

Use of TADS and Other Select Herbicides for Use as Spring Transition Agents in Turfgrass Management

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Introduction

Almost all sports and golf facilities in the southwestern desert areas overseed bermudagrass in the late summer/early fall in order to provide a green year round season play surface. This is necessary since bermudagrass growth and winter dormancy can severely limit performance of sports fields and golf course turfs for six months or longer, which often occurs in high use periods. In the last fifteen years, the natural conversion of ryegrass back to bermudagrass has become problematic due to any single or combination of the following: (1) widespread use of ryegrass cultivars which now tolerate high temperature stress, close mowing and produce high tiller densities, (2) clientele demand for high quality turf on a year round basis, and (3) inadequate response of newer ryegrasses to standard typical cultural management practices for transition. These issues often create a condition whereby transition from the overseed to bermudagrass produces an unacceptable turf surface. A number of scenarios arise where any of the following is possible: (1) ryegrass persists for an unacceptable length of time, (2) bermudagrass is weak and thin, or (3) ryegrass persists and then fails abruptly leaving a dead straw turf mat, often without bermudagrass regrowth.

Spring transition is now one of the top three issues facing sports turf managers and golf course superintendents in Southern Arizona. Three options for promoting spring transition are (1) a forced mechanical transition by abrupt and severe scalping of the ryegrass (2) use of improved hybrid ryegrass cultivars which are less heat tolerant and (3) use of chemical agents for transition. To many facilities, the first may be aesthetically unacceptable. The second option is only used to a limited extent, and the third (chemical) has gained increased interest in the last four years. Formerly, use of PGR's or herbicides like KERB has produced limited and inconsistent results. Many Sulfonylurea (mid 1980's) compounds were too rapid in transition and persisted for up to six months in western soils with high soil pH. Newer chemistries since then have produced potential new products, which are slower acting in effect and have much shorter soil residual activity. A perfect scenario for a chemical transition agent would include (1) gradual yet complete decline of the overseed ryegrass, (2) which had minimal or no effect on the bermudagrass which would (3) provide minimal loss of turf at any one point and thus, (4) provide a high quality turf during transition.

With these parameters in mind, a field test was conducted to investigate the use of TADS liquid herbicide (sulfosulfuron) and other select herbicides (commercial and experimental) for the removal of ryegrass in a common bermudagrass sports turf. Many of the field application treatments were tested previously the previous year.

Materials and Methods

A stand of 100% perennial ryegrass at the University of Arizona baseball stadium was used as the test site. The underlying common bermudagrass was overseeded in October of 2001 at a seed rate of 550 lbs./acre of turf-type perennial ryegrass (*Lolium perenne*). The turf was mowed at 1.25 inches 3 x weekly throughout the season and irrigated to avoid moisture stress. The field was fertilized several times from November to March 15, 2002 with 0.5 lbs. N/M on average. No nitrogen was added after March 15. The test area was located out of play behind the visitor teams pitchers warm up mounds, between the third base line and stands. The turf was grown in full sun conditions. The test area was 40' x 75', with an 18 foot border between the last replication and the left field foul line. Treatments included BAYER TADS SL at three different rates (0.21, 0.42, 0.64 ounces/product/M) both with and without extra fertilizer applications. TADS at 0.42 + methylated seed oil was included, as well as a TADS WG

formulation tested at 2 grams product plus MSO. The following other products and controls were included: KERB herbicide at 0.5 lb. AI/A, Transit herbicide @ 1.0 oz. Product/M, Trifloxysulfuron @ 4/0 grams AI/A, Velocity 80S @ 76 gram product/acre.

A standard control (standard fertilizer only) and non-fertilized control were included as replicated checks. Plot size was 8'x5', arranged in a randomized complete block design with four replications. Treatments were applied with a Co2 backpack sprayer, using a hand held 3 nozzle boom (5' width, 20 inch spacing), on May 5, 2002. The Sulfonylurea plots had no traffic for four hours after being sprayed. KERB treated plots were hand irrigated with 3/8" water four hours after treatment. All chemical treatments included 0.5% v/v non-ionic surfactant, except when a treatment requires MSO, as stated previously. The entire test received "standard" fertility of 0.5 lbs. N/M and 1.0 lb. N/M on May 14 and June 14 respectively. Treatments receiving "extra" fertilizer received twice those amounts, on each of the dates mentioned. This was performed to evaluate the effect of extra nitrogen along with the TADS SL formula treatments (@ 0.21, 0.42, 0.64 ounces/product/M). Plots were evaluated and assigned for visual estimates of turfgrass canopy composition as percent plot bermuda, ryegrass, straw (dead grass if any, and/or bare ground). NTEP visual rating scales were used to assess plots for overall turfgrass color, quality, density, texture and uniformity. Relative injury and percent plot injury were assigned, when applicable. All data were subjected to the analysis of variance technique, using SAS software. LSD values were computed for use as the treatment mean separation statistic. Treatments included both fertilized and unfertilized checks, since these nitrogen practices are both utilized by various turf managers as part of spring transition programs. Orthogonal polynomial contrasts were devised to test for specific treatment comparisons of each separate TADS SL rate, with and without fertilizer, the 0.42 SL vs. the 2 gram WG treatment, the mean of all three TADS SL treatments, based on standard vs. extra fertilizer, KERB vs. Transit, trifloxysulfuron vs. KERB, and Manor vs. KERB. Chlorosulfuron was not available at the time of application.

