Response of Common Bermudagrass Sports Turf to Select Herbicides Used for Spring Transition Enhancement

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Abstract

Common bermudagrass often struggles with spring transition, when overseeded the previous fall with turf-type perennial ryegrass. Select herbicides were applied once on an overseeded common bermudagrass baseball field, on either an early May, or late May application in both 2003 and 2004 summer in order to evaluate their performance as an aid in spring transition. The same treatments were applied to the same plots in the two year study. The sulfonyl urea products of Tads or foramsulfuron 'Revolver', rimsulfuron 'Tranxit', trifloxysulfuron 'Monument', caused noticeable necrosis to the perennial ryegrass, which lasted up to 30 days after application, as the common bermudagrass became re-established. The other s.u. product of chlorsulfuron 'Manor', was similar to pronamid 'Kerb', which did not cause as much necrosis as the other products. However, both 'Manor' and 'Kerb' had lesser effects on transition as did the other products. This was generally true in both years. The greatest amounts of necrotic turf (percent plot straw values) occurred 30 days after application, regardless if products were applied the first week in May ('early'), or when applied the last few days of May ('late'). The e herbicide treatment main affect was significant for most turfgrass responses when herbicides were applied 'early'. This was true in both years of the study. In year 1 (2003), the 'late' application of herbicides were less effective in enhancing transition, but in year 2 (2004) the treatment affect was significant for enhancing the removal of ryegrass and enhancing the re-introduction of the underlying bermudagrass. The ' early' application program did allow for a longer bermudagrass summer season, (before the next fall overseeding) , which is deemed helpful in promoting good bermudagrass turf growth before the next overseed season Perennial ryegrass will last long into midsummer, when left untreated.

Introduction

The transition from perennial ryegrass overseed, back to Bermudagrass is often problematic. This is due to (1) increased heat tolerance incorporated into most perennial ryegrass cultivars, (2) increased tolerance and persistence to low and frequent mowing regimes, (3) enhanced persistence under suboptimal irrigation. The lower shoot density and internode length of common bermudagrass (compared to Tifway 419) also causes a poor spring transition back to the warm season turf. Poor transition scenarios can include but are not limited to (1) long term maintenance of perennial ryegrass, followed by a sudden loss of perennial ryegrass cover, (2) loss of perennial ryegrass with limited

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bermudagrass re-growth, (3) season long, co-dominant stands of both perennial ryegrass and bermudagrass and (4) any combination of the above which include considerable amounts of dead straw turf as a result of perennial ryegrass necrosis. Since common bermudagrass truly struggles against the perennial ryegrass overseed, it would be highly beneficial to use an herbicide which could enhance transition and yet maintain acceptable quality for as much of the growing season as is possible.

Materials and Methods

The test site was a common bermudagrass baseball turf overseeded in late September of 2002 with 525 lbs/PLS/acre of Palmer/Prelude blend of perennial ryegrass. The test area selected was an area starting 10 feet from the third-base foul line, inwards to the out-of-bounds fence (45 feet wide). The turf was mowed year-round at 1.0 inches with a tri-plex reel-type mower, and fertilized with starter fertilizer in November 2002. Afterwards, the test area received 3/8 to ½ pounds N/M per growing month up until April 2003. Herbicide treatments included four Sulfonyl urea herbicides – foramsulfuron (TADS), metsulfuron (Manor), rimsulfuron (Tranxit), and trifloxysulfuron (Monument). Pronamid (KERB) was included as a standard herbicide treatment. Rate applications were as follows: TADS [0.2 and 0.4 ounces/product/1000 ft^2], Manor [0.4 fluid ounces/product/acre], Tranxit [1.0 ounce/product/acre], Monument [5.33 gram/product/acre], and KERB [1.0 lb product /acre]. Manor, Tranxit, and Monument received 0.25 % v/v non-ionic surfactant as per label instructions. All herbicides were applied once, either on 3 May or on 23 May 2003, and again on May 4, or on May 27, 2004 in order to determine the best time to induce transition and to measure turf responses. Each plot received both a 1.0 and 2.0 lb/N/M rate of quick release fertilizer from a 15-15-15 source. For the May and June fertilizer applications, 15-15-15 was applied the first week of May, and the June application was applied the first week of June (in both years). Therefore, the "early" applied herbicide-treated turf received either the 1.0 or 2.0 lbs of –N- application in early May, while the "late" applied herbicide treatments (not yet treated in May) received 1.0 lb in early May, which later received the sequential 1.0 and 2.0 lbs./M split treatments of N in early June. All herbicides were allowed to dry without traffic six hours after application. KERB plots were irrigated by hand 1 hour after application, and Traxit was hand watered 5 hours after application (label directions). Plot size was 5' x 8', with the 5' width split with both fertilizer rates. The field design was a RCBD with herbicide/fertilizer combinations comprising the number of treatments since this best reflects detection of a management scheme suitable for turf managers. A linear polynomial contrast was used to test the effect of applied N rates. Plots received timely visual scores of plot composition (%bermudagrass cover, % perennial ryegrass cover, % straw-turf cover). Visual rating scores using the approved NTEP Scale System (1-9, 1=dead, 5=marginal, 6=acceptable, 9=best possible) were assigned to plots for turfgrass color, overall quality, and density and uniformity. Visual stunting was assigned to plots once on 12 May (to "early" applied plots) using a 1-6 scale where 1= no stunting, 4=moderate, 6=severe stunting, just prior to a mowing event.

All data was subjected to the analysis of variance technique (within years) using SAS software. LSD values were calculated as the separation statistic for the (herbicide/fertilizer combination) treatment means, only if the P-value for the treatment F-ratio was P=0.05, or less. Individual ANOVAs were calculated based on post-application date data collection (by application date), and a joint analyses was also performed for all data collected after the "late" applications were made as well. Untreated control means were included in the full analysis to show absolute turf conditions with time and to better reflect actual (seasonal) changes in turf performance with time.

Results and Discussion –Year 1 (2003)

Data results are discussed and interpreted in terms of response of treatments after application dates, general turf performance in time, and response to treatments on the (nearest) number of days after application (between application dates). Field events at the facility did not allow for data to be taken on the exact number of days after each of the "early" and "late" application events. There is adequate data for full interpretation otherwise.

Transition and Plot Composition:

Plots were evaluated for percent bermudagrass, percent perennial ryegrass, and percent plot straw on 12 May, 24 May, 30 May, 6 June, 24 June, 17 July, and 4 August. Therefore, the first evaluation for the "late" applied treatments was on 30 May (7 DAT).

Early Applied Treatments (applied 3 May 2003)

On all seven evaluation dates following the "early" series applications, the treatment main effect was highly significant for percent bermudagrass cover (Table 1), percent perennial ryegrass cover (Table 2), and for four of six percent straw rating dates (Table 3). There was no straw evident on 12 May.

The UTC turf had 3 % bermudagrass and 97 % Perennial perennial ryegrass on 12 May (9 DAT/1) (Tables 1,2). The UTC turfgrass had 16 – 18 % bermudagrass up until 24 June, and then developed 62 – 71 % bermudagrass by 17 July, still lagging behind the herbicide treated turf. It was not until the first week of August until the UTC turf had 90 % or more bermudagrass cover (Table 1).

On 12 May, TADS at the 0.4 ounce product rate ranked first for bermudagrass cover, regardless of applied –N- (30 %). The remaining S.U. materials had 13 – 15 % bermudagrass, while KERB had 6 % cover, which was similar to the UTC (Table 1).

On 24 May, TADS-treated turf ranged from 16 – 29 % bermudagrass, while Monument at the 2x fertilization rate had 25 % bermudagrass. KERB had the same percentage bermudagrass as did Tranxit and Manor-treated turfs (16 – 17 %). The UTC now averaged 9 % bermudagrass cover (Table 1).

On 30 May, there seemed to be a slight decline in bermudagrass cover among TADS-treated turfs. This was not the case among other treatments and is thus assumed a valid observation. On average, percent bermudagrass declined 4 – 8 % in absolute values from 24 May to 30 May for these treatments only. Other treatments were essentially unchanged (Table 1).

On 6 June, Manor and Monument at the 2x fertility regime had the greatest amount of bermudagrass (34 % and 38 %, respectively) while most other treatments had 23 % to 28 % bermudagrass cover.
On 24 June, TADS at the high product rate of 0.40 ounce/product/1000 ft^2 produced the greatest amount of bermudagrass (75 %) followed by Monument which had 62 – 68 % cover. The UTC turf averaged only 17 – 19 % bermudagrass at the end of June (Table 1).

By mid-July, the bermudagrass began to return. TADS at 0.2 ounce/P/M rate had 80 to 86 % bermudagrass cover, and 97 % cover at the 0.4 ounce/P/M rate with the double fertilization program. All other S.U. treatments produced 90 % or more bermudagrass cover at that time. The 1.0 lb. product/acre rate of KERB benefited from the double fertility program by producing 86 % cover, vs. 78 % with normal –N- fertility. The UTC turfs were 71 % and 63 % cover, still lagging behind the herbicide treated turfs. By 4 August, all turfs were essentially 95 % or greater bermudagrass cover, with KERB finally catching up with the other treatments. The UTC turfs were 92 – 94 % bermudagrass as well.

Late Applied Treatments (applied 23 May 2003):

The treatment main effect of herbicide and fertilizer combinations was not significant on any post-applied dates when treatments were applied "late" (Table 1). Up until 6 June, Manor ranked numerically first for bermudagrass cover (30 May and 6 June) along with KERB at the low rate of –N- (24 % bermudagrass). Note that UTC turfs still had very low bermudagrass cover on these two dates (8 – 13 %) across both fertility levels. The 2x fertility UTC did have 23 % straw cover evident on 6 June, showing an initial decline of perennial ryegrass alone (Table 3).

By 24 June, Tranxit ranked highest for bermudagrass at the 2x fertilizer program (44 %), followed next by Monument plus 2x fertility (38 %), followed by TADS at 0.40 ounce plus 1x fertility (33 % bermudagrass),. The UTC averaged 21 – 27 % bermudagrass cover on 24 June. By 17 July, the range of bermudagrass plot cover was from 65 – 92 %, with the UTC turfs now at 78 – 81 % bermudagrass cover. Monument ranked first with 92 % bermudagrass (2x fertility) (Table 1). By 4 August, the 0.4 ounce herbicide rate of TADS produced 100 % bermudagrass cover, regardless of –N- applied. All plots had 98 % or more bermudagrass with the exception of Manor (93 %). Note again that the overall treatment effect was non-significant (Table 1).

Note that between application events, the amount of bermudagrass had essentially doubled up to and including 24 June, when the treatments were applied "early" (3 May) vs. "late" (23 May), as test mean values were 50% and 28% bermudagrass on 4 June, for the "early" and "late" tests, respectively. By 17 July, overall test means were close (87 % "early", 79 % "late") for overall percent bermudagrass cover. By 17 July, most treatments applied "late" were within 10 % absolute bermudagrass cover behind their "early" applied counterparts (Table 1). Manor is an exception, as it most noticeably lagged behind in transition when applied "late". In this case on 17 July, "early" treatments were 93 – 95 % bermudagrass, and "late" treatments were 65 – 73 % bermudagrass cover for Manor treated turf (Table 1).

For comparative interest only, we observed the degree of herbicide effect the treatments produced *close* to the same number of days after the "treatments" (DAT) were applied from. This would show if herbicides may interact with responses in time, when applied initially at different intervals ("early" and "late"). Note also that the seasonal (natural) progression of incoming bermudagrass later in the season does confound absolute comparisons to some degree. The following post application evaluation dates matched somewhat closely for purposes of discussion.

9/DAT/1 12 May [Early]
7/DAT/2 30 May [Late]

At these points, the herbicides were similar in rank for percent bermudagrass, with KERB having a slightly better rank response when it was applied "late". In absolute terms, all TADS treatments, as well as the Monument-treated turfs, had less bermudagrass as "late" treatments than when applied "early" (Table 1).

35/DAT/1 6 June [Early]
32/DAT/2 24 June [Late]

TADS applied treatments were essentially identical at approximately 30 DAT, regardless of application date. Manor was very close for percent bermudagrass (28 – 33 %) across both dates and fertility levels. Tranxit produced more bermudagrass conversion when applied "late" (~30 DAT). It had 38 – 44 % applied "late" and 22 – 27 % bermudagrass at 30 DAT when applied "early". Monument plots were essentially identical to each other, as was KERB (Table 1).

