wks	83	-2	75	2	28	69	44	9	78	15
8	Tenacity@1.5+Prograss@.38 8wks&12wks	85	-2	66	18	65	30	74	1	80	14
9	Tenacity@2oz 8wks&Tenacity@2+Prograss@.38 12wks	79	8	85	-8	88	5	90	0	96	-4
10	Tenacity@3oz 1st_mow&Tenacity@1.5+Prograss@.38 8wks	79	12	76	6	89	4	87	0	92	1
11	NTC	85	--	79	--	92	--	90	--	93	--
Test Mean		80	7	78	1	81	13	85	1	90	2
LSD		ns	ns	ns	ns	20	22	17	6	ns	ns
Treatment	Overseeded turf.	12/22/2007	12/22/2007	1/15/2008	1/15/2008	2/20/2008	2/20/2008	3/7/2008	3/7/2008	4/4/2008	4/4/2008
		%-poa	%-poa control	%-poa	%-poa control	%-poa	%-poa control	%-poa	%-poa control	%-poa	%-poa control
1	Tenacity@2oz 7dbos&1st_mow	74	-81	74	-27	85	-25	81	-10	80	-32
2	Tenacity@2oz 7dbos&1st_mow&3wks	70	-118	69	-31	74	-12	70	4	66	-15
3	Tenacity@3oz 7dbos&1st_mow	67	-47	73	-18	85	-23	86	-16	79	-28
4	Tenacity@2oz 1dbos&1st_mow	73	-69	78	-27	87	-20	86	-12	85	-29
5	Tenacity@2oz 1dbos&1st_mow&3wks	64	-24	81	-34	85	-19	89	-16	81	-14
6	Tenacity@3oz 1dbos&1st_mow	76	-113	81	-40	89	-27	89	-18	89	-36
7	Prograss@0.75# 8wks&12wks	74	-107	73	-36	33	55	6	86	21	67
8	Tenacity@1.5+Prograss@.38 8wks&12wks	65	-36	70	-18	61	15	46	47	64	2
9	Tenacity@2oz 8wks&Tenacity@2+Prograss@.38 12wks	85	-143	83	-47	86	-27	85	-17	85	-36
10	Tenacity@3oz 1st_mow&Tenacity@1.5+Prograss@.38 8wks	77	-128	83	-51	82	-23	80	-8	79	-29
11	NTC	59	0	70	0	77	0	79	0	75	0
Test Mean		71	-79	76	-30	77	-10	72	4	73	-14
LSD		ns	ns	ns	ns	22	41	22	38	28	56

Application rates for Tenacity are in Ounces, AI/A. Prograss in Lbs., AI/A.

Poa annua plot over = (0-100%). Amount of the entire plot surface with Poa annua present. Values are the mean of four replications.

Poa annua control = Percent weed control as 1-(trt/control) X 100, based on Poa annua percent plot cover values. Values are the mean of four replications.

Test mean = mean of all treatments and Non-treated controls on that date.

LSD = Least significant difference treatment mean separation statistic.

Treatments which differ in value greater than the LSD value are significantly different from each other.

**Table 3. Percent plot straw, and percent plot bermudagrass cover after overseeding and select treatments of Tenacity and Prograss herbicides. University of Arizona. Fall 2007, Winter / Spring 2008.**