Results and Discussion

Data from replication number four was omitted, due to visible irrigation inequities and severe traffic from a sports clinic event which included a line-up which affected (severely) that replication only.

Percent Plot Composition:

The amount of bermudagrass, ryegrass, dead straw/bare soil was significant on all four-evaluation dates [10 May, 21 May, 6 June, 20 June]. This demonstrated that treatment differences were real in affect and magnitude. The amount of bermudagrass across all treatments (and both controls) on each of the above dates ranged from 12% to 30%, 17% to 63%, 17% to 78%, and from 18% to 98%, respectively (Table 1, Figs. 1-4).

On May 10 (5DAT), the test mean for bermudagrass was 21.2%. The 0.21 TADS with standard fertilizer ranked first numerically for the amount of bermudagrass cover (30%), with no difference in rate response observed for TADS, either with standard or extra fertilizer applied (Table 1). Transit and trifloxysulfuron averaged 16.7% and 18.3% bermuda, respectively, which was similar to both fertilizer controls. No contrasts were significant for % bermuda at 5DAT. At that time, most all treatments were largely perennial ryegrass in cover, with NO straw or bare turf present (Fig. 1). Across all treatments, the average ryegrass was 78.8% plot cover (test mean on 10 May).

Degree of injury to the ryegrass was evident in as little as 5DAT on 10 May. The velocity caused slight-moderate injury (mean = 3.3) followed by TADS at 0.42 + MSO + standard fertility (mean = 3.3). KERB had minimal effect at that time (1.3) (Table 2).

On 21 May (15DAT) the average bermudagrass cover was 37%, with a range of 16.7% (both checks) to 63.3% (TADS 0.42 ounce/p/M with MSO and standard fertilizer). By 15DAT, KERB and Transit accelerated in pace for transition (47% and 48% bermuda, respectively), but Transit treated turf had on average 25% straw turf (dead-rye) (Table 1, Fig. 1). On May 21, contrasts showed that KERB had a greater % of bermuda than Manor. At 15DAT, there was no difference between rates of TADS, with or without extra fertilizer for % bermuda. For percent ryegrass present, the 0.64 ounce rate of TADS produced less ryegrass when extra fertilizer was added (16.7% rye), than when receiving standard fertilizer at that same application rate 41.7%. This demonstrated the pronounced effect of the extra fertilizer at that time on the ryegrass (Table 1, Fig. 2). However, the turf did suffer in color appearance and overall quality because of the large amount of dead rye (45%) that occurred at 15DAT for the 0.64 ounce of TADS

when extra fertilizer was included (Tables 3, 4). Both fertilizer controls showed no dead rye or bare ground at that time (Table 1, Fig. 2).

Degree of ryegrass injury and percent plot injury were significant on 21 May. TADS AL at 0.64 ounces with extra nitrogen exhibited severe loss of ryegrass turf (mean = 5.0), while the same treatment with standard nitrogen had less sudden turf loss (mean degree of injury = 3.7). TADS WG at 2 gms/prod/M also showed a rapid effect on rye at 15DAT with a mean injury score to ryegrass of 4.3. Transit had the largest amount of the plot area exhibiting some stress effect (38% plot affected) with a degree of injury score of 3.3 (Table 2).

On 6 June the average bermudagrass cover was 56%, which ranged from 16.7 (std. Control) to 86.7% (TADS at 0.21 with extra fertilizer). The standard control was around 23% bermuda. The non-fertilized control had 75% live ryegrass at that time (Table 1, Fig. 3).

Without extra fertilizer, the 0.21 ounce rate had less than half (40%) of the amount of bermuda versus the treatment rate when extra fertilizer as noted 87%. The contrast for the comparison of these two treatments was highly significant, as was the contrast which compared standard versus extra fertilizer added to the three rates of TADS SL. Here again, the addition of extra -N- was beneficial for percent plot bermuda. KERB, Transit and trifloxysulfuron all had 43% to 47% bermudagrass plot cover, with Velocity at 33% bermuda at that time. The fertilizer treated bermuda had 23. Bermuda 40% ryegrass and 36% straw at that point in time (Table 1, Fig. 3).

Transit, as mentioned, had 43.3% bermuda and 0% living ryegrass, and 57% dead rye or bare ground at that time. These composition results produced poor overall turf quality for Transit at this time (3.3), as well as poor color and turf density scores (Tables 3, 4, 5).