53/DAT/1 24 June [Early]
56/DAT/2 3 July [Late]

The low rate of TADS (0.2 ounce/P/M) had less bermudagrass at 50 days after treatment when applied "early" vs. "late" which had much more bermudagrass. Note that the UTC controls drastically increased in bermudagrass from 24 June to 17 July (17 % to 80 % bermudagrass) (Table 1).

<u>Percent perennial ryegrass and Straw Cover:</u>
As part of the transition process, the amount of perennial ryegrass declines, but often not graciously. The effect of necrotic perennial ryegrass as a visual aspect of spring transition can be dramatic if over 20 % of the plot bears necrotic perennial ryegrass turf. Therefore, the amount of "straw" is highly correlated with overall turf quality.

<u>Early Applications (applied 3 May, 2003):</u>
When applied "early", the main effect of "treatments" was significant in four evaluation dates up to and including the 25 June data collection for visible plot straw (Table 3). The least amount of straw among treatments on 24 May occurred on Monument plots which received regular fertilizer amounts (9 %) and among the TADS-treated turfs which received the low product rate of 0.2 ounce/P/M (11 % to 15 % straw). Note that the extra nitrogen applied to Monument turfs dramatically increased its straw content (23 %). There was no straw on the UTC turfs at this time (Table 3).

On 30 May (27 DAT/1), the percent plot straw content ranged from 3 % to 81 % among treated turfs. TADS applied at the high product rates of 0.4 ounce/P/M had 70 – 81 % straw present, Manor had 39 – 52 %, Tranxit had 71 – 78 % straw, and Monument had 50 – 61 % straw (Table 3). These S.U. materials did produce large amounts of visible straw (necrotic) ryegrass soon after application. Only TADS at the 0.2 ounce/P/M with standard fertility had fairly low straw cover (23 %). Only KERB had trace amounts of straw (3 – 4 %).

On both 30 May and 6 June, TADS produced a positive rate response towards increased straw cover with product rate and nitrogen rate, as both increased the amount of straw (dead perennial ryegrass). Tranxit also had extremely high straw contents (64 – 74 % plot straw) while Monument was now intermediate (26 – 33 %). Manor dramatically reduced the presence of visible straw which was now 11 – 15 % plot straw. KERB still produced minimal straw (1 – 4 %) (Table 3).

By 24 June (53 DAT/1), the UTC turfs averaged 5 – 10 % straw, from stolon sheaths on flowering culms which remained below the mower blades. All TADS-treated turfs had 19 – 24 % straw, while Manor produced the least straw among S.U. treatments (8 – 9 %). Tranxit produced the most straw at this time (23 – 38 %) followed by Monument (18 – 28 % straw). KERB was similar to that of the controls (Table 3).

On 17 July (73 DAT/1), the main effect of "treatments' was not significant. Note that most treatments now had less straw than the UTC turf, which now averaged 13 – 15 % straw. KERB had straw contents similar to that of the UTC turfs as well.

By 4 August (100 DAT/1), straw contents ranged from 0 – 6 % for treated turfs. The UTC turfs averaged 6 – 7 % straw at the end of the trial (Table 3).

<u>Late Applications (applied 23 May, 2003):</u>
Applying the treatments "late" in May did not alleviate the production of straw- colored turf in the post application transition process. Considerable necrotic turf (perennial ryegrass) developed at 6 June (14 DAT/2), with extreme necrosis evident at 24 June (32 DAT/2 (Table 3). This was a function of both herbicide activity and seasonal effects on perennial ryegrass decline.

The "treatment" effect was significant only on 30 May (7 DAT/2),for late applied treatments. The maximum expression of perennial ryegrass necrosis (straw) was achieved at about 30 days after treatment, regardless of the application date (Table 3). On 30 May (7 DAT/2), the 0.40 ounce rate of TADS produced the greatest amount of straw (8 – 9 %). Manor had very little perennial ryegrass necrosis as did Tranxit and KERB. On 6 June, the percent plot straw ranged from 5 % to 30 % among herbicide treated turf, while the UTC with high nitrogen averaged 23 % straw (Table 3). The high –N- at this time expedited the death of perennial ryegrass but did not increase bermudagrass cover (on 16 June) (Table 1). Manor and KERB had low percent straw cover at this time (Table 3).

By 24 June (32 DAT/2), maximum necrosis had developed and percent plot straw treatment means range from 30% to 73 % with the UTC averaging about 60 % dead perennial ryegrass (straw) (Table 3),with very little bermudagrass cover as well (Table1). TADS at the 0.4 ounce rate with extra fertilizer had 73 % straw cover. KERB treated turf averaged 34 – 39 % straw, which was similar to Manor-treated turf (Table3). Note at this time that the percent bermudagrass was greatest on 24 June among all treatments when herbicides were applied "early" vs. "late" (Table 1). Since both application "timings" did cause considerable straw development at 30 DAT, it would be advisable to apply these herbicides "<u>early</u>" if there are no major events planned at a time when the turf would require adequate quality.

By 17 July (56 DAT/2), Tranxit plots had no necrotic straw tissue present, while other treated turfs ranged from 8 % t 18 % straw. The UTC had the greatest amount of straw (16 – 18 %). Note again that the treatment F-ratio was not significant after 30 May for percent plot straw (Table 3). By 4 August (80 DAT/2, 100 DAT/1), very little straw was present. The greatest amounts were detected on Manor and KERB-treated plots. These treatments produced similar responses in terms of transition to bermudagrass and necrosis. Manor did have the greatest amount of perennial ryegrass present mid-summer, with 19 – 23 % perennial ryegrass on 17 July (Table 2).

<u>Turfgrass Color:</u>
Turfgrass color was assigned to plots on 7 dates. Color was scored for the entire plot appearance (regardless of composition). Therefore, plots with considerable straw would receive low scores otherwise than plots which had less or no straw, regardless of living grass color.

Early Applications(May 3, 2003):

Like percent bermudagrass, perennial ryegrass, and straw cover, the treatment F-ratio was significant on 5 of 7 dates, up to and including 24 June. All S.U. treatments caused some loss of plot color up to 36 DAT/1 (6 June). A score of 5.0 is marginal in color, as score of less than 5.0 is generally unacceptable to the lay person. Common bermudagrass is inherently light in color, but scores of 4.0 would be definitely noticeable to the lay person.

In general, TADS applied at the high product rate of 0.4 ounces and the Tranxit- treated turfs produced turfs with the lowest color scores, from 24 May to 24 June (Table 4). KERB ranked first for plot color among treated plots throughout the test period. Not until 24 June did some treatments for the first time show color scores of 6.0 or greater. After that time, all turfs had satisfactory color.

Late Applications (applied 23 May, 2003):

The treatment main effect F-ratio was significant at the first two evaluation dates (7 and 14 DAT/2, 30 May and 6 June, respectively) and also on the final evaluation date (4 August). The overall color of UTC turf was greatest in mid-summer, as expected (Table 4). As was the case with "early" applied treatments, the lowest color scores were also achieved at 30 DAT for the "late" applied treatments (24 June). Tranxit-treated common bermudagrass had extremely poor color on 24 June (32 DAT/2) with mean color score of 2.8, regardless of applied –N-. The Monument-treated plots had low color scores at this time as well (3.3 – 3.5 %). Color scores were generally fully acceptable by 17 July (56 DAT/2) among late applied treatments (Table 4).

Quality:

Turfgrass overall quality includes all aspects of turf performance including density, uniformity, and general appearance. It is the single most important variable in assessing overall turf appearance.

Early Applications:

The F-ratio for the treatment main effect was significant on 5 of 7 evaluation dates up to and including the 24 June evaluations (53 DAT/2) (Table 5). A quality score of 5.0 is marginally acceptable. All S.U.-treated turfs had quality scores of 5.0 to 5.8 on 12 May (9 DAT/1). KERB treatments produce a slightly better quality turf (7.3) close to that of the UTC turfs (7.5) (Table 5).

By 24 May (21 DAT/1), overall quality was diminished for all S.U.-treated turfs. Tranxit had mean quality scores of 3.8 – 4.0. The largest quality scores were still sub-marginal for TADS at the 0.2 ounce product rate, as they also were for Tranxit (4.5 – 4.8). KERB plots (with the least amount of bermudagrass) produced fully acceptable turf (6.5) (Table 5).

By 30 May (27 DAT/2), overall quality decreased to the lowest point of the test, as S.U. "early"treated turfs ranged from 2.0 to 4.5 for quality. Tranxit-treated turf had very poor quality (2.0 – 3.0), as did TADS at the high product rate of 0.4 ounce/P/M. At the high fertilizer rate, Monument also scored low (3.5) (Table 5). As noted before, color and percent straw were affected to the greatest degree at approximately one month after application, regardless of actual application date (Tables2, 3).

On 6 June (35 DAT/1), treatments basically were similar in turf quality. Note that Monument now reached a mean quality of 5.0 when normal fertilizer was applied. KERB was first for overall quality, with mean scores of 6.8. The high herbicide rate of TADS still produced low-quality turf (2.8 – 3.0) at 35 DAT/1, which occurred on 6 June.

On 24 June (53 DAT/1), the overall quality of all turfs had improved, where the S.U.-treated plots produced scores of 4.3 – 5.8. Both Tranxit and the high rate of TADS produced sub-marginal quality scores of 4.3 – 4.8 (Table 5). All other were 5.0 or greater for quality at this time (Table 5). The remaining two evaluations in July and August showed improved quality for treated turfs, noting that both the UTC turfs were marginal on 17 July (due to natural transition) and that the high rates of fertilizer tended to increase quality vs. the standard fertilization by the 4 August evaluation (Table 5). The overall treatment effect was again not statistically significant for quality, however. Note again, the return of bermudagrass to the UTC controls by 4 August (Table 1). The low rate of TADS produced good quality turf at the end of the test (Table 5).

Late Applications (applied 23 May, 2003):

For treatments applied “late”, the F-ratio for the treatment main effect was significant at 7 and 14 DAT/2, but not afterwards. On 30 May (7 DAT/2), the TADS applied at the low rate of 0.2 ounces/P/M had slightly better quality than the 0.4 ounce rate, regardless of applied –N-0 (6.5 vs. 5.5, respectively) (Table 5). Tranxit-treated turf was somewhat marginal at 30 May, with quality mean scores of 5.0 to 5.5. Manor and KERB treatments produced good turf quality at 7 DAT/2.

By 14 DAT/2 (6 June), several treatments produced sub-standard quality turfs. These included TADS at the 0.4 ounce rate, Tranxit and Monument had very low turf quality scores (3.5 to 4.5) at 14 DAT/2 when fertilized at the high N rate. By 24 June (32 DAT/2), quality scores were still low, with herbicide treated turfs ranging from 2.3 to 5.0. The only herbicide-treated turf with a marginal quality mean score of 5.0 was that of Manor at the low fertilizer rate (Table 5).

By 17 July (56 DAT/2), the turf rebounded with rapid bermudagrass growth which improved turf quality scores appreciably. Most herbicide-treated turfs now had mean quality scores of 5.0 or greater. TADS at 0.4 ounce/product/M plus regular fertility and Monument at the high fertility rate had scores of 6.0 and 6.5, respectively (Table 5). The untreated controls now had mean quality scores of 5.8 to 6.0. On 4 August (80 DAT/2), all turfs had mean quality scores of 6.5 to 7.0 (Table 5). All plots also had 97 % or more bermudagrass cover (Table 1), and minimal straw (except for Manor and KERB) (Table3).

When observing quality trends after application dates, most treatments caused the same large amounts of straw cover, which affected quality. At around 30 DAT (30 May for “early” and 24 June for “late” treatments, respectively), the same low quality scores occurred for the TADS-treated turfs while Manor had slightly better quality at 30 days after (each) application, when compared to TADS (Table 5). Tranxit and Monument also had unacceptable turf quality at 30 days after treatment, regardless of actual application date. KERB plots did have much better quality when applied “early” (6.0 – 6.3) than when applied “late” (4.0 – 4.3) (Table 5).

At nearly 50 days after actual application, (24 June, “early”: 17 July, “late”), TADS applied at the high product rate (0.4 ounce) had better quality scores (5.3 to 6.0) than when applied “late” (4.5 to 4.8). Manor had similar quality turfs at 50 DAT, while Tranxit plots had slightly better turf quality when applied “late” (5.0 – 5.3) than when applied “early” (4.3 – 4.8). Monument was similar in appearance at both 50 days after the actual application dates (Table 5). KERB had better quality when applied “early” (6.5) than “late” (5.5) after 50 days after application (24 June “early”, 17 July “late”).