Treatment	<i>Non-overseeded turf.</i>	Date								
		11/1/2007	11/13/2007	12/13/2007	12/22/2007	1/15/2008	2/20/2008	4/4/2008	11/1/2007	11/13/2007
		<u>%-straw</u>	<u>%-straw</u>	<u>%-straw</u>	<u>%-straw</u>	<u>%-straw</u>	<u>%-straw</u>	<u>%-straw</u>	<u>%-berm</u>	<u>%-berm</u>
1	Tenacity@2oz 7dbos&1st_mow	.	9	35	26	8	16	4	.	33
2	Tenacity@2oz 7dbos&1st_mow&3wks	.	22	36	27	4	12	5	.	33
3	Tenacity@3oz 7dbos&1st_mow	.	19	29	10	4	10	7	.	28
4	Tenacity@2oz 1dbos&1st_mow	.	11	28	24	2	10	3	.	39
5	Tenacity@2oz 1dbos&1st_mow&3wks	.	9	31	26	12	11	5	.	26
6	Tenacity@3oz 1dbos&1st_mow	.	14	25	18	3	8	3	.	38
7	Prograss@0.75# 8wks&12wks	.	23	26	18	4	73	15	.	34
8	Tenacity@1.5+Prograss@.38 8wks&12wks	.	11	30	15	9	35	9	.	39
9	Tenacity@2oz 8wks&Tenacity@2+Prograss@.38 12wks	.	13	25	21	12	13	3	.	40
10	Tenacity@3oz 1st_mow&Tenacity@1.5+Prograss@.38 8w	.	5	24	21	2	12	4	.	40
11	NTC	.	3	29	15	4	8	8	.	36
<hr/>										
Test Mean		.	12	29	20	6	19	6	.	35
LSD		na	ns	ns	ns	ns	20	ns	na	ns
<hr/>										
Treatment	<i>Overseeded turf.</i>	39387	39399	39429	39438	39462	39498	39542	39387	39399
		<u>%-straw</u>	<u>%-straw</u>	<u>%-straw</u>	<u>%-straw</u>	<u>%-straw</u>	<u>%-straw</u>	<u>%-straw</u>	<u>%-berm</u>	<u>%-berm</u>
1	Tenacity@2oz 7dbos&1st_mow	25	11	35	18	10	3	0	35	18
2	Tenacity@2oz 7dbos&1st_mow&3wks	28	9	30	18	11	2	2	40	31
3	Tenacity@3oz 7dbos&1st_mow	35	10	24	16	4	3	0	30	26
4	Tenacity@2oz 1dbos&1st_mow	26	3	30	20	5	2	2	26	13
5	Tenacity@2oz 1dbos&1st_mow&3wks	16	15	35	27	9	4	0	38	20
6	Tenacity@3oz 1dbos&1st_mow	21	15	25	19	9	2	0	40	25
7	Prograss@0.75# 8wks&12wks	16	8	35	14	3	35	1	43	16
8	Tenacity@1.5+Prograss@.38 8wks&12wks	33	6	29	29	14	8	1	29	28
9	Tenacity@2oz 8wks&Tenacity@2+Prograss@.38 12wks	24	9	25	8	5	4	0	33	21
10	Tenacity@3oz 1st_mow&Tenacity@1.5+Prograss@.38 8w	20	11	24	17	5	3	1	31	26
11	NTC	28	13	38	29	14	4	0	35	33
<hr/>										
Test Mean		25	10	30	19	8	6	1	34	23
LSD		ns	ns	ns	ns	ns	6	ns	ns	ns

Application rates for Tenacity are in Ounces, AI/A. Prograss in Lbs., AI/A.

Percent plot straw = (0-100%). Amount of straw covering the entire plot surface. Values are the mean of 4 replications.

Percent plot bermudagrass = (0-100%). Amount of straw covering the entire plot surface. Values are the mean of 4 replications.

Test mean = mean of all treatments and Non-treated controls on that date.

LSD = Least significant difference treatment mean separation statistic.

Treatments which differ in value greater than the LSD value are significantly different from each other.

**Table 4. Mean turfgrass color, density quality and uniformity values after select treatments of Tenacity and Prograss herbicides. University of Arizona. Fall 2007, Winter / Spring 2008.**