Final evaluations were made on 20 June [45DAT] 2002. The average percent plot bermudagrass for all turfs was 77.8%, which ranged from 18.3 (fertilized control), to 98.3% (TADS at 0.42 ounce with standard fertilizer) (Table 1, Fig. 4). The unfertilized control had only 18% ryegrass, 28% living ryegrass, and 53% dead rye or bare ground at that time. This demonstrates the importance and benefit of enhancing transition with the proper rate and product choice. The standard fertilizer control treatment alone was clearly strongly dominated by dead ryegrass and then by equal amounts of bermuda and poor quality ryegrass remaining. By this time, TADS at either the 0.42 and 0.64 rates (no extra fertilizer) had 97% to 98% bermuda cover, with the 0.21 ounce rate having 60% bermuda cover. The addition of extra fertilizer at the 0.21 ounce rate greatly enhanced transition by 45DAT. The addition of extra -N- in both May and June (Table 1, Fig. 4) increased percent bermudagrass cover to 97%.

At the close of the test, TADS at 0.42 ounce plus MS0 had 98% bermudagrass, while the TADS WG formulation a 2 grams/product/M = MS0 had 97% bermuda. Manor ended with 88% bermuda followed by Transit (77%) and trifloxysulfuron (75%). KERB had 68% bermuda, 12% ryegrass, and 20% straw. Velocity finished with 37% bermuda, 27% living rye, and 37% dead rye/bare ground. The standard control had 18% bermudagrass plot cover, 28% ryegrass, and 53% dead turf.

Individual Treatment Performance:

Turfgrass color, overall quality, density, uniformity and the like will be discussed within the descriptive interpretation of each individual treatment, as noted below.

1. TADS at 0.21 ounce product/M + std. fertilizer: This was the lowest level of TADS tested and produced bermudagrass cover percentages of 30%, 40%, 40%, and 60% at 10, 15, 30, 45DAT, respectively. By 30DAT most of the remaining ryegrass died, producing 55% straw at 30 DAT and ending with 37% straw at 45DAT (Table 1). Likewise, quality (3.3) and color (4.0) mean scores were very low at 30 DAT, and low (4.7 color, 4.7 color) at 45 DAT, 20 June (Tables 3, 4).
2. TADS at 0.21 ounce/product/M +| extra fertilizer: With extra fertilizer added, the 0.21 ounce rate of the SL formulation had similar percent bermudagrass cover to the standard fertilized turf at the same product rate at 5 and 15DAT. The extra -N- fertilizer greatly enhanced transition at by 30 and 45DAT. With the addition of "extra -N-", the percent straw turf was only 13% by 15DAT, 10% by 30DAT, and 5% by 45DAT. Likewise color and quality mean scores were most acceptable, with the May 21 (15DAT) showing only a slight but still acceptable turf performance (Table 4). By 30 and 45DAT, this specific treatment exhibited good to excellent

turf quality and color for common bermudagrass (Tables 3, 4). Overall, this combination of TADS with extra fertilizer produced a low to medium level transition, which excelled by 45DAT. It did produce good turf color and quality throughout the entire test.

3. TADS at 0.42 ounce/product/M, standard fertilizer: This treatment provided average bermuda transition, yielding slightly more percent plot bermuda than the 0.21 ounce rate at 5 and 15DAT. At 30DAT, it had over twice as much bermuda as the 0.21 ounce standard treatment (85% vs. 40%, respectively), and produced 98% bermuda by 45DAT. As most other treatments did, as well, the greatest amount of straw was present at 15DAT, which was 25% for the 0.42 ounce rate with standard fertilizer. For turfgrass color and quality, this treatment showed low quality at 30DAT (quality = 4.7) but responded quickly to the second standard nitrogen application made shortly afterwards.
4. TADS SL at 0.42 ounce/product/M + extra fertilizer: This treatment produced slightly lesser amounts of percent bermuda than the same rate with the “standard” fertilizer applications. This was true on all four-evaluation dates. It also produced more straw ryegrass than the same rate with standard nitrogen. Because of the larger amounts of noticeable straw, the 0.42 ounce + extra fertilizer treatment had low and quite marginal color and quality scores, which would be undesirable (Tables 3, 4). In this case the response to extra nitrogen was just the reverse compared to the 0.21 ounce treatments, where the addition of extra nitrogen proved beneficial.
5. TADS SL at 0.64 ounce/product/M – std. fertilizer: Although this was the highest rate of TADS SL applied, this treatment produced only average transition results at 5 and 15DAT, but above average transition at 30 and 45DAT (20%, 28%, 78%, 97% bermuda, respectively). This treatment did produce 30% straw on 21 May (15DAT). Its overall turf performance for color and quality were marginal for the first two weeks after applications, with quality scores of 4.7 and color scores ranging from 4.3 to 5.3 (Tables 3, 4).
6. TADS SL at 0.64 ounce/product/M + extra fertilizer: The addition of “extra” fertilizer increased the initial bermuda transition at 5 and 15DAT, but had no effect at 30 and 45DAT. Mean percent bermudagrass cover for this treatment for these times were 23%, 38%, 73% and 97%, respectively. This treatment did produce a whopping 45% straw cover at 15DAT, which reflected in poor color (4.0) and quality (4.0) scores at that time.