At the end of the test on 4 August (100 DAT/1 : 80 DAT/2), the “late” applied plots collectively had slightly better quality than those applied earlier. Al l turfs which were applied “late” had mean quality scores of 6.3 – 7.0, while those applied “early” had scores of 5.5 – 6.5. The combined analysis of 4 August showed quality to be a significant response from all treatments combined over both application dates. Within each application group, the treatment effect was not significant for quality at the close of the test (Table 5).

Bermudagrass Transition and Turf Quality Together: (Year 1)

This data overall demonstrated that (1) perennial ryegrass will last long into mid-summer when overseeded into common bermudagrass (2) Select herbicides will aid transition of common bermudagrass but not without injury (advanced necrosis) to the perennial ryegrass at some point. (3) Regardless of timing of the herbicide applications, the perennial ryegrass will collapse and appear straw-like (especially from TADS, Monument, Tranxit, and Manor) from 21 – 30 days after the actual application. This was true if these products were applied “early” (3 May) or “late” (23 May). (4) Early applications produced 46 – 75 % bermudagrass cover by 24 June (53 DAT/1), while the late season applied treatments had 18 – 43 % bermudagrass by 24 June (32 DAT/2). (5) By 17 July, “early” treatments had 80 – 98 % bermudagrass while “late” treatments averaged 64 – 91 % cover (Table 1).

If treatments are applied “early”, and if turf quality is an issue during the first three weeks of June, then the following treatments should be considered if quality (turf appearance) is *more* important than actual transition. KERB provided better-than-average quality and was equal to most other treatments for the amount of percent plot bermudagrass at 6 June, but was noticeably slower in overall transition from 6 June to 17 July. Manor would rank next, noting that Manor produced marginal quality scores from 24 May up to 24 June. Other treatments had greater transition effects, but produced considerable plot straw on the perennial ryegrass, which was the major single factor associated which decreased over turf quality.

If sub-marginal quality is acceptable for up to 1 month (24 May to 24 June), then TADS applied at the 0.4 ounce product rate provided a more rapid return of bermudagrass (when applied “early”) (Table 1,5). The low product rate of 0.2 ounces of TADS had sub-marginal quality, but did not enhance bermudagrass transition greatly over the UTC turfs.

Tranxit produced poor quality turf from 24 May to 24 June, with a fair return of bermudagrass during that time span. Monument was slightly better than Tranxit in quality (from 24 May to 24 June), when it received the standard fertilizer program (Table 5). When applied as a “late” treatment, KERB and Manor produced the better-looking turfs (most quality scores of 5.0 or greater) from 30 May up to 17 July). These treatments had a moderate transition only up to 24 June.

If enhanced transition is warranted starting in late June (turf requires good quality in May and early June) and turf quality can be compromised from middle-to-late June until mid-July, then Tranxit is suitable as is Monument, as is TADS at the 0.4 ounce (high product) rate, regardless of application date. Again, note that the overall seasonal effects of a typical monsoon summer in the Sonoran Desert, as increased bermudagrass cover in the UTC plots similar to that of most treated turfs by 17 July. Thus, greater treatment effects were achieved for “early” applications.

In effect, “early” herbicide applications should be beneficial to the bermudagrass since the early return of bermudagrass should produce more growing points and stored carbohydrates for the next overseed season.

Results and Discussion, Year 2 (2004)

Transition and Plot Composition Year 2, (2004)

In year two (2004), the plots were evaluated for visual turf attributes from May 10 to July 16, 2004.

Early applied treatments (applied May 4, 2004).

Plots were evaluated for percent bermudagrass, percent ryegrass and percent plot straw (or bare ground) on eight evaluation dates. The “treatment” main effect was highly significant on all dates, except on May 18 and July 9, 2004. (Table 6).

By June 3, 2004, percent bermuda among herbicide treated turfs ranged from 40% to almost 75%, while the untreated turf averaged only 30-35% bermuda. The was some maintenance of live ryegrass (20%) in TADS turfs treated at 0.2 ounce and 10% or less ryegrass for TADS turfs treated at 0.4 ounce. Manor and KERB maintained the greatest amounts of living rye at this time (25-30% for Manor, 55%-60% for KERB). The non-treated controls averaged 65%-70% ryegrass. Again, turfs with the most amounts of necrotic ryegrass (straw) had lower overall turf quality scores. (Table 7).

On May 10, KERB had the least amount of bermuda (5.3%) while TADS at the 0.2 ounce/product/M rate, Manor, and Monument had the most bermuda (11.3-16.3%). No straw was present at this time. On May 18, 2004, Revolver at the 0.2 ounce rate averaged 32% bermuda cover, while the 0.4 ounce rate had 38% and 24% plot cover at the ‘regular’ and ‘high’ nitrogen application rates, respectively. Other treatments averaged between 17-27% bermuda cover at this time, regardless of applied nitrogen level. No straw was apparent on May 18. (Table 8).

On May 18, 2004, noticeable straw developed (necrotic ryegrass), which ranged from 2-3% of the plot (KERB) to 40% or more for Revolver @ 0.20 ounce, and Revolver at the 0.4 ounce rate plus high nitrogen/ This was also the case for Manor at the high nitrogen rate, Tranxit at the high nitrogen application, and both Monument treatments. This presence of straw decreased overall quality ratings.

On May 26, 2004, the percent bermudagrass plot cover ranged from 16-60% among herbicide treated turfs. The KERB treated plots had no more bermudagrass cover than the controls (16-18%), but 25% straw developed on KERB turfs, which received the 'high' –N- application. Manor treated turfs displayed a 're-growth' of ryegrass compared to canopy cover estimates just eight days prior. Tranxit and Monument treated turfs showed 50% or more plot straw on May 26, which negatively affected turf quality. Both Revolver treated turfs had the greater amounts of bermuda cover (45-60% bermuda) at this time, with less straw (30-35%) than Tranxit and Monument treated turfs. KERB had no increase in bermuda cover over the controls (16-18% bermuda), but the 'high' rate of applied –N- caused more straw (ryegrass necrosis) than for KERB that received the 'standard' applied –N-. (Table 6).

By June 18, 2004 (45 DAT/1), bermudagrass transition had become enhanced due to larger day length and warmer day/night temperatures. All herbicide treated turfs (with the exception of KERB) had 90% or greater bermudagrass plot cover. Manor had 5-8% living ryegrass, while Tranxit and Monument had the least (trace). Monument treated turfs had the most visible straw (5-6%) plot cover, which was acceptable. KERB had 84% bermuda (at high –N-) with the rest of turf essentially being live ryegrass. The non-treated controls averaged 62-64% bermuda, among the remaining live ryegrass.

On June 28 (55 DAT/1), necrosis began to appear in more noticeable amounts in the non-treated control plots, as well as in the KERB treated plots. However, the amount of straw was comparatively small (3-5%). Most S.U. treated turfs had 98% or more bermudagrass cover. Those with 100% bermuda cover included Revolver at 0.2 and 0.4 ounce rates, when they received 'high' applied nitrogen rates. Tranxit also produced 100% bermuda cover, regardless of applied nitrogen. The non-treated controls averaged 85-87% bermuda and roughly 10% green ryegrass.

From July 9 to 16 2004, S.U. herbicide plots maintained high levels of bermudagrass cover, with no damage showing to new bermuda growth. On July 9 (66DAT/1) the 'treatment' main effect was not statistically significant for bermudagrass cover. KERB plots showed some regrowth in ryegrass cover, averaging 7-10% living ryegrass at that time. The non-treated controls averaged 10-15% living ryegrass. On July 16, the death of the remaining ryegrass was clearly noticeable in the non-treated controls, which averaged 20% straw.

<u>Late applied treatments : (applied May 27, 2004)</u>
On each of the five evaluation dates following "late" applied treatments, the F ratio for the treatment main effect was statistically significant.

On June 3 (7 DAT/2), the non-treated controls averaged 20% bermuda cover. Turfs with the most bermudagrass cover occurred for both Revolver rate treatments, Manor, and Monument. Tranxit was slightly less active for bermuda transition at this time, and was similar in performance to that of KERB (Table 6).

On June 18 (22 DAT/2), herbicide treated turfs ranged from 40-78% bermudagrass cover. At this time (three weeks after applications), the amount of necrotic ryegrass (straw) was at its peak. Tranxit treated turf averaged 38-42% straw turf, while all other S.U. compounds caused an average of 18-22% straw cover. Manor and Monument (at low applied –N-) maintained greater amounts of living ryegrass at this time (20-30%), while KERB was again no different from the non-treated controls which averaged essentially 60% perennial ryegrass. This much ryegrass is not desirable by the middle of June (Table 6).

On June 28, 20004 (32 DAT/2), three treatments reached 80% or more cover. These included Revolver at both the 0.2 and 0.4 ounce rates and Manor. This was the case, regardless of applied –N-. Only Revolver applied at the 0.4 ounce rate had over 93% cover (no –N- rate affect). Both Tranxit and Monument had significant straw composition at this time. Tranxit treated turfs averaged 30% straw levels, while Monument averaged around 20% plot straw. KERB had minimal straw and the same bermuda cover as both the Monument and Tranxit treated turfs. The untreated turfs averaged 50% bermuda, 40% bermuda, and 10% plot straw, respectively (Table 6).

On July 9, 2004 (43 DAT/2), both TADS treatments had 90-95% bermuda cover, as did Manor. Tranxit, KERB and Monument produced on average 80% bermuda plot cover. KERB and Monument had the most amount of living rye (10-15%) at that time. The non-treated turfs averaged 60% bermuda, 25-30% live rye, and around 8% straw cover (Tables 6,7,8).

At the close of the test on July 16, 2004 (50 DAT/2), all herbicide treated turfs had 90% bermuda. The untreated turfs had 63-68% bermuda cover, about 10% living rye and 18-22% dead ryegrass (straw). Thus, bermuda did benefit from applications of these herbicide/rate combinations, versus non-treated ryegrass, which lagged behind in bermudagrass cover.

Percent perennial ryegrass and straw cover:
As in Year 1, overall turf quality was highly influenced by the presence and variable amounts of necrotic perennial ryegrass (straw) which developed at one time or another.

Early Applied Treatments (applied 4 May, 2004):
The "treatment" main effect was statistically significant on six of seven evaluation dates after the early-applied treatments were executed in 2004. The percent ryegrass was not significant on July 9 (66 DAT/1) 2004. The non-treated control plots averaged 80-85% ryegrass cover at 14 DAT/1 (May 18, 2004) and maintained 64-70% ryegrass cover in early June. By July 18, plots averaged 34-36% ryegrass cover when they received no herbicide treatment (Table 7).

The percent plot cover of necrotic ryegrass (straw) response was significant for the herbicide treatment main effect on seven of nine evaluation dates after the "early" application in 2004. As in Year 1 (2003), the greatest amount of straw appeared in the first 30 days after treatment application. In Year 1, the test mean average at 27 DAT/1 (May 30, 2003) reached a maximum of 41% straw cover, while in Year 2, the test mean average was greatest at 14 DAT/1 (May 18, 2003).

In 2004, there was more "bare ground" present from the dislodging of straw necrotic leaf tissue, than was noticeable in 2003. Therefore bare ground values were taken in 2004 only. Regardless, bare soil and straw cover percentages are expressed as areas void of bermuda.

As in 2003, all the S. U. herbicides did cause noticeable to extreme leaf necrosis of ryegrass, ranging from 30-60% of the plot cover, after "early applications." The Manor treated turf did maintain greater numerical amounts of ryegrass after application, than did TADS, Monument, or Tranxit. This was true in both years, following the "early" treatment applications. In 2004, KERB again maintained high levels of perennial ryegrass, similar to that of non-treated controls on almost all evaluation dates. In 2004, the large amounts of visible plot straw lasted into early June (June 3, 30 DAT/1), which was followed by a resurgence of bermuda by June 18 (45 DAT/1).