Treatment	<i>Non-overseeded turf.</i>	Date						
		3/7/2008 <u>color</u>	1/15/2008 <u>density</u>	3/7/2008 <u>density</u>	11/1/2007 <u>quality</u>	11/13/2007 <u>quality</u>	12/13/2007 <u>quality</u>	11/13/2007 <u>uniformity</u>
1	Tenacity@2oz 7dbos&1st_mow	4.8	5.8	6.8	.	3.5	5.5	4.0
2	Tenacity@2oz 7dbos&1st_mow&3wks	4.8	6.0	7.8	.	3.0	6.3	3.5
3	Tenacity@3oz 7dbos&1st_mow	4.0	6.3	7.5	.	3.3	5.8	3.5
4	Tenacity@2oz 1dbos&1st_mow	4.3	6.0	7.3	.	4.8	5.0	4.8
5	Tenacity@2oz 1dbos&1st_mow&3wks	4.0	6.0	6.5	.	4.5	5.0	4.5
6	Tenacity@3oz 1dbos&1st_mow	4.0	6.8	7.3	.	3.8	6.0	4.0
7	Prograss@0.75# 8wks&12wks	5.8	5.0	3.5	.	3.8	6.3	4.0
8	Tenacity@1.5+Prograss@.38 8wks&12wks	6.0	5.0	4.3	.	3.8	5.3	4.3
9	Tenacity@2oz 8wks&Tenacity@2+Prograss@.38 12wks	5.8	5.8	6.3	.	4.0	6.3	4.5
10	Tenacity@3oz 1st_mow&Tenacity@1.5+Prograss@.38 8wks	4.5	5.8	7.3	.	4.3	6.0	4.5
11	NTC	4.3	6.0	6.8	.	4.3	6.5	4.0
Test Mean		4.7	5.8	6.5	.	3.9	5.8	4.1
LSD		0.7	ns	1.8	na	ns	ns	ns
Treatment	<i>Overseeded turf.</i>	3/7/2008 <u>color</u>	1/15/2008 <u>density</u>	3/7/2008 <u>density</u>	11/1/2007 <u>quality</u>	11/13/2007 <u>quality</u>	12/13/2007 <u>quality</u>	11/13/2007 <u>uniformity</u>
1	Tenacity@2oz 7dbos&1st_mow	5.0	6.0	6.3	4.5	4.3	5.3	5.0
2	Tenacity@2oz 7dbos&1st_mow&3wks	5.3	6.3	7.3	3.5	4.0	6.0	5.3
3	Tenacity@3oz 7dbos&1st_mow	4.5	6.5	6.8	4.0	4.3	6.0	5.3
4	Tenacity@2oz 1dbos&1st_mow	4.8	5.8	7.0	4.3	5.5	6.0	6.5
5	Tenacity@2oz 1dbos&1st_mow&3wks	4.5	6.0	6.5	5.5	5.3	5.0	5.5
6	Tenacity@3oz 1dbos&1st_mow	4.3	6.5	7.3	4.5	4.3	5.8	5.0
7	Prograss@0.75# 8wks&12wks	7.0	5.5	4.3	4.8	5.3	5.5	5.8
8	Tenacity@1.5+Prograss@.38 8wks&12wks	6.0	5.5	5.5	3.8	5.8	6.5	5.3
9	Tenacity@2oz 8wks&Tenacity@2+Prograss@.38 12wks	5.5	6.5	6.8	4.5	5.8	6.5	5.8
10	Tenacity@3oz 1st_mow&Tenacity@1.5+Prograss@.38 8wks	4.5	6.3	6.5	4.5	5.5	7.0	5.3
11	NTC	5.0	6.0	6.5	4.5	6.3	5.3	5.5
Test Mean		5.1	6.1	6.4	4.4	5.1	5.9	5.5
LSD		1.0	ns	ns	ns	1.4	ns	ns

Application rates for Tenacity are in Ounces, AI/A. Prograss in Lbs., AI/A.

Turfgrass color (1-9): 1=dead, 5=light green; 6=moderate green; 9=dark forest green. Values are the mean of four replications.

Turfgrass density, quality and uniformity. (1-9): 1=dead, 5=marginal, 6=fully acceptable, 9= best possible. Values are the mean of four replications.

Test mean = mean of all treatments and Non-treated controls on that date.

LSD = Least significant difference treatment mean separation statistic.

Treatments which differ in value greater than the LSD value are significantly different from each other.

**Table 5. Poa annua seed head suppression and percent of the existing amount of Poa annua in flower Winter / Spring 2008. after select treatments of Tenacity and Prograss herbicides. Univ.Arizona, Fall 2007,**

Treatment	<i>Non-overseeded turf.</i>	Date		
		3/7/2008 <u>seed head suppression</u>	3/7/2008 %-poa in-flower (whole plot)	4/4/2008 <u>seed head suppression</u>
1	Tenacity@2oz 7dbos&1st_mow	1.8	40	2.8
2	Tenacity@2oz 7dbos&1st_mow&3wks	2.5	35	2.5
3	Tenacity@3oz 7dbos&1st_mow	2.3	41	2.3
4	Tenacity@2oz 1dbos&1st_mow	2.3	49	2.8
5	Tenacity@2oz 1dbos&1st_mow&3wks	1.3	51	2.8
6	Tenacity@3oz 1dbos&1st_mow	1.5	55	2.8
7	Prograss@0.75# 8wks&12wks	5.8	2	1.0
8	Tenacity@1.5+Prograss@.38 8wks&12wks	4.0	13	1.3
9	Tenacity@2oz 8wks&Tenacity@2+Prograss@.38 12wks	3.5	18	1.5
10	Tenacity@3oz 1st_mow&Tenacity@1.5+Prograss@.38 8wks	1.8	35	2.5
11	NTC	2.0	41	2.3
<hr/>				
Test Mean		2.6	35	2.2
LSD		1.4	32	1.2
<hr/>				
Treatment	<i>Overseeded turf.</i>	3/7/2008 <u>seed head suppression</u>	3/7/2008 %-poa in-flower	4/4/2008 <u>seed head suppression</u>
1	Tenacity@2oz 7dbos&1st_mow	1.8	34	2.3
2	Tenacity@2oz 7dbos&1st_mow&3wks	2.5	18	2.3
3	Tenacity@3oz 7dbos&1st_mow	1.5	34	1.8
4	Tenacity@2oz 1dbos&1st_mow	1.8	41	1.5
5	Tenacity@2oz 1dbos&1st_mow&3wks	1.0	46	2.5
6	Tenacity@3oz 1dbos&1st_mow	1.0	58	1.8
7	Prograss@0.75# 8wks&12wks	6.0	1	1.0
8	Tenacity@1.5+Prograss@.38 8wks&12wks	4.5	7	1.8
9	Tenacity@2oz 8wks&Tenacity@2+Prograss@.38 12wks	3.3	14	1.8
10	Tenacity@3oz 1st_mow&Tenacity@1.5+Prograss@.38 8wks	3.0	38	2.5
11	NTC	1.3	50	2.5
<hr/>				
Test Mean		2.5	31	2.0
LSD		1.5	24	ns