TADS SL treatments, rates and fertilizer additions exhibited some trends emerged for these six treatment combinations. At 5DAT, there was a slightly negative rate response for TADS. Note that the first fertilization did not take place yet. After the first fertilization, the “standard” application increased bermudagrass cover at the 0.21 ounce rate, more than the other rates of TADS. By 30DAT, the extra fertilizer greatly increased bermuda transition at the 0.21 ounce rate. By 45DAT, only the 0.21 ounce rate without extra fertilizer had 60% or less bermuda, while the other five TADS SL treatments had 97% to 98% bermudagrass cover. Therefore, among TADS SL treated turfs, the 0.21 ounce rate with extra fertilizer had good (strong) transition, with good turf quality and color, with a minimum of straw turf or bare ground (13% maximum at 15DAT) (Tables 1, 3, 4, Figs. 1-4).

7. TADS SL at 0.42 + MSO + std. fertility: The MSO did not appreciably affect the bermudagrass transition when compared to the regular ionic surfactant treated turfs (both having standard nitrogen applications). Once again, the 0.42 ounce treatment had the greatest performance for transition when “extra” fertilizer was added (Table 1)
8. TADS WG at 2 gms product/M std. fertilizer: Compared to all other applied TADS treatments, the WG formulation at 2 gms/product/M was quite slow in transition up to and including 30DAT. It produced 20%, 30%, 68%, and 97% bermuda cover by 5, 15, 30, and 45DAT, respectively. Its performance up to and including 30DAT was similar to that of Manor, which it exceeded by 45DAT. Overall turf plot performance was low in quality at 21 May (4.0) and 6 June (4.3) which would be unacceptable (Table 4). This treatment did produce 38% straw and 28% straw plot cover on those above dates, respectively (Figs. 2, 3).
9. Manor at 0.4 ounce/product/M – std. fertilizer: Manor produced a transition similar to the average of the test mean at 5 and 15DAT (18%, 33% bermuda, respectively). Percent bermuda was 68% and 88% plot cover at 30 and 45DAT, respectively, as the percent bermuda nearly doubled at each of the first three-evaluator dates (Table 2, Figs. 1-3). Manor produced 27% straw at 15DAT, which diminished to 13% by 30DAT. The overall turfgrass

quality was at or above the test mean average on all for dates, with a marginally acceptable score on 6 June (30DAT) of 5.3 (Table 4). All other performance scores were acceptable.

10. KERB at 0.5 lb. ai/a - - std. fertilizer: KERB has been used for many years as a transition agent, with very mixed results in terms of transition and bermuda tolerance. In this test, KERB produced at moderate transition (20%, 47%, 43%, 68%) on all four dates. It maintained a modest amount of living perennial ryegrass (80%, 52%, 40%, 12%) and had hardly any straw turf at 15DAT (2%). At the close of the test, it had 20% straw turf, 12% rye, and 68% bermuda (Table 1). Other treatments had 95% or more bermuda at that time. The KERB had very good turf quality and color scores at the beginning of the test (Tables 3, 4), but decreased in performance by 30 and 45DAT, when straw (dead ryegrass) finally developed, especially at 45DAT.
11. Tranxit at 1.0 ounce/product/M - - std. fertilizer: Tranxit produced a transition similar to that of the test mean scores on all four dates. It produced on average, one third to one-half as much bermuda than most TAD treatments at 15 and 30DAT and three fourths of those treatments by 45DAT. Tranxit had about 50% bermuda, 25% live rye and 25% straw by 15DAT (Table1). Tranxit produced a whopping 57% straw turf canopy cover at 30DAT, eliminating all rye and ended up with 77% bermuda and 23% dead rye at the close of the test (Table 1, Figs. 1-4). The extent and degree of straw color turf did not allow for a graceful transition, and was reflected in low color and quality scores on each and every evaluation date (Tables 3, 4).
12. Trifloxysulfuron at 4 gms AI/A - - std. fertilizer: The performance of this treatment for transition to bermuda was similar to that of Tranxit, producing near identical amounts of bermuda. The effect on actual ryegrass was slower than that of Tranxit, as trifloxysulfuron had only 5% straw cover at 15DAT and 32% at 30DAT. At the end of the test, Trifloxysulfuron had 20% dead ryegrass, straw and 75% bermuda cover (Table 1, Fig. 4). Overall turfgrass color and quality was slightly better than that of Tranxit, but the delayed effect of the chemical on the ryegrass caused decreased turf plot performance at 30 and 45DAT (Tables 3, 4).
13. Velocity at 80 gms/product/acre - - std. fertilizer: Velocity had a minimal effect and appears initially to have little application as a chemical transition agent. It produced bermudagrass similar to that of the fertilizer-only control and closed the test with only 36% bermudagrass cover, 27% live rye, and 37% straw turf. Velocity was observed to slowly, but evenly stunt both bermudagrass and ryegrass (no data taken).
14. Untreated controls: As mentioned previously, two controls were included; a standard fertility control and a non-fertilized control, which lasted up to and including 6 June [30DAT]. At 45DAT, this specific control was usable due to traffic pattern bias from on-site clinics.