Late applied treatments (May 27, 2004):
For "late applied" treatments in 2004, the percent rye response was significant due to herbicide treatments on all five evaluation dates, while the percent plot straw was significant on five of six evaluation dates (Table 7). At 7 DAT/2 (June 3, 2004), all turfs had the same relative amounts of ryegrass, bermuda, and trace amount of straw. By June 18, 2004 (22 DAT/2), significant reductions in ryegrass and increased straw cover occurred for the S.U. treated turfs. Tranxit had the numerically largest amounts of straw (38-42% straw) on this date, while others averaged 15-22% straw cover. Again, the KERB treated turfs maintained lots of ryegrass and minimal straw. The amount of straw cover diminished at 32 (DAT/2), June 28, 2004, among S.U. treated turfs. The Tranxit treated turfs ranked first with the largest percent plot straw, (28-32% straw and/or bare turf). Monument treated turfs followed with about 20% straw and/or bare ground, followed closely by Manor (8-10%) and TADS at the 0.2-ounce rate (4-10% bare straw). TADS at the 0.4 ounce rate averaged 2-4% straw/bare cover on June 28 (32 DAT/2) and had 95% or more bermuda present. KERB had equally low amounts of straw/bare ground cover, but had much more ryegrass.

On July 9, 2004 (43 DAT/2), both TADS treatments and the Manor treated turfs had 10% or less rye and 3% or less percent plot straw (Tables 7,8) Both Tranxit and Monument treated turfs had more visible straw and live ryegrass amounts than the other S.U. treatments. The amount of ryegrass present on this date was similar to that of KERB, for Tranxit and Monument.

On July 16 (50 DAT/2) all herbicide treated turfs had 90% or more bermuda with 3% living ryegrass or less, and 4% straw or less. The non-treated controls averaged almost 20% straw cover on this date, showing the inherent mid-summer collapse of ryegrass. In general, the "herbicide induced transition" from "late applications" caused a quicker return of the bermuda in Year 2 (2004), than that which was observed in Year 1 (2003)

Turf Color Turfgrass Color Scores: Early Applications (applied May 4, 2004):
The treatment main effect was significant on six of eight-evaluation date after the "early applications" treatments in Year 2. Turfgrass color scores included the integration of the "straw" present, which would be discernable by the lay person as a "bad color", especially as the amount of visible straw increased (Table 9).

Therefore "color" scores of 5.0 or less indicate a 'poor color' turf plot overall, mainly due to the presence of straw (necrotic ryegrass). TADS treated turfs had low color scores of 5.0 or less occurred on May 18 and on May 26 (both at the high –N- rate), irrespective of applied herbicide product amounts. Monument had low mean color scores on May 26 and June 3, 2004 (regardless of applied –N-). The Tranxit high –N- combination had a low mean color score of 4.5 on May 26 only. (Table 9).

Late applications (applied May 27, 2004).
TADS at the 0.2 ounce rate had a mean color score of 4.8 (regardless of applied –N-) on May 18, 2004 (22 DAT/2). At this time, both Tranxit and Monument treated turfs had mean color scores of 4.0-4.8 as well, due to vast amounts of temporary necrotic ryegrass straw. These effects were minimal by June 28, 2004 (32 DAT/2). (Table 9).

Turfgrass Quality - Early treatments (applied May 4, 2004):
The F ration for the treatment mean effect was statistically significant on all seven "early" post-treatment evaluation dates in Year 2 (2004) (Table 10). Treatments, which induced the greater amounts of necrotic ryegrass (straw), tended to have the lowest corresponding quality ratings. From May 10 to June 28, the untreated ryegrass turfs had good quality, but a large percentage of living ryegrass was present. On July 16, 2004, the ryegrass was beginning to collapse and show marginal quality. At 14 DAT/1 (May 18, 2004) no S.U. treated turfs had a mean quality score of 6.0. Tranxit with extra applied –N- had the lowest quality mean score (4.8), followed by Monument (5.0), and both treatments of TADS (5.0-5.5) on May 18. By 22 DAT/1 (May 26, 2004), the enhanced development of necrotic ryegrass (straw), caused the cessation of continued low overall turfgrass quality scores for Monument treated turfs (regardless of –N- level), and for Tranxit (at the high applied –N- level). These particular treatments averaged (4.0-4.5) quality scores. TADS treated turfs were slightly better in quality (5.0-5.5) at that time as well. These same relative quality trends carried over to June 3, 2004 (30 DAT/1), noting that Monument at the high applied -N- rate had a very low turf quality mean score (3.5). These plots did recover by June 18, 2004 (45 DAT/2). Therefore, Monument treated turf produced low quality appearing turf from about 30 days. Manor, however, maintained fairly good quality turf throughout the transition period, noting that it did have more living ryegrass present than the S.U. treated turfs (Table 10).

Essentially, all turfs had acceptable overall quality turf scores at 45 DAT/1 (June 18, 2004), and afterwards as well (Table 10). Revolver at the 0.4 ounce rate had exceptional turfgrass quality on June 28, 2004 (8.3, regardless of applied –N-). Tranxit and Monument produced "better" quality scores by this date versus previous ratings, due to the regrowth of bermuda into the rapid treatment induced necrotic ryegrass canopy.

Late treatments (applied May 27, 2004):
The herbicide treatment main effect was significant on three of four evaluation dates after the "late" applications in 2004. On June 30, 2004 (7 DAT/2), all turfs had very good turf quality, but were not ranked as high in quality compared to the KERB and non-treated controls, which still had larger percentages of living ryegrass cover (Table 10).

By 22 DAT/2 (June 18, 2004), the cholorotic straw induced by S.U. herbicides caused decreased quality scores again. TADS @ 0.4 ounce (at either –N- levels) and Tranxit (at the low –N- level) had quality scores of 5.0 or less (Table 10). Tranxit averaged 3.8 for quality at that time. Monument at the lower applied nitrogen rate averaged a low quality score of 4.8. Once again, KERB and the non-treated controls had mean quality scores of 7.3, but had high levels of living ryegrass.

By June 28, 2004, (32 DAT/2) Tranxit still had low quality scores (related to straw levels present) and average 4.8, regardless of supplemental applied –N-. The same was true for Monument turfs which received the high applied –N- level as well (mean quality = 4.8).

The overall quality scores improved by July 16, 2004, (50 DAT/2), as all herbicide treated turfs had mean quality scores within the range o 6.0-7.5 (Table 10).

Bermudagrass transition and Turf Quality Together - Year 2

Again, this test demonstrated that (1) perennial ryegrass will last long into mid-summer when overseeded into common bermudagrass, and that when (left) untreated, the overseeded ryegrass will produce a low quality turf in the late season closeout during its 'natural' transition, (2) select herbicides (at rates tested here) will hasten transition, but usually at a cost of the production of necrotic ryegrass, resulting in "straw." The amount and duration of this necrotic tissue is generally inversely proportional to overall turfgrass quality.

When applied in "early" May in Year 1, the inducement of necrotic straw from S.U. herbicides occurred at 21 DAT, and was at maximum expression at both 27 and 34 DAT, which in Year 1 persisted up to June 24 (52 DAT/1).

In Year 2, the percent plot straw occurred more quickly after the initial "early treatment," as significant visual necrosis occurred by May 18 (14 DAT/1) 2004. All S.U. herbicides caused high levels of necrosis at that time. With exception of Manor, percent plot chlorosis remained high at 22 DAT/1 (May 25, 2004) and moderately so up to and including 30 DAT/1 (June 3, 2004).

In general, Tranxit had the greatest amounts of plot straw present near 30 DAT following the "early" applications in both years. Tranxit averaged 60% or more "straw" cover at 34 DAT/1 (June 6, 2003) and 30-45% straw at 30 DAT/1 (June 3, 2004).

TADS, at the 0.4 ounce rate, also had tremendous amounts of necrotic ryegrass plot composition at 34 DAT in Year 1 (50-70% straw) June 6, 2003, but nominal (average amounts) at 30 DAT in Year 2 (9-18% straw) on June 3, 2004.

In both years KERB had good quality turf scores (applied "early"), but had high levels of ryegrass up until late June in 2004 and up until mid July in 2003.

Manor was intermediate in transition, but had less numerous mean quality scores dropping below 5.0 as Manor caused lesser amounts of ryegrass necrosis. This was generally true in both years.

Late applied treatments (applied May 27, 2004)

The herbicide affected turfs quickly after the "late" application was executed. As early a 7 DAT/2 (June 3) 2004, all the herbicide treated turfs averaged 30-50% bermudagrass cover and good initial quality at 7 DAT/2. The non-treated turf had 23% bermuda cover at that time. By 22 DAT/2 (June 18, 2004) TADS treated turfs had the most bermuda cover and nominal straw cover (18% on average).

TADS at the 0.2 ounce rate had nominal quality scores at that time (5.0) on June 18, 2004. Tranxit had low quality scores due to high straw levels on June 18 also. When applied "late," Tranxit also caused high "straw" levels, as it did when applied earlier. Monument was "intermediate" in quality and similar to Manor in transition and quality up until June 28, 2004 (32 DAT/2), when Monument had mean quality score of 5.3 and 4.8, and Manor had mean quality scores of 6.5 and 6.5 for both applied –N- levels, respectively.

Overall Conclusions

1. The S.U. herbicides of Revolver, Monument and Tranxit generally had the greater affects as transition agents, from perennial ryegrass overseed back to Common bermudagrass than did metsulfuron and pronamid. This as true in both years..

2. There again was associated necrotic ryegrass which occurred to the greatest extent with the above mentioned herbicides at rates and timings tested here. Tads (foramsulfuron), trifloxysulfuron and rimsulfuron did cause more necrosis to the perennial ryegrass, which decreased turf quality for up to 3 weeks.

3. Revolver at the 0.2 ounce/prod/M rate did enhance transition initially after application, and was more affective when applied 'early' in 2003, than when applied late in 2003. Bermuda transition was the same for Revolver at both the 0.2 and0.4 ounce rates in 2004, noting that there is more ryegrass necrosis associated with the 0.4 ounce rate than the 0.2 ounce rate.

4. Among S.U. herbicides, Manor in general, , caused the least amount of necrosis, but retained and intermediate amount of green perennial ryegrass on occasion. This was true when Manor was applied either 'early' or 'late'.

5. KERB had the least affect on transition, and was often no different from that of the UTC in terms of percent living ryegrass , and percent bermudagrass present. In 2003, Kerb was slowest in transition, as much ryegrass remained into the summer months, especially when applied 'early'. Kerb was slow in transition, when applied 'late' in 2004. When applied 'late', Tranxit and Monument were similar to Kerb for transition from 32 to 45 DAT in 2003.

6. The main affect of "herbicide treatments" was significant for most variables when the herbicides were applied "early' in 2003, 'early' in 2004, or 'late' in 2004. Reponses were minimal from herbicides when applied 'late' in 2003 only.

7. Early bermudagrass return from 'early' May applications allowed for a longer season of bermudagrass cover, which is beneficial for both turf utility and growth before the next overseed season. This was true in both years.

8. The addition of nitrogen to form 1x to 2x application was not consistent across herbicide treatments on ryegrass decline, bermudagrass return, or both. This was true in both years.

9. Without the addition of herbicides, perennial ryegrass will remain into mid summer at high plot percentages in common bermudagrass sports turf.

Appendix Table - A - . Number of rating events a herbicide treatment resulted in a mean turfgrass` quality rating of less than 5.0. University of Arizona, Summers 2003 and 2004. 'Early' and 'late' refer to application timings of herbicides. See text for specific dates and details.

		2003		2004	
		'EARLY'	'LATE'	'EARLY'	'LATE'
	-N- FERT	# EVENTS	# EVENTS	#EVENTS	<# EVENTS
TADS 0.2	L	3/7	1/5	0/7	0/4
TADS 0.2	H	3/7	2/8	0/7	0/4
TADS 0.4	L	4/7	2/5	0/7	1/4
TADS 0.4	H	4/7	2/5	0/7	1/4
MANOR	L	3/7	0/5	0/7	0/4
MANOR	H	3/7	1/5	0/7	0/4
TRANXIT	L	4/7	2/5	1/7	2/4
TRANXIT	H	4/7	2/5	3/7	1/4
MONUMENT	L	2/17	2/5	2/7	1/4
MONUMENT	H	3/17	2/5	2/7	1/4
KERB	L	0/7	1/5	0/7	0/4
KERB	H	0/7	1/5	0/7	0/4
UTC	L	0/7	2/5	0/7	0/4
UTC	H	0/7	2/5	0/7	0/4

Other observation s made in year 2 (only) included those of turfgrass density, texture , uniformity, stress to ryegrass, vertical height suppression of unmowed turf, and degree and % plot chlorosis type symptoms.