Application rates for Tenacity are in Ounces, A/A. Prograss in Lbs., A/A.

Seed head suppression (1-6) 1=no suppression; 4=moderate suppression; 6= severe suppression. Values are the mean of four replications.

Percent Poa in flower = (0-100%). Amount of the entire Poa annua present in flower. Amount of total Poa annua surface cover is irrelevant.

Values are the mean of 4 replications.

Test mean = mean of all treatments and Non-treated controls on that date.

LSD = Least significant difference treatment mean separation statistic.

Treatments which differ in value greater than the LSD value are significantly different from each other.

**Table 6. Percent Poa annua injury and degree of injury after select treatments of Tenacity and Prograss herbicides. Univ.Arizona, Fall 2007, Winter / Spring 2008**

Treatment	<i>Non-overseeded turf.</i>	Date		
		1/15/2008 <u>%-poa injury</u>	1/15/2008 <u>degree poa injury</u>	4/4/2008 <u>degree poa injury</u>
1	Tenacity@2oz 7dbos&1st_mow	18	1.3	3.3
2	Tenacity@2oz 7dbos&1st_mow&3wks	10	1.3	3.0
3	Tenacity@3oz 7dbos&1st_mow	13	1.3	3.0
4	Tenacity@2oz 1dbos&1st_mow	24	1.5	3.0
5	Tenacity@2oz 1dbos&1st_mow&3wks	25	1.5	3.0
6	Tenacity@3oz 1dbos&1st_mow	33	1.5	2.8
7	Prograss@0.75# 8wks&12wks	84	3.5	6.0
8	Tenacity@1.5+Prograss@.38 8wks&12wks	69	2.8	5.0
9	Tenacity@2oz 8wks&Tenacity@2+Prograss@.38 12wks	25	1.8	3.8
10	Tenacity@3oz 1st_mow&Tenacity@1.5+Prograss@.38 8wks	20	2.0	2.8
11	NTC	18	1.3	3.0
<hr/>				
Test Mean		31	1.8	3.5
LSD		37	0.9	1.6
<hr/>				
Treatment	<i>Overseeded turf.</i>	1/15/2008 <u>%-poa injury</u>	1/15/2008 <u>degree poa injury</u>	4/4/2008 <u>degree poa injury</u>
1	Tenacity@2oz 7dbos&1st_mow	8	1.3	3.0
2	Tenacity@2oz 7dbos&1st_mow&3wks	19	1.3	3.5
3	Tenacity@3oz 7dbos&1st_mow	53	2.3	3.3
4	Tenacity@2oz 1dbos&1st_mow	19	1.8	2.8
5	Tenacity@2oz 1dbos&1st_mow&3wks	58	1.8	3.0
6	Tenacity@3oz 1dbos&1st_mow	21	1.3	2.8
7	Prograss@0.75# 8wks&12wks	83	3.8	4.8
8	Tenacity@1.5+Prograss@.38 8wks&12wks	61	2.5	3.3
9	Tenacity@2oz 8wks&Tenacity@2+Prograss@.38 12wks	23	1.8	3.3
10	Tenacity@3oz 1st_mow&Tenacity@1.5+Prograss@.38 8wks	44	2.3	3.0
11	NTC	21	1.3	3.0
<hr/>				
Test Mean		37	1.9	3.2
LSD		45	0.8	ns

Application rates for Tenacity are in Ounces, AI/A. Prograss in Lbs., AI/A.

Percent Poa injury . (0-100%). Amount of the existing Poa annua cover that exhibits injury. Values are the mean of four replications.

Degree of injury, (1-6): 1= none; 4=moderate, 6=severe. Values are the mean of four replications.

Test mean = mean of all treatments and Non-treated controls on that date.

LSD = Least significant difference treatment mean separation statistic.

Treatments which differ in value greater than the LSD value are significantly different from each other.