The standard fertilizer controls produced low levels of bermudagrass plot cover at each evaluation date [16%, 17%, 23% 18%, respectively]. This clearly demonstrates the summer persistence of turf-type perennial ryegrass to persist and to slow down the regrowth of bermudagrass into the rye and/or dead straw. There was no straw at 21 May in either of the control plots, while the std. fertilizer controls had 23% bermuda, 40% rye, and 37% dead turf on 6 June (30DAT). At the close of the test on 20 June (45DAT), the fertilized check had 18% bermuda, 28% live rye, and 53% straw turf, showing the final collapse of the rye had occurred. The non-fertilized check had 75% live rye by 6 June. By that time many treated plots had between 60% to 96% or more bermudagrass, some of which had minimal straw present.

This test demonstrates the persistence of turf-type perennial ryegrass and inherent poor transition which occurs in early summer, the importance and value of using special herbicides for enhancing transition, and that for TADS (sulfosulfuron) the addition of extra nitrogen increased transition for certain chemical application rates.

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Table 1. Visual estimate of Canopy Composition (%-bermudagrass, Ryegrass & Straw (dead rye)) as Affected by Select Herbicides, Spring 2002. Mens Baseball Field, Univ. of Arizona, Tucson, AZ. Values are the mean of 3 replications.

Treatment	10-May -5 DAT			21-May -15 DAT			6-Jun -30 DAT			20-Jun -45 DAT		
	berm	rye	straw	berm	rye	straw	berm	rye	straw	berm	rye	straw
TADS SL @ 0.21 w/ std. Fert.	30.0	70.0	0	40.0	56.7	3.3	40.0	5.0	55.0	60.0	3.3	36.7
TADS SL @ 0.42 w/ std. Fert.	28.3	71.7	0	50.0	25.0	25.0	85.0	1.7	13.3	98.3	0.0	1.7
TADS SL @ 0.64 w/ std. Fert.	20.0	80.0	0	28.3	41.7	30.0	78.3	3.3	18.3	96.7	0.0	3.3
TADS SL @ 0.21 w/ xtra Fert.	26.7	73.3	0	48.3	38.3	13.3	86.7	3.3	10.0	93.3	1.7	5.0
TADS SL @ 0.42 w/ xtra Fert.	21.7	78.3	0	38.3	31.7	30.0	55.0	8.3	36.7	86.7	0.0	13.3
TADS SL @ 0.64 w/ xtra Fert.	22.7	77.3	0	38.3	16.7	45.0	73.3	3.3	23.3	96.7	0.0	3.3
TADS SL @ 0.42 w/ std. Fert. + MSO	20.0	80.0	0	63.3	26.7	10.0	78.3	5.0	16.7	97.7	0.0	2.3
TADS WG @ 2 grms prod./M w/std. Fert.+ MSO	20.0	80.0	0	30.0	31.7	38.3	68.3	3.3	28.3	96.7	0.0	3.3
Manor @ 0.4 oz. w/ std. Fert.	18.3	81.7	0	33.3	40.0	26.7	68.3	18.3	13.3	88.3	8.3	3.3
Kerb @ 0.5 lb. ai/A w/ std. Fert.	20.0	80.0	0	46.7	51.7	1.7	43.3	40.0	16.7	67.7	12.3	20.0
TranXit @ 1.0 oz / M w/ std. Fert.	16.7	83.3	0	48.3	26.7	25.0	43.3	0.0	56.7	76.7	0.0	23.3
Trifloxy @ 4 grms ai/A w/ std. Fert.	18.3	81.7	0	31.7	63.3	5.0	46.7	20.0	31.7	75.0	5.0	20.0
Velocity 80S @ 76 grams prod. / A	26.7	73.3	0	23.3	71.7	8.3	33.3	56.7	10.0	36.7	26.7	36.7
Untreated Control w/ std fert	16.0	84.0	0	16.7	83.3	0.0	23.3	40.0	36.7	18.3	28.3	53.3
Untreated Control w/ no fert	13.3	86.7	0	16.7	83.3	0.0	16.7	75.0	6.7	na	na	na
Test Mean*	21.2	78.8	-	36.9	45.9	17.4	56.0	18.9	24.9	77.8	6.1	16.1
LSD Value	12.5	12.5	-	19.4	25.1	23.1	29.6	20.8	33.6	24.6	15.9	28.1

*Test Mean = Mean of all treatments on each particular evaluation date.
LSD Value = Treatment mean separation statistic.