In general, treatments which caused the greatest amount of sudden ryegrass decline (necrosis) naturally had low density scores ,which is based on living grass cover. Likewise, loss of green turf cover (from ryegrass necrosis) caused loss of uniformity. These variables are all components of overall turfgrass quality which has already been discussed. Mean treatment responses are listed in Appendix Tables B,C,D.
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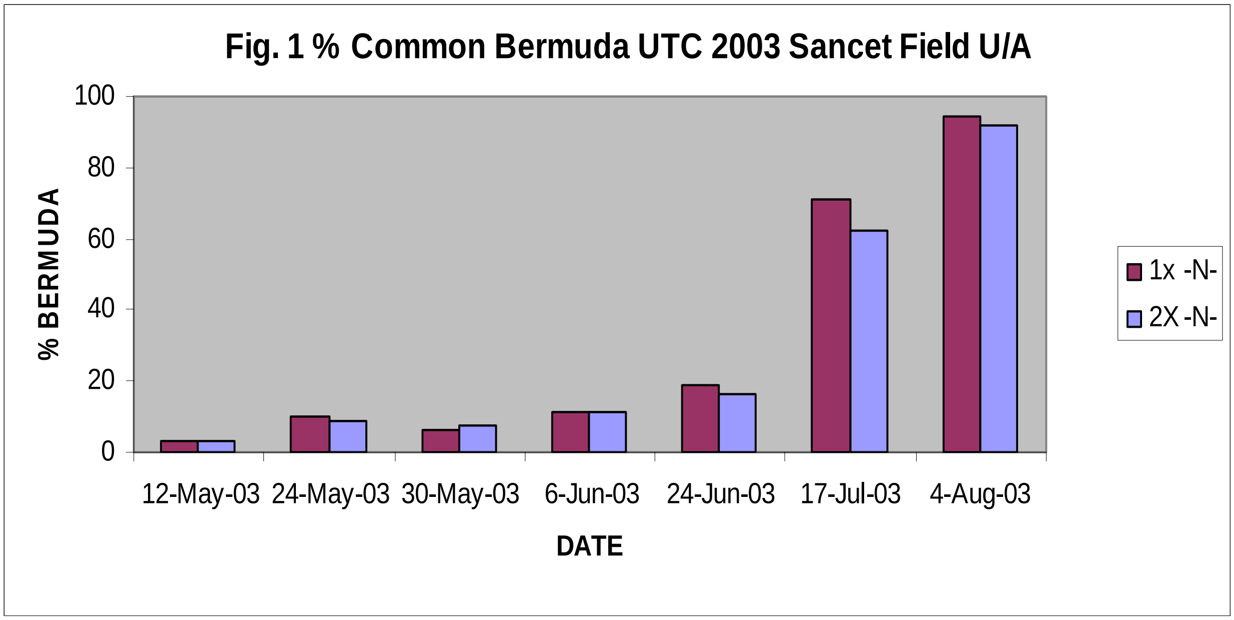
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% BERMUDA
100
80
60
40
20
0
12-May-03
24-May-03
30-May-03
6-Jun-03
24-Jun-03
17-Jul-03
4-Aug-03
DATE
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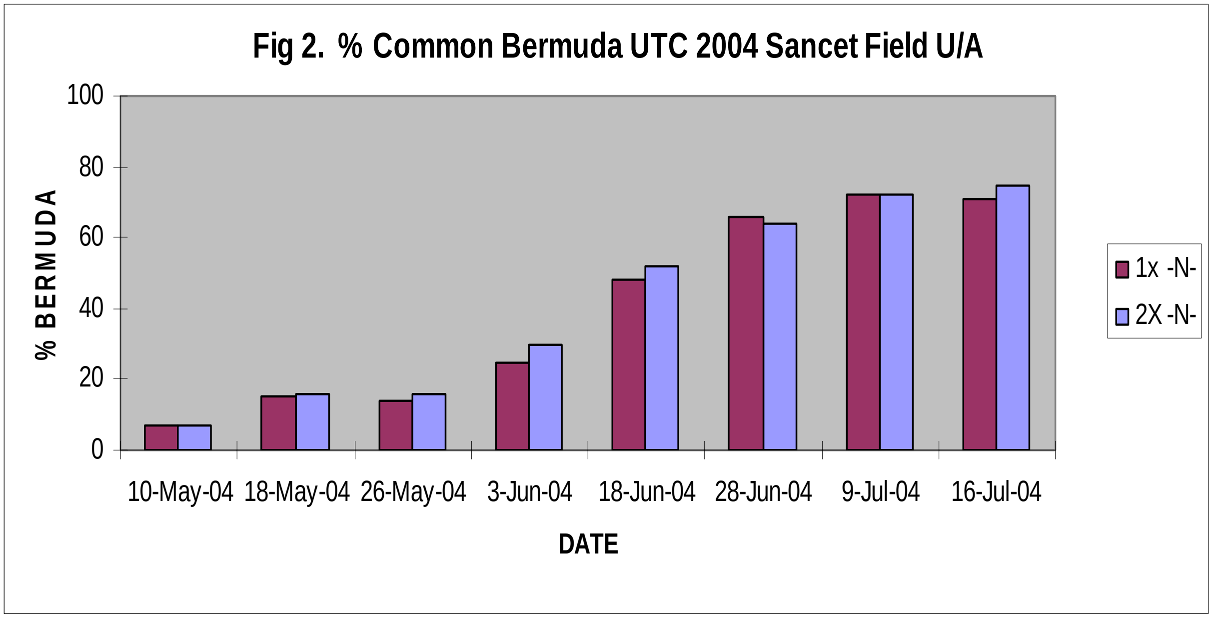
Fig 2. % Common Bermuda UTC 2004 Sancet Field U/A
100
80
60
40
20
0
% BERMUDA
10-May-04
18-May-04
26-May-04
3-Jun-04
18-Jun-04
28-Jun-04
9-Jul-04
16-Jul-04
DATE
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[TABLE 1] REVOLVER Common Bermuda - U/A Mens Baseball Field, Spring 2003 Treatments Applied May 3rd	bermuda1 12-May-03 7 DAT/1	bermuda 24-May-03 21 DAT/1	bermuda 30-May-03 27 DAT/1	bermuda 6-Jun-03 35 DAT/1	bermuda 24-Jun-03 53 DAT/1	bermuda 17-Jul-03 73 DAT/1	bermuda 4-Aug-03 100 DAT/1
REVOLVER @ 0.2 fluid oz./1000 ft2 + 1x nitrogen fert.	22	21	14	20	31	80	98
REVOLVER @ 0.2 fluid oz./1000 ft2 + 2x nitrogen fert.	12	29	20	26	43	86	99
REVOLVER @ 0.4 fluid oz./1000 ft2 + 1x nitrogen fert.	20	23	15	25	75	93	95
REVOLVER @ 0.4 fluid oz./1000 ft2 + 2x nitrogen fert.	20	16	13	26	75	97	95
MANOR @ 0.4 oz./acre + 1x -N- fert. w/ surf. @ .25 % v/v	15	16	18	28	59	93	95
MANOR @ 0.4 oz./acre ft2 + 2x -N- fert. w/ surf. @ .25 % v/v	15	15	16	34	46	95	100
TRANXIT @ 1.0 oz./Acre + 1x -N-fert. w/ surf. @ .25 % v/v	14	16	19	26	59	96	100
TRANXIT @ 1.0 oz./Acre + 2x -N-fert. w/ surf. @ .25 % v/v	14	15	14	23	65	98	100
TRIFLOXY @ 5.33 grams./Acre + 1x -N-fert. w/ surf. @ .25 % v/v	14	19	19	29	68	92	99
TRIFLOXY @ 5.33 grams./Acre + 2x -N-fert. w/ surf. @ .25 % v/v	14	25	19	38	62	93	99
KERB @ 1.0 lb./Acre + 1x nitrogen fert.	6	18	16	24	41	79	94
KERB @ 1.0 lb./Acre + 2x nitrogen fert.	6	18	23	29	46	86	95
UTC + 1x nitrogen fert.	3	10	6	11	19	71	94
UTC + 2x nitrogen fert.	3	9	8	11	16	63	92
Early Application							
Test Mean	12	18	16	25	50	87	97
LSD	7	11	12	19	29	16	6
Treatments Applied May 23rd			7 DAT/2	14 DAT/2	32 DAT/2	56 DAT/2	80 DAT/2
REVOLVER @ 0.2 fluid oz./1000 ft2 + 1x nitrogen fert.		.	6	11	18	84	98
REVOLVER @ 0.2 fluid oz./1000 ft2 + 2x nitrogen fert.		.	6	8	19	65	98
REVOLVER @ 0.4 fluid oz./1000 ft2 + 1x nitrogen fert.		.	10	15	33	80	100
REVOLVER @ 0.4 fluid oz./1000 ft2 + 2x nitrogen fert.		.	7	10	23	81	100
MANOR @ 0.4 oz./acre + 1x -N- fert. w/ surf. @ .25 % v/v		.	16	24	30	65	92
MANOR @ 0.4 oz./acre + 2x -N- fert. w/ surf. @ .25 % v/v		.	16	21	29	73	93
TRANXIT @ 1.0 oz./Acre + 1x -N-fert. w/ surf. @ .25 % v/v		.	13	13	38	80	99
TRANXIT @ 1.0 oz./Acre + 2x -N-fert. w/ surf. @ .25 % v/v		.	15	16	44	88	99
TRIFLOXY @ 5.33 grams./Acre + 1x -N-fert. w/ surf. @ .25 % v/v		.	9	11	29	82	99
TRIFLOXY @ 5.33 grams./Acre + 2x -N-fert. w/ surf. @ .25 % v/v		.	9	10	39	92	99
KERB @ 1.0 lb./Acre + 1x nitrogen fert.		.	13	24	29	79	96
KERB @ 1.0 lb./Acre + 2x nitrogen fert.		.	10	13	30	82	94
UTC + 1x nitrogen fert.		.	9	13	28	78	99
UTC + 2x nitrogen fert.		.	8	10	21	81	99
Late Application							
Test Mean		.	10	14	29	79	97
LSD			ns	ns	ns	ns	ns
Combined Test Mean	12	17.8	13	20	40	83	97
LSD	7	11.3	11	16	37	26	ns