Table 2. Degree injury to ryegrass & %-plot injury as Affected by Select Herbicides, Spring 2002. Mens Baseball Field, University of Arizona, Tucson, AZ.

Treatment	degree injury		%-plot injury
	10-May (5 DAT)	21-May (15 DAT)	21-May (15 DAT)
TADS SL @ 0.21 w/ std. Fert.	2.7	2.3	25.0
TADS SL @ 0.42 w/ std. Fert.	2.3	2.7	15.0
TADS SL @ 0.64 w/ std. Fert.	2.3	3.7	26.7
TADS SL @ 0.21 w/ xtra Fert.	2.3	3.3	13.3
TADS SL @ 0.42 w/ xtra Fert.	3.0	3.3	31.7
TADS SL @ 0.64 w/ xtra Fert.	2.3	5.0	25.0
TADS SL @ 0.42 w/ std. Fert. + MSO	3.3	2.3	23.3
TADS WG @ 2 grms prod./M w/std. Fert.+ MSO	2.7	4.3	30.0
Manor @ 0.4 oz. w/ std. Fert.	2.0	3.3	13.3
Kerb @ 0.5 lb. ai/A w/ std. Fert.	1.3	1.7	3.3
TranXit @ 1.0 oz / M w/ std. Fert.	3.3	3.3	38.3
Trifloxy @ 4 grms ai/A w/ std. Fert.	2.7	2.3	18.3
Velocity 80S @ 76 grams prod. / A	3.3	2.3	11.7
Untreated Control w/ std fert	1.0	1.0	0.0
Untreated Control w/ no fert	na	1.0	0.0
Test Mean*	2.5	2.8	18.3
LSD Value	1.0	1.3	23.7

Injury = 1-6; 1=none, 3=slite/moderate, 4=moderate, 6=severe. Values are the average of 3 replications.
%-plot injury = percent of entire plot exhibiting stressed ryegrass. Values are the average of 3 replications.
*Test Mean = Mean of all treatments on each particular evaluation date.
LSD Value = Treatment mean separation statistic.

**Table 3. Visual Turfgrass Color as Affected by Select Herbicides,
Spring 2002. Mens Baseball Field, University of Arizona, Tucson, AZ.**

Treatment	<i>5 DAT</i>	<i>15 DAT</i>	<i>30 DAT</i>	<i>45 DAT</i>
	<i>10-May</i>	<i>21-May</i>	<i>6-Jun</i>	<i>20-Jun</i>
TADS SL @ 0.21 w/ std. Fert.	5.7	5.3	4.0	4.7
TADS SL @ 0.42 w/ std. Fert.	6.0	5.0	5.7	7.3
TADS SL @ 0.64 w/ std. Fert.	5.3	4.3	6.0	7.0
TADS SL @ 0.21 w/ xtra Fert.	6.3	5.3	6.3	7.3
TADS SL @ 0.42 w/ xtra Fert.	5.7	4.0	4.7	6.7
TADS SL @ 0.64 w/ xtra Fert.	5.3	4.0	5.7	7.7
TADS SL @ 0.42 w/ std. Fert. + MSO	5.3	5.3	5.7	7.3
TADS WG @ 2 grms prod./M w/std. Fert.+ MSO	6.0	3.3	5.3	6.7
Manor @ 0.4 oz. w/ std. Fert.	6.3	5.7	6.7	7.3
Kerb @ 0.5 lb. ai/A w/ std. Fert.	8.0	7.3	6.0	5.3
TranXit @ 1.0 oz / M w/ std. Fert.	5.0	3.3	4.0	5.7
Trifloxy @ 4 grms ai/A w/ std. Fert.	6.3	5.0	4.3	5.3
Velocity 80S @ 76 grams prod. / A	4.3	6.7	7.0	4.7
Untreated Control w/ std fert	8.0	8.0	6.0	3.3
Untreated Control w/ no fert	na	7.7	6.7	na
Test Mean*	6.0	5.4	5.6	6.2
LSD Value	1.1	1.4	2.2	1.9

Color = 1-9; 1=dead, 5=marginal, 6= fully acceptable, 9=best possible.

Values are the average of 3 replications.

*Test Mean = Mean of all treatments on each particular evaluation date.

LSD Value = Treatment mean separation statistic.

**Table 4. Visual Turfgrass Quality as Affected by Select Herbicides,
Spring 2002. Mens Baseball Field, University of Arizona, Tucson, AZ.**

Treatment	<i>5 DAT 15 DAT 30 DAT 45 DAT</i>			
	<i>10-May</i>	<i>21-May</i>	<i>6-Jun</i>	<i>20-Jun</i>
TADS SL @ 0.21 w/ std. Fert.	6.0	6.0	3.3	4.7
TADS SL @ 0.42 w/ std. Fert.	6.3	5.0	4.7	7.3
TADS SL @ 0.64 w/ std. Fert.	4.7	4.7	5.0	6.3
TADS SL @ 0.21 w/ xtra Fert.	6.0	5.7	6.3	7.0
TADS SL @ 0.42 w/ xtra Fert.	5.3	4.7	4.0	5.3
TADS SL @ 0.64 w/ xtra Fert.	6.0	4.0	5.3	7.3
TADS SL @ 0.42 w/ std. Fert. + MSO	5.7	5.3	5.0	6.7
TADS WG @ 2 grms prod./M w/std. Fert.+ MSO	5.7	4.0	4.3	6.7
Manor @ 0.4 oz. w/ std. Fert.	6.0	5.7	5.3	7.3
Kerb @ 0.5 lb. ai/A w/ std. Fert.	7.0	7.3	5.0	5.0
TranXit @ 1.0 oz / M w/ std. Fert.	5.3	4.3	3.3	4.7
Trifloxy @ 4 grms ai/A w/ std. Fert.	5.3	5.0	3.7	4.7
Velocity 80S @ 76 grams prod. / A	5.3	6.7	5.7	4.7
Untreated Control w/ std fert	7.3	8.0	4.7	2.7
Untreated Control w/ no fert	na	6.7	6.7	na
Test Mean*	5.9	5.5	4.8	5.7
LSD Value	1.2	1.4	2.1	2.2

Quality = 1-9; 1=dead, 5=marginal, 6=acceptable, 9=best possible.

Values are the average of 3 replications.

*Test Mean = Mean of all treatments on each particular evaluation date.

LSD Value = Treatment mean separation statistic.

**Table 5. Visual Turf Canopy Density as Affected by Select Herbicides,
Spring 2002. Mens Baseball Field, University of Arizona, Tucson, AZ.**

Treatment	<i>15 DAT 30 DAT 45 DAT</i>		
	<i>21-May</i>	<i>6-Jun</i>	<i>20-Jun</i>
TADS SL @ 0.21 w/ std. Fert.	6.3	3.7	3.7
TADS SL @ 0.42 w/ std. Fert.	5.3	5.3	7.0
TADS SL @ 0.64 w/ std. Fert.	4.7	4.7	6.0
TADS SL @ 0.21 w/ xtra Fert.	5.0	6.3	6.7
TADS SL @ 0.42 w/ xtra Fert.	5.0	4.0	5.3
TADS SL @ 0.64 w/ xtra Fert.	4.0	5.3	7.7
TADS SL @ 0.42 w/ std. Fert. + MSO	5.7	5.3	6.7
TADS WG @ 2 grms prod./M w/std. Fert.+ MSO	3.3	4.7	6.3
Manor @ 0.4 oz. w/ std. Fert.	5.0	6.3	6.7
Kerb @ 0.5 lb. ai/A w/ std. Fert.	7.0	5.7	4.7
TranXit @ 1.0 oz / M w/ std. Fert.	5.0	3.0	4.7
Trifloxy @ 4 grms ai/A w/ std. Fert.	5.7	4.3	4.7
Velocity 80S @ 76 grams prod. / A	7.0	7.0	4.3
Untreated Control w/ std fert	8.3	5.7	2.7
Untreated Control w/ no fert	7.0	7.0	na
Test Mean*	5.6	5.2	5.5
LSD Value	1.3	2.3	2.0

Density = 1-9; 1=dead, 5=marginal, 6= acceptable, 9=best possible.

Values are the average of 3 replications.

*Test Mean = Mean of all treatments on each particular evaluation date.

LSD Value = Treatment mean separation statistic.

**(Appendix -A). Estimate of Percent Visual Bermudagrass as Affected by Select Herbicides,
Spring 2002. Mens Baseball Field, University of Arizona, Tucson, AZ**

Treatment	<i>5 DAT</i>	<i>15 DAT</i>	<i>30 DAT</i>	<i>45 DAT</i>
	<i>10-May</i>	<i>21-May</i>	<i>6-Jun</i>	<i>20-Jun</i>
TADS SL @ 0.21 w/ std. Fert.	30.0	40.0	40.0	60.0
TADS SL @ 0.42 w/ std. Fert.	28.3	50.0	85.0	98.3
TADS SL @ 0.64 w/ std. Fert.	20.0	28.3	78.3	96.7
TADS SL @ 0.21 w/ xtra Fert.	26.7	48.3	86.7	93.3
TADS SL @ 0.42 w/ xtra Fert.	21.7	38.3	55.0	86.7
TADS SL @ 0.64 w/ xtra Fert.	22.7	38.3	73.3	96.7
TADS SL @ 0.42 w/ std. Fert. + MSO	20.0	63.3	78.3	97.7
TADS WG @ 2 grms prod./M w/std. Fert.+ MSO	20.0	30.0	68.3	96.7
Manor @ 0.4 oz. w/ std. Fert.	18.3	33.3	68.3	88.3
Kerb @ 0.5 lb. ai/A w/ std. Fert.	20.0	46.7	43.3	67.7
TranXit @ 1.0 oz / M w/ std. Fert.	16.7	48.3	43.3	76.7
Trifloxy @ 4 grms ai/A w/ std. Fert.	18.3	31.7	46.7	75.0
Velocity 80S @ 76 grams prod. / A	26.7	23.3	33.3	36.7
Untreated Control w/ std fert	16.0	16.7	23.3	18.3
Untreated Control w/ no fert	13.3	16.7	16.7	na
Test Mean*	21.2	36.9	56.0	77.8
LSD Value	12.5	19.4	29.6	24.6

Percent bermudagrass = 0-100% of entire plot surface area.