[TABLE 2] REVOLVER Common Bermuda - U/A Mens Baseball Field, Spring 2003 Treatments Applied May 3rd	rye 12-May-03 7 DAT/1	rye 24-May-03 21 DAT/1	rye 30-May-03 27 DAT/1	rye 6-Jun-03 35 DAT/1	rye 24-Jun-03 53 DAT/1	rye 17-Jul-03 73 DAT/1	rye 4-Aug-03 100 DAT/1
REVOLVER @ 0.2 fluid oz./1000 ft2 + 1x nitrogen fert.	83	68	64	64	45	14	0
REVOLVER @ 0.2 fluid oz./1000 ft2 + 2x nitrogen fert.	83	56	36	54	39	6	0
REVOLVER @ 0.4 fluid oz./1000 ft2 + 1x nitrogen fert.	77	59	15	25	6	2	0
REVOLVER @ 0.4 fluid oz./1000 ft2 + 2x nitrogen fert.	77	61	7	8	4	0	0
MANOR @ 0.4 oz./acre + 1x -N- fert. w/ surf. @ .25 % v/v	78	63	44	58	34	4	0
MANOR @ 0.4 oz./acre ft2 + 2x -N- fert. w/ surf. @ .25 % v/v	78	53	33	55	45	3	0
TRANXIT @ 1.0 oz./Acre + 1x -N-fert. w/ surf. @ .25 % v/v	81	49	10	10	4	1	0
TRANXIT @ 1.0 oz./Acre + 2x -N-fert. w/ surf. @ .25 % v/v	81	50	8	4	13	1	0
TRIFLOXY @ 5.33 grams./Acre + 1x -N-fert. w/ surf. @ .25 % v/v	78	73	31	45	14	0	0
TRIFLOXY @ 5.33 grams./Acre + 2x -N-fert. w/ surf. @ .25 % v/v	78	53	20	30	10	1	0
KERB @ 1.0 lb./Acre + 1x nitrogen fert.	93	66	81	73	54	13	0
KERB @ 1.0 lb./Acre + 2x nitrogen fert.	93	66	74	70	49	2	0
UTC + 1x nitrogen fert.	97	90	94	86	76	14	0
UTC + 2x nitrogen fert.	97	91	91	88	74	25	1
Early Application							
Test Mean	84	64	43	48	33	6	0
LSD	6	30	20	20	31	14	0
Treatments Applied May 23rd			7 DAT/2	14 DAT/2	32 DAT/2	56 DAT/2	80 DAT/2
REVOLVER @ 0.2 fluid oz./1000 ft2 + 1x nitrogen fert.		.	93	79	39	9	0
REVOLVER @ 0.2 fluid oz./1000 ft2 + 2x nitrogen fert.		.	93	75	30	18	0
REVOLVER @ 0.4 fluid oz./1000 ft2 + 1x nitrogen fert.		.	81	61	8	10	0
REVOLVER @ 0.4 fluid oz./1000 ft2 + 2x nitrogen fert.		.	84	60	5	9	0
MANOR @ 0.4 oz./acre + 1x -N- fert. w/ surf. @ .25 % v/v		.	84	71	40	23	0
MANOR @ 0.4 oz./acre ft2 + 2x -N- fert. w/ surf. @ .25 % v/v		.	83	73	40	19	0
TRANXIT @ 1.0 oz./Acre + 1x -N-fert. w/ surf. @ .25 % v/v		.	85	72	5	20	0
TRANXIT @ 1.0 oz./Acre + 2x -N-fert. w/ surf. @ .25 % v/v		.	84	65	6	12	0
TRIFLOXY @ 5.33 grams./Acre + 1x -N-fert. w/ surf. @ .25 % v/v		.	86	71	16	8	0
TRIFLOXY @ 5.33 grams./Acre + 2x -N-fert. w/ surf. @ .25 % v/v		.	88	65	11	5	0
KERB @ 1.0 lb./Acre + 1x nitrogen fert.		.	86	70	38	7	0
KERB @ 1.0 lb./Acre + 2x nitrogen fert.		.	89	75	31	5	0
UTC + 1x nitrogen fert.		.	88	71	14	5	0
UTC + 2x nitrogen fert.		.	86	68	18	4	0
Late Application							
Test Mean		.	86	70	21	11	0
LSD			ns	ns	ns	ns	ns
Combined Test Mean	84	64	65	59	27	8	0
LSD	6	30	17	24	36	20	0

[TABLE 3]	straw	straw	straw	straw	straw	straw
REVOLVER Common Bermuda - U/A Mens Baseball Field, Spring 2003	24-May-03	30-May-03	6-Jun-03	24-Jun-03	17-Jul-03	4-Aug-03
Treatments Applied May 3rd	21 DAT/1	27 DAT/1	35 DAT/1	53 DAT/1	73 DAT/1	100 DAT/1
REVOLVER @ 0.2 fluid oz./1000 ft2 + 1x nitrogen fert.	11	23	16	24	6	3
REVOLVER @ 0.2 fluid oz./1000 ft2 + 2x nitrogen fert.	15	44	20	19	8	1
REVOLVER @ 0.4 fluid oz./1000 ft2 + 1x nitrogen fert.	19	70	50	19	6	5
REVOLVER @ 0.4 fluid oz./1000 ft2 + 2x nitrogen fert.	23	81	66	21	3	5
MANOR @ 0.4 oz./acre + 1x -N- fert. w/ surf. @ .25 % v/v	21	39	15	8	4	6
MANOR @ 0.4 oz./acre ft2 + 2x -N- fert. w/ surf. @ .25 % v/v	33	51	11	9	2	0
TRANXIT @ 1.0 oz./Acre + 1x -N-fert. w/ surf. @ .25 % v/v	35	71	64	38	3	1
TRANXIT @ 1.0 oz./Acre + 2x -N-fert. w/ surf. @ .25 % v/v	35	79	74	23	1	0
TRIFLOXY @ 5.33 grams./Acre + 1x -N-fert. w/ surf. @ .25 % v/v	9	50	26	19	8	1
TRIFLOXY @ 5.33 grams./Acre + 2x -N-fert. w/ surf. @ .25 % v/v	23	61	33	28	6	1
KERB @ 1.0 lb./Acre + 1x nitrogen fert.	16	3	4	5	9	6
KERB @ 1.0 lb./Acre + 2x nitrogen fert.	16	4	1	5	12	5
UTC + 1x nitrogen fert.	0	0	3	5	15	6
UTC + 2x nitrogen fert.	0	1	1	10	13	7
Early Application						
Test Mean	18	41	27	16	7	3
LSD	25	20	19	24	ns	ns
Treatments Applied May 23rd		7 DAT/2	14 DAT/2	32 DAT/2	56 DAT/2	80 DAT/2
REVOLVER @ 0.2 fluid oz./1000 ft2 + 1x nitrogen fert.		1	10	44	8	3
REVOLVER @ 0.2 fluid oz./1000 ft2 + 2x nitrogen fert.		2	18	51	18	3
REVOLVER @ 0.4 fluid oz./1000 ft2 + 1x nitrogen fert.		9	24	60	10	0
REVOLVER @ 0.4 fluid oz./1000 ft2 + 2x nitrogen fert.		9	30	73	11	0
MANOR @ 0.4 oz./acre + 1x -N- fert. w/ surf. @ .25 % v/v		0	5	30	13	8
MANOR @ 0.4 oz./acre ft2 + 2x -N- fert. w/ surf. @ .25 % v/v		1	6	31	9	8
TRANXIT @ 1.0 oz./Acre + 1x -N-fert. w/ surf. @ .25 % v/v		3	15	58	0	1
TRANXIT @ 1.0 oz./Acre + 2x -N-fert. w/ surf. @ .25 % v/v		1	19	50	0	1
TRIFLOXY @ 5.33 grams./Acre + 1x -N-fert. w/ surf. @ .25 % v/v		5	18	55	11	1
TRIFLOXY @ 5.33 grams./Acre + 2x -N-fert. w/ surf. @ .25 % v/v		4	25	50	4	1
KERB @ 1.0 lb./Acre + 1x nitrogen fert.		1	6	34	14	4
KERB @ 1.0 lb./Acre + 2x nitrogen fert.		1	13	39	13	6
UTC + 1x nitrogen fert.		4	16	59	18	1
UTC + 2x nitrogen fert.		6	23	61	16	1
Late Application						
Test Mean		3	16	50	10	3
LSD		6	ns	ns	ns	ns
Combined Test Mean	18	22	22	33	8	3
LSD	25	14	20	32	ns	ns

[TABLE 4]	color	color	color	color	color	color	color
REVOLVER Common Bermuda - U/A Mens Baseball Field, Spring 2003	12-May-03	24-May-03	30-May-03	6-Jun-03	24-Jun-03	17-Jul-03	4-Aug-03
Treatments Applied May 3rd	7 DAT/1	21 DAT/1	27 DAT/1	35 DAT/1	53 DAT/1	73 DAT/1	100 DAT/1
REVOLVER @ 0.2 fluid oz./1000 ft2 + 1x nitrogen fert.	5.8	5.5	5.0	4.3	6.0	6.3	6.3
REVOLVER @ 0.2 fluid oz./1000 ft2 + 2x nitrogen fert.	5.8	5.5	4.8	4.3	5.5	6.0	6.5
REVOLVER @ 0.4 fluid oz./1000 ft2 + 1x nitrogen fert.	5.0	5.0	3.3	3.3	4.8	6.8	6.3
REVOLVER @ 0.4 fluid oz./1000 ft2 + 2x nitrogen fert.	5.0	5.0	2.5	2.8	5.0	6.0	6.3
MANOR @ 0.4 oz./acre + 1x -N- fert. w/ surf. @ .25 % v/v	5.3	4.8	5.3	5.3	6.8	6.0	7.0
MANOR @ 0.4 oz./acre ft2 + 2x -N- fert. w/ surf. @ .25 % v/v	5.3	4.5	5.0	5.5	6.8	6.5	7.0
TRANXIT @ 1.0 oz./Acre + 1x -N-fert. w/ surf. @ .25 % v/v	5.0	3.8	3.0	3.0	5.0	6.3	6.3
TRANXIT @ 1.0 oz./Acre + 2x -N-fert. w/ surf. @ .25 % v/v	5.0	3.8	2.3	2.5	6.0	6.0	6.5
TRIFLOXY @ 5.33 grams./Acre + 1x -N-fert. w/ surf. @ .25 % v/v	5.3	4.8	4.5	4.8	5.5	5.8	5.8
TRIFLOXY @ 5.33 grams./Acre + 2x -N-fert. w/ surf. @ .25 % v/v	5.3	4.5	4.0	3.8	5.3	6.5	5.8
KERB @ 1.0 lb./Acre + 1x nitrogen fert.	7.5	6.8	6.3	6.8	6.5	5.5	6.0
KERB @ 1.0 lb./Acre + 2x nitrogen fert.	7.5	6.8	6.0	6.8	6.5	6.0	6.0
UTC + 1x nitrogen fert.	8.0	7.8	6.8	6.8	7.0	5.8	6.8
UTC + 2x nitrogen fert.	8.0	7.8	7.3	6.3	6.5	5.8	7.3
Early Application							
Test Mean	6.0	5.4	4.7	4.7	5.9	6.1	6.4
LSD	0.9	1.2	0.9	1.4	1.6	ns	ns
Treatments Applied May 23rd			7 DAT/2	14 DAT/2	32 DAT/2	56 DAT/2	80 DAT/2
REVOLVER @ 0.2 fluid oz./1000 ft2 + 1x nitrogen fert.	.	.	6.3	5.8	4.5	5.5	6.5
REVOLVER @ 0.2 fluid oz./1000 ft2 + 2x nitrogen fert.	.	.	5.8	5.3	3.3	4.5	7.3
REVOLVER @ 0.4 fluid oz./1000 ft2 + 1x nitrogen fert.	.	.	4.8	4.3	4.0	6.0	6.5
REVOLVER @ 0.4 fluid oz./1000 ft2 + 2x nitrogen fert.	.	.	4.8	3.8	3.3	5.8	6.8
MANOR @ 0.4 oz./acre + 1x -N- fert. w/ surf. @ .25 % v/v	.	.	6.5	5.8	5.3	5.3	6.3
MANOR @ 0.4 oz./acre ft2 + 2x -N- fert. w/ surf. @ .25 % v/v	.	.	6.3	5.8	5.3	5.8	6.3
TRANXIT @ 1.0 oz./Acre + 1x -N-fert. w/ surf. @ .25 % v/v	.	.	5.5	4.8	2.8	5.0	6.0
TRANXIT @ 1.0 oz./Acre + 2x -N-fert. w/ surf. @ .25 % v/v	.	.	4.8	4.5	2.8	5.0	5.8
TRIFLOXY @ 5.33 grams./Acre + 1x -N-fert. w/ surf. @ .25 % v/v	.	.	6.0	4.8	3.3	5.5	6.8
TRIFLOXY @ 5.33 grams./Acre + 2x -N-fert. w/ surf. @ .25 % v/v	.	.	5.0	4.0	3.5	6.0	6.5
KERB @ 1.0 lb./Acre + 1x nitrogen fert.	.	.	6.8	5.8	4.8	5.5	6.3
KERB @ 1.0 lb./Acre + 2x nitrogen fert.	.	.	6.8	5.3	4.0	5.8	6.0
UTC + 1x nitrogen fert.	.	.	5.8	5.0	3.8	5.8	6.8
UTC + 2x nitrogen fert.	.	.	5.5	4.5	3.0	5.8	7.0
Late Application							
Test Mean	.	.	5.7	4.9	3.8	5.5	6.5
LSD			1.4	1.4	ns	ns	0.9
Combined Test Mean	6.0	5.4	5.2	4.8	4.9	5.8	6.4
LSD	0.9	1.2	1.1	1.4	1.9	1.5	1.2

[TABLE 5] REVOLVER Common Bermuda - U/A Mens Baseball Field, Spring 2003 **Treatments Applied May 3rd**	quality 12-May-03 7 DAT/1	quality 24-May-03 21 DAT/1	quality 30-May-03 27 DAT/1	quality 6-Jun-03 35 DAT/1	quality 24-Jun-03 53 DAT/1	quality 17-Jul-03 73 DAT/1	quality 4-Aug-03 100 DAT/1
REVOLVER @ 0.2 fluid oz./1000 ft2 + 1x nitrogen fert.	5.8	4.8	4.3	4.3	5.3	6.0	6.3
REVOLVER @ 0.2 fluid oz./1000 ft2 + 2x nitrogen fert.	5.8	4.8	4.3	4.3	5.3	6.8	6.5
REVOLVER @ 0.4 fluid oz./1000 ft2 + 1x nitrogen fert.	5.8	4.3	3.3	3.0	4.5	6.0	5.8
REVOLVER @ 0.4 fluid oz./1000 ft2 + 2x nitrogen fert.	5.8	4.0	2.3	2.8	4.8	6.0	6.0
MANOR @ 0.4 oz./acre + 1x -N- fert. w/ surf. @ .25 % v/v	5.8	4.5	4.3	4.5	5.8	6.3	5.8
MANOR @ 0.4 oz./acre ft2 + 2x -N- fert. w/ surf. @ .25 % v/v	5.8	4.0	4.5	4.8	5.8	6.5	6.0
TRANXIT @ 1.0 oz./Acre + 1x -N-fert. w/ surf. @ .25 % v/v	5.3	4.0	3.0	3.0	4.3	6.5	5.5
TRANXIT @ 1.0 oz./Acre + 2x -N-fert. w/ surf. @ .25 % v/v	5.3	3.8	2.0	2.5	4.8	6.5	5.8
TRIFLOXY @ 5.33 grams./Acre + 1x -N-fert. w/ surf. @ .25 % v/v	5.0	4.8	4.3	5.0	5.8	6.5	5.5
TRIFLOXY @ 5.33 grams./Acre + 2x -N-fert. w/ surf. @ .25 % v/v	5.0	4.5	3.5	3.8	5.3	6.8	5.8
KERB @ 1.0 lb./Acre + 1x nitrogen fert.	7.3	6.5	6.3	6.8	6.5	5.8	6.0
KERB @ 1.0 lb./Acre + 2x nitrogen fert.	7.3	6.5	6.5	6.0	6.8	6.5	5.5
UTC + 1x nitrogen fert.	7.5	7.3	7.0	6.5	6.8	5.5	6.0
UTC + 2x nitrogen fert.	7.5	7.5	7.0	7.0	6.3	5.5	6.5
Early Application							
Test Mean	6.0	5.1	4.4	4.6	5.5	6.2	5.9
LSD	1.1	1.2	0.8	1.2	1.6	ns	ns
Treatments Applied May 23rd			7 DAT/2	14 DAT/2	32 DAT/2	56 DAT/2	80 DAT/2
REVOLVER @ 0.2 fluid oz./1000 ft2 + 1x nitrogen fert.		.	6.5	5.5	4.0	5.5	6.3
REVOLVER @ 0.2 fluid oz./1000 ft2 + 2x nitrogen fert.		.	6.5	5.3	3.0	4.8	6.5
REVOLVER @ 0.4 fluid oz./1000 ft2 + 1x nitrogen fert.		.	5.5	3.8	3.3	6.0	6.5
REVOLVER @ 0.4 fluid oz./1000 ft2 + 2x nitrogen fert.		.	5.5	3.3	2.3	5.3	6.5
MANOR @ 0.4 oz./acre + 1x -N- fert. w/ surf. @ .25 % v/v		.	6.8	5.8	5.0	5.3	6.5
MANOR @ 0.4 oz./acre ft2 + 2x -N- fert. w/ surf. @ .25 % v/v		.	6.5	5.8	4.5	5.3	6.5
TRANXIT @ 1.0 oz./Acre + 1x -N-fert. w/ surf. @ .25 % v/v		.	5.5	4.5	3.3	5.3	6.3
TRANXIT @ 1.0 oz./Acre + 2x -N-fert. w/ surf. @ .25 % v/v		.	5.0	3.5	3.3	5.0	6.3
TRIFLOXY @ 5.33 grams./Acre + 1x -N-fert. w/ surf. @ .25 % v/v		.	6.0	4.5	3.3	5.5	6.5
TRIFLOXY @ 5.33 grams./Acre + 2x -N-fert. w/ surf. @ .25 % v/v		.	5.8	3.5	3.3	6.5	6.5
KERB @ 1.0 lb./Acre + 1x nitrogen fert.		.	6.5	5.5	4.3	5.5	6.5
KERB @ 1.0 lb./Acre + 2x nitrogen fert.		.	6.5	5.3	4.0	5.5	6.0
UTC + 1x nitrogen fert.		.	6.0	4.8	3.0	5.8	6.5
UTC + 2x nitrogen fert.		.	5.5	4.0	3.0	6.0	7.0
Late Application							
Test Mean		.	6.0	4.6	3.5	5.5	6.4
LSD			1.3	1.9	ns	ns	ns
Combined Test Mean	6	5.1	5.2	4.6	4.5	5.9	6.2
LSD	1.1	1.2	1.1	1.6	2.0	1.5	1.1

TABLE 6. Percent plot bermudagrass after herbicide treatments, 2004, Sancet Ball Field, University of Arizona.

Treatment	%berm 5/10/04	%berm 5/18/04	%berm 5/26/04	%berm 6/3/04	%berm 6/18/04	%berm 6/28/04	%berm 7/9/04	%berm 7/16/04
Applied May 4, 2004								
days after treatment ---->	6	14	22	30	45	55	66	73
Revolver@0.2 oz./M	16.3	31.3	60.0	68.8	97.0	99.3	97.8	94.3
Revolver@0.2 oz./M+fert	16.3	32.5	52.5	62.5	97.8	100.0	96.5	93.5
Revolver@0.4 oz./M	9.5	37.5	46.3	75.0	97.3	99.5	99.5	96.5
Revolver@0.4 oz./M+fert	9.5	23.8	53.8	73.8	97.5	100.0	99.0	98.5
Manor@0.4 oz./A+surfactant	12.5	27.5	18.8	65.0	94.5	99.0	95.3	95.3
Manor@0.4 oz./A+surfactant+fert	12.5	23.8	30.0	72.5	93.0	98.3	92.8	96.0
TranXit@1.0 oz./A+surfactant	8.8	23.8	42.5	72.5	97.0	100.0	97.3	96.5
TranXit@1.0 oz./A+surfactant+fert	8.8	21.3	33.8	66.3	97.8	100.0	98.5	96.5
Monument@5.33 gms/A+surfactant	11.3	23.8	38.8	51.3	94.5	98.8	92.0	94.5
Monument@5.33 gms/A+surfactant+fert	11.3	25.0	30.0	42.5	93.8	99.5	93.8	95.0
Kerb@1.0 lb./A	5.3	17.5	18.8	41.3	76.3	95.0	82.3	91.3
Kerb@1.0 lb./A+fert	5.3	22.5	16.3	41.3	83.8	96.5	85.0	93.3
Non-treated Control	7.0	15.0	13.8	28.8	63.8	85.8	81.3	75.0
Non-treated Control+fert	7.0	16.3	16.3	36.3	65.0	87.5	86.3	80.0
Test Mean	10.1	24.4	33.7	57.0	89.2	97.1	92.6	92.6
LSD	*7.2*	*ns*	*24.6*	*27.2*	*19.8*	*9.1*	*ns*	*9.0*
Applied May 27, 2004								
days after treatment ---->				7	22	32	43	50
Revolver@0.2 oz./M	.	9.5	.	41.3	75.0	86.3	90.8	95.3
Revolver@0.2 oz./M+fert	.	9.5	.	50.0	75.0	84.0	91.8	97.5
Revolver@0.4 oz./M	.	15.0	.	45.0	76.3	96.0	95.5	95.5
Revolver@0.4 oz./M+fert	.	15.0	.	48.8	78.8	93.3	95.8	96.0
Manor@0.4 oz./A+surfactant	.	8.8	.	47.5	52.5	87.0	92.8	97.3
Manor@0.4 oz./A+surfactant+fert	.	8.8	.	41.3	62.5	80.8	89.8	94.5
TranXit@1.0 oz./A+surfactant	.	10.8	.	35.0	47.5	57.5	82.5	93.8
TranXit@1.0 oz./A+surfactant+fert	.	10.8	.	32.5	49.3	65.3	81.3	92.5
Monument@5.33 gms/A+surfactant	.	12.0	.	43.8	57.5	64.5	77.8	96.0
Monument@5.33 gms/A+surfactant+fert	.	12.0	.	40.0	61.3	65.8	82.0	92.5
Kerb@1.0 lb./A	.	11.3	.	32.5	42.5	68.3	80.5	91.3
Kerb@1.0 lb./A+fert	.	11.3	.	35.0	48.8	70.0	80.0	92.5
Non-treated Control	.	8.3	.	20.0	32.5	48.8	62.5	65.0
Non-treated Control+fert	.	8.3	.	25.0	38.8	48.3	58.8	68.8
Test Mean		10.8		38.4	57.0	72.5	83.0	90.6
LSD		*ns*		*20.8*	*26.0*	*31.7*	*16.9*	*11.2*

TABLE 7. Percent plot ryegrass after herbicide treatments, 2004, Sancet Ball Field, University of Arizona.

	Treatment	%rye 5/18/04	%rye 5/26/04	%rye 6/3/04	%rye 6/18/04	%rye 6/28/04	%rye 7/9/04	%rye 7/16/04
	days after treatment ---->	14	22	30	45	55	66	73
Applied May 4, 2004	Revolver@0.2 oz./M	22.5	11.3	22.5	2.3	0.8	2.3	1.8
	Revolver@0.2 oz./M+fert	26.3	16.3	21.3	2.3	0.0	2.5	2.0
	Revolver@0.4 oz./M	33.8	15.0	11.3	1.5	0.0	0.5	2.5
	Revolver@0.4 oz./M+fert	17.5	12.5	8.8	2.3	0.0	1.0	0.3
	Manor@0.4 oz./A+surfactant	35.0	73.8	32.5	5.5	0.0	3.0	1.5
	Manor@0.4 oz./A+surfactant+fert	16.3	53.8	22.5	7.0	0.8	5.5	1.3
	TranXit@1.0 oz./A+surfactant	45.0	7.5	3.8	1.0	0.0	1.0	1.3
	TranXit@1.0 oz./A+surfactant+fert	20.0	7.5	5.0	0.5	0.0	1.0	0.0
	Monument@5.33 gms/A+surfactant	20.0	13.8	18.0	1.8	0.8	6.3	1.3
	Monument@5.33 gms/A+surfactant+fert	28.8	11.8	11.3	1.3	0.0	2.5	2.0
	Kerb@1.0 lb./A	78.8	75.0	57.5	23.3	2.5	13.5	4.3
	Kerb@1.0 lb./A+fert	70.0	57.5	53.8	14.8	1.8	10.5	0.5
	Non-treated Control	85.0	85.0	70.0	36.3	10.8	15.0	4.5
	Non-treated Control+fert	80.0	82.5	63.8	34.5	11.3	11.3	1.8
Test Mean		41.3	37.4	28.7	9.6	2.0	5.4	1.8
LSD		*28.7*	*22.7*	*16.9*	*19.8*	*8.7*	*ns*	*3.7*
	days after treatment ---->			7	22	32	43	50
Applied May 27, 2004	Revolver@0.2 oz./M	90.5	.	57.5	8.0	8.8	7.3	0.8
	Revolver@0.2 oz./M+fert	90.5	.	47.5	8.3	8.0	6.3	0.0
	Revolver@0.4 oz./M	85.0	.	55.0	6.8	1.3	2.0	0.3
	Revolver@0.4 oz./M+fert	85.0	.	48.8	3.8	2.5	1.8	0.8
	Manor@0.4 oz./A+surfactant	91.3	.	51.3	28.0	6.8	6.0	0.5
	Manor@0.4 oz./A+surfactant+fert	91.3	.	57.5	13.0	9.3	7.3	1.8
	TranXit@1.0 oz./A+surfactant	89.3	.	63.8	9.5	11.3	6.3	1.3
	TranXit@1.0 oz./A+surfactant+fert	89.3	.	65.0	13.8	7.0	8.8	2.0
	Monument@5.33 gms/A+surfactant	88.0	.	52.5	22.5	16.3	14.3	1.3
	Monument@5.33 gms/A+surfactant+fert	88.0	.	58.8	16.3	11.8	11.8	2.0
	Kerb@1.0 lb./A	88.8	.	67.5	56.3	28.0	17.0	3.3
	Kerb@1.0 lb./A+fert	88.8	.	65.0	50.0	25.0	17.5	2.8
	Non-treated Control	91.8	.	80.0	66.3	45.0	30.0	11.8
	Non-treated Control+fert	91.8	.	75.0	61.3	43.0	33.8	15.5
Test Mean		89.2		60.4	26.0	16.0	12.1	3.1
LSD		*ns*		*21.2*	*16.9*	*23.5*	*13.4*	*4.7*

TABLE 8. Percent plot straw / bare ground after herbicide treatments, 2004, Sancet Ball Field, University of Arizona.