Values are the average of 3 replications.

*Test Mean = Mean of all treatments on each particular evaluation date.

LSD Value = Treatment mean separation statistic.

**(Appendix -B). Estimate of Percent Visual Ryegrass as Affected by Select Herbicides,
Spring 2002. Mens Baseball Field, University of Arizona, Tucson, AZ.**

Treatment	<i>5 DAT</i>	<i>15 DAT</i>	<i>30 DAT</i>	<i>45 DAT</i>
	<i>10-May</i>	<i>21-May</i>	<i>6-Jun</i>	<i>20-Jun</i>
TADS SL @ 0.21 w/ std. Fert.	70.0	56.7	5.0	3.3
TADS SL @ 0.42 w/ std. Fert.	71.7	25.0	1.7	0.0
TADS SL @ 0.64 w/ std. Fert.	80.0	41.7	3.3	0.0
TADS SL @ 0.21 w/ xtra Fert.	73.3	38.3	3.3	1.7
TADS SL @ 0.42 w/ xtra Fert.	78.3	31.7	8.3	0.0
TADS SL @ 0.64 w/ xtra Fert.	77.3	16.7	3.3	0.0
TADS SL @ 0.42 w/ std. Fert. + MSO	80.0	26.7	5.0	0.0
TADS WG @ 2 grms prod./M w/std. Fert.+ MSO	80.0	31.7	3.3	0.0
Manor @ 0.4 oz. w/ std. Fert.	81.7	40.0	18.3	8.3
Kerb @ 0.5 lb. ai/A w/ std. Fert.	80.0	51.7	40.0	12.3
TranXit @ 1.0 oz / M w/ std. Fert.	83.3	26.7	0.0	0.0
Trifloxy @ 4 grms ai/A w/ std. Fert.	81.7	63.3	20.0	5.0
Velocity 80S @ 76 grams prod. / A	73.3	71.7	56.7	26.7
Untreated Control w/ std fert	84.0	83.3	40.0	28.3
Untreated Control w/ no fert	86.7	83.3	75.0	na
Test Mean*	78.8	45.9	18.9	6.1
LSD Value	12.5	25.1	20.8	15.9

Percent ryegrass = 0-100% of entire plot surface area.

Values are the average of 3 replications.

*Test Mean = Mean of all treatments on each particular evaluation date.

LSD Value = Treatment mean separation statistic.

**(Appendix -C). Estimate of Percent Visual Straw (dead rye) as Affected by Select Herbicides,
Spring 2002. Mens Baseball Field, University of Arizona, Tucson, AZ.**

Treatment	<i>15 DAT 30 DAT 45 DAT</i>		
	<i>21-May</i>	<i>6-Jun</i>	<i>20-Jun</i>
TADS SL @ 0.21 w/ std. Fert.	3.3	55.0	36.7
TADS SL @ 0.42 w/ std. Fert.	25.0	13.3	1.7
TADS SL @ 0.64 w/ std. Fert.	30.0	18.3	3.3
TADS SL @ 0.21 w/ xtra Fert.	13.3	10.0	5.0
TADS SL @ 0.42 w/ xtra Fert.	30.0	36.7	13.3
TADS SL @ 0.64 w/ xtra Fert.	45.0	23.3	3.3
TADS SL @ 0.42 w/ std. Fert. + MSO	10.0	16.7	2.3
TADS WG @ 2 grms prod./M w/std. Fert.+ MSO	38.3	28.3	3.3
Manor @ 0.4 oz. w/ std. Fert.	26.7	13.3	3.3
Kerb @ 0.5 lb. ai/A w/ std. Fert.	1.7	16.7	20.0
TranXit @ 1.0 oz / M w/ std. Fert.	25.0	56.7	23.3
Trifloxy @ 4 grms ai/A w/ std. Fert.	5.0	31.7	20.0
Velocity 80S @ 76 grams prod. / A	8.3	10.0	36.7
Untreated Control w/ std fert	0.0	36.7	53.3
Untreated Control w/ no fert	0.0	6.7	na
Test Mean*	17.4	24.9	16.1
LSD Value	23.1	33.6	28.1

Percent straw = 0-100% of entire plot surface area.

Values are the average of 3 replications.

*Test Mean = Mean of all treatments on each particular evaluation date.

LSD Value = Treatment mean separation statistic.