Treatment	%straw 5/18/04	%straw 5/26/04	%bare 5/26/04	%straw 6/3/04	%bare 6/3/04	%straw 6/18/04	%straw 6/28/04	%straw 7/9/04	%straw 7/16/04
Applied May 4, 2004									
days after treatment ---->	14	22	22	30	30	45	55	66	73
Revolver@0.2 oz./M	46.3	23.8	5.0	5.0	3.8	0.8	0.0	0.0	4.0
Revolver@0.2 oz./M+fert	41.3	31.3	0.0	6.3	10.0	0.0	0.0	1.0	4.5
Revolver@0.4 oz./M	28.8	36.3	2.5	2.5	11.3	1.3	0.5	0.0	1.0
Revolver@0.4 oz./M+fert	58.8	32.5	1.3	1.3	16.3	0.3	0.0	0.0	1.3
Manor@0.4 oz./A+surfactant	37.5	7.5	0.0	1.3	1.3	0.0	1.0	1.8	3.3
Manor@0.4 oz./A+surfactant+fert	60.0	7.5	8.8	2.0	3.0	0.0	1.0	1.8	2.8
TranXit@1.0 oz./A+surfactant	31.3	48.8	1.3	1.3	22.5	2.0	0.0	1.8	2.3
TranXit@1.0 oz./A+surfactant+fert	58.8	56.3	2.5	2.5	26.3	1.8	0.0	0.5	3.5
Monument@5.33 gms/A+surfactant	56.3	47.5	0.0	5.0	25.8	3.8	0.5	1.8	4.3
Monument@5.33 gms/A+surfactant+fert	46.3	58.3	0.0	0.0	46.3	5.0	0.5	3.8	3.0
Kerb@1.0 lb./A	3.8	6.3	0.0	0.0	1.3	0.5	2.5	4.3	4.5
Kerb@1.0 lb./A+fert	7.5	5.0	21.3	2.5	2.5	1.5	1.8	4.5	6.3
Non-treated Control	0.0	1.3	0.0	0.0	1.3	0.0	3.5	3.8	20.5
Non-treated Control+fert	3.8	1.3	0.0	0.0	0.0	0.5	1.3	2.5	18.3
Test Mean	34.3	25.9	3.0	2.1	12.2	1.2	0.9	1.9	5.7
LSD	*25.3*	*21.6*	*17.7*	*ns*	*19.2*	*3.0*	*1.7*	*ns*	*9.1*
Applied May 27, 2004									
days after treatment ---->				7	7	22	32	43	50
Revolver@0.2 oz./M	0.0	.	.	0.0	1.3	17.0	5.0	2.0	4.0
Revolver@0.2 oz./M+fert	0.0	.	.	0.0	2.5	16.8	8.0	2.0	2.5
Revolver@0.4 oz./M	0.0	.	.	0.0	0.0	17.0	2.8	2.5	4.3
Revolver@0.4 oz./M+fert	0.0	.	.	1.3	1.3	17.5	4.3	2.5	3.3
Manor@0.4 oz./A+surfactant	0.0	.	.	1.3	0.0	19.5	6.3	1.3	2.3
Manor@0.4 oz./A+surfactant+fert	0.0	.	.	1.3	0.0	24.5	10.0	3.0	3.8
TranXit@1.0 oz./A+surfactant	0.0	.	.	0.0	1.3	43.0	31.3	11.3	5.0
TranXit@1.0 oz./A+surfactant+fert	0.0	.	.	0.0	2.5	37.0	27.8	10.0	5.5
Monument@5.33 gms/A+surfactant	0.0	.	.	1.3	2.5	20.0	19.3	8.0	2.8
Monument@5.33 gms/A+surfactant+fert	0.0	.	.	0.0	1.3	22.5	22.5	6.3	5.5
Kerb@1.0 lb./A	0.0	.	.	0.0	0.0	1.3	3.8	2.5	5.5
Kerb@1.0 lb./A+fert	0.0	.	.	0.0	0.0	1.3	5.0	2.5	4.8
Non-treated Control	0.0	.	.	0.0	0.0	1.3	6.3	7.5	23.3
Non-treated Control+fert	0.0	.	.	0.0	0.0	0.0	8.8	7.5	15.8
Test Mean	0.0			0.4	0.9	17.0	11.5	4.9	6.3
LSD	*ns*			*ns*	*ns*	*18.6*	*20.9*	*6.7*	*8.7*

TABLE 9. Turfgrass color after herbicide treatments, 2004, Sancet Ball Field, University of Arizona.

Treatment	color 5/10/04	color 5/18/04	color 5/26/04	color 6/3/04	color 6/18/04	color 6/28/04	color 7/9/04	color 7/16/04
days after treatment ——>	6	14	22	30	45	55	66	73
Applied May 4, 2004								
Revolver@0.2 oz./M	6.0	5.8	5.5	6.0	7.3	6.0	7.0	5.5
Revolver@0.2 oz./M+fert	6.0	4.8	5.3	5.5	7.3	6.8	7.3	5.8
Revolver@0.4 oz./M	6.5	5.0	5.0	5.3	6.8	7.0	6.5	6.3
Revolver@0.4 oz./M+fert	6.5	5.5	4.8	5.5	7.0	6.8	7.0	6.8
Manor@0.4 oz./A+surfactant	6.5	6.0	6.8	6.5	7.0	6.5	6.3	6.3
Manor@0.4 oz./A+surfactant+fert	6.5	5.8	6.5	7.3	6.8	6.8	6.5	6.3
TranXit@1.0 oz./A+surfactant	5.8	5.8	5.3	4.8	6.5	7.0	6.8	5.8
TranXit@1.0 oz./A+surfactant+fert	5.8	5.3	4.5	5.5	7.0	7.0	7.3	6.5
Monument@5.33 gms/A+surfactant	5.8	5.5	4.5	4.8	5.8	7.5	7.0	6.0
Monument@5.33 gms/A+surfactant+fert	5.8	5.3	4.0	4.3	6.0	7.8	7.3	6.3
Kerb@1.0 lb./A	8.0	7.8	7.0	7.8	7.0	6.5	7.3	7.5
Kerb@1.0 lb./A+fert	8.0	7.3	7.0	7.8	7.3	7.3	7.0	7.3
Non-treated Control	7.5	8.3	8.0	7.8	5.8	6.0	6.5	6.0
Non-treated Control+fert	7.5	8.0	8.0	7.8	5.8	5.5	6.5	5.8
Test Mean	6.6	6.1	5.9	6.2	6.6	6.7	6.9	6.3
LSD	*0.7*	*1.2*	*1.2*	*1.2*	*ns*	*1.0*	*ns*	*1.3*
days after treatment ——>				7	22	32	43	50
Applied May 27, 2004								
Revolver@0.2 oz./M	.	.	.	6.0	4.8	6.5	7.0	5.8
Revolver@0.2 oz./M+fert	.	.	.	6.5	4.8	7.0	7.0	6.3
Revolver@0.4 oz./M	.	.	.	6.0	5.0	6.5	6.3	5.8
Revolver@0.4 oz./M+fert	.	.	.	6.0	5.0	6.8	6.3	5.8
Manor@0.4 oz./A+surfactant	.	.	.	6.5	5.3	7.0	6.5	6.0
Manor@0.4 oz./A+surfactant+fert	.	.	.	6.8	5.3	7.3	7.0	6.3
TranXit@1.0 oz./A+surfactant	.	.	.	6.3	4.0	5.0	5.5	5.8
TranXit@1.0 oz./A+surfactant+fert	.	.	.	6.5	4.3	5.0	6.3	6.0
Monument@5.33 gms/A+surfactant	.	.	.	6.0	4.3	5.8	5.8	5.8
Monument@5.33 gms/A+surfactant+fert	.	.	.	6.0	4.8	5.8	6.3	6.3
Kerb@1.0 lb./A	.	.	.	8.0	6.8	6.0	6.3	6.5
Kerb@1.0 lb./A+fert	.	.	.	8.0	6.8	6.0	6.3	6.5
Non-treated Control	.	.	.	8.5	7.0	5.8	5.5	4.8
Non-treated Control+fert	.	.	.	8.5	7.0	5.8	5.8	5.3
Test Mean				6.8	5.3	6.1	6.3	5.9
LSD				*0.8*	*1.3*	*1.6*	*1.1*	*1.4*

TABLE 10. Turfgrass quality after herbicide treatments, 2004, Sancet Ball Field, University of Arizona.

	Treatment	quality 5/10/04	quality 5/18/04	quality 5/26/04	quality 6/3/04	quality 6/18/04	quality 6/28/04	quality 7/16/04
	days after treatment ------>	6	14	22	30	45	55	73
Applied May 4, 2004	Revolver@0.2 oz./M	6.5	5.5	5.5	5.8	5.3	6.8	6.5
	Revolver@0.2 oz./M+fert	6.5	5.0	5.0	5.5	6.5	6.5	6.0
	Revolver@0.4 oz./M	6.5	5.0	5.0	5.0	7.0	8.3	7.0
	Revolver@0.4 oz./M+fert	6.5	5.0	5.3	5.5	7.3	8.3	7.5
	Manor@0.4 oz./A+surfactant	6.5	5.3	6.8	7.3	7.3	7.0	7.0
	Manor@0.4 oz./A+surfactant+fert	6.5	5.8	6.8	7.0	7.3	7.3	7.0
	TranXit@1.0 oz./A+surfactant	6.0	5.3	5.0	4.8	6.3	6.5	7.0
	TranXit@1.0 oz./A+surfactant+fert	6.0	4.8	4.3	4.5	6.8	7.0	7.0
	Monument@5.33 gms/A+surfactant	6.8	5.0	4.5	4.0	5.5	6.8	6.5
	Monument@5.33 gms/A+surfactant+fert	6.8	5.0	4.0	3.5	5.8	7.0	7.3
	Kerb@1.0 lb./A	7.3	7.8	7.5	7.8	7.3	6.8	7.3
	Kerb@1.0 lb./A+fert	7.3	7.5	7.0	7.5	6.5	6.8	6.5
	Non-treated Control	7.5	7.8	8.0	8.5	6.3	6.0	5.3
	Non-treated Control+fert	7.5	7.8	8.0	8.3	6.5	5.8	5.5
Test Mean		6.7	5.9	5.9	6.1	6.5	6.9	6.7
LSD		*0.8*	*1.2*	*1.3*	*1.5*	*1.2*	*0.9*	*1.1*
	days after treatment ------>				7	22	32	50
Applied May 27, 2004	Revolver@0.2 oz./M	.	.	.	6.5	5.0	6.3	6.3
	Revolver@0.2 oz./M+fert	.	.	.	6.5	5.0	6.5	6.0
	Revolver@0.4 oz./M	.	.	.	6.8	4.3	6.3	6.8
	Revolver@0.4 oz./M+fert	.	.	.	6.8	4.5	6.3	6.8
	Manor@0.4 oz./A+surfactant	.	.	.	7.3	5.5	6.5	7.5
	Manor@0.4 oz./A+surfactant+fert	.	.	.	6.8	5.0	6.5	6.5
	TranXit@1.0 oz./A+surfactant	.	.	.	6.5	3.8	4.8	6.0
	TranXit@1.0 oz./A+surfactant+fert	.	.	.	6.5	5.0	4.8	6.3
	Monument@5.33 gms/A+surfactant	.	.	.	6.0	4.8	5.3	6.5
	Monument@5.33 gms/A+surfactant+fert	.	.	.	5.8	5.0	4.8	6.3
	Kerb@1.0 lb./A	.	.	.	8.0	7.3	6.8	6.8
	Kerb@1.0 lb./A+fert	.	.	.	8.5	7.3	6.5	6.5
	Non-treated Control	.	.	.	8.3	7.3	6.3	5.0
	Non-treated Control+fert	.	.	.	8.5	7.3	5.8	5.3
Test Mean					7.0	5.5	5.9	6.3
LSD					*1.0*	*1.6*	*ns*	*1.3*