Perennial Ryegrass Transition Using Selected Herbicides.

2006 Field Trial.

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ABSTRACT :

Thirteen herbicide treatments were applied on May 8, 2006, on a golf course fairway to assess transition and turf quality effects. Initial injury to perennial ryegrass was most extreme for Tranxit GTA when applied at 1.0 oz/prod/acre and Katana applied at 2.0 oz/prod/acre. Katana resulted in the total elimination of ryegrass and resulted in a fully necrotic canopy (straw cover) within two weeks after application to July 19, 2006 (72 Days after treatment). The development and persistence of necrotic leaf tissue of perennial ryegrass (straw) had the greatest impact on decreasing overall turfgrass quality ratings. No treatment went through the summer without some loss of quality at some point, including the untreated control. Certainty had little or no effect on transition when applied once at the rate of 1.25 oz/prod/acre. Surflan was not effective in ryegrass transition. The tank mix of Transit and nicosulfuron applied at the rate of 0.25 oz/prod./A each, produced an enhanced transition with nominal quality. In similar fashion, Monument applied at 0.35 oz./A produced an enhanced transition with nominal quality. A rates used in this test, other treatments had either too slow of a transition or had poor and extended low quality turf scores from rapid development of dead ryegrass (straw) and subsequent slow bermudagrass re-establishment. The UTC turf maintained a high percentage of living green ryegrass into the summer and 20% live ryegrass on August 8, 2006 which is roughly six weeks before the next overseeding.

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 periods of frequent turf use. 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 re-growth.

Spring transition is now one of the top three issues facing turf managers 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 five or so 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 compounds 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 would have 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.

Materials and Methods

A mature stand of 'Tifway' Bermudagrass with an intermixed stand of common and Tifway along the south edge of fairway #5 at Tucson Country Club served as the sight for this transition trial. A perennial ryegrass overseed acre ("Sonoran Blend") was established at 600-650 lb.s per 1000 ft2. The components of the blend were equal amounts of Brighstar SLT, Salinas, and Citation Fore. The turfgrass was maintained at a fairway height of ¾" a for the first two weeks after opening and then lowered to 5/8" until mid December 2006. On January 2, 2006, the fairway was lowered to ½" which remained so until the height was dropped to 7/16" in late June. The turf was fertilized with quick release N sources at the rate of 5/8 lb./N/ 1000 ft^2 per month from October to May. At the end of May, 1.5 lbs./N/M/ 1000 ft was applied from a slow release fertilizer along with ½ lb. /N/M/1000 ft biweekly from fertigation (27-0-0). All additional management practices (i.e., irrigation, aeration and fertilization) were consistent with high quality golf course fairways. Thirteen transition aid herbicide treatments plus a non-treated control (Table 1) were applied once on May 8, 2006. All treatments were applied via 3-nozzle hand held boom equipped with Teejet 8004 nozzles at 28 psi delivering 63 gpa. Treatments 1-10 also received a 0.25% v/v nonionic surfactant.

Individual experimental units were 5' wide by 11' long arranged in a randomized complete block design with four replications (56 plots total). Data collection consisted of visual estimates for turfgrass color (5 dates), quality (7 dates), degree and percent injury (2 dates), uniformity (2 dates), and canopy composition (percent living rye, bermuda and straw) (6dates). Percent 'rye control' was calculated as (1-(trt/control)) * 100, which compares the rate of rye loss between treated and the non-treated control plots.

For all qualitative data (except degree injury), the National Turfgrass Evaluation Program (NTEP) scale of 1-9 was utilized. Values of 5 are considered marginal while values of 6.0 or more are considered fully acceptable for fairway quality turfgrass (9 being the most desirable). For the degree of injury, a 1-6 scale was used with 1 being the least and 6 being the most (severely) injured. Data were subjected to analysis of variance technique and Duncan's Multiple range test was used for means separation when the treatment mean squares F value was significant at P=0.05, or less. Orthogonal polynomial contrast were utilized to test the effects of the herbicide 'TranXit' alone versus the tank mix with 'Nicosulfuron' and 'TranXit' alone, or in combination with Nicosulfuron compared to all other tested transition aids. Contrasts results are noted only as text when applicable in the results.

Results

Color:

Color scores in this study were used as a visual indicator of turfgrass response to applied herbicides. Turfgrass color was significantly effected by applied herbicides on 3 of 5 rating dates (Table 2). All three dates where color was significantly different between treatments occurred within the first month after initial application. In all three cases, ryegrass receiving 'Katana' showed the lowest scores, with a differential decrease of 4, 6 and 5.8 in color compared to UTC, at 7, 15 and 28 DAT, respectively (Table 2). Katana treated turfgrass also showed the greatest degree and percent ryegrass injury on both 7 DAT (May 15) and 15 DAT (May 23) (Table 3).

The color scores declined throughout the study. At 28 DAT (June 5) the ryegrass showed the lowest average (test mean) color of 4.9. Color improved slightly by 56 DAT (July 3) and treatments were non-significantly different from one another with an average of 5.2. (Table 3). At 92 DAT (Aug 8) there was a slight improvement in overall color (test mean Aug 5.6) which may be attributed to an increase in the percent bermudagrass (from some treatments) present in the canopy.(Table 4).Visible straw in the canopy composition also effected the overall plot color score and therefore contributes to color differences between treatments (Table 5). Increases in straw (dead or dying ryegrass), lowered overall color scores during the first month following treatment application.

Not until mid-June was there significant Bermudagrass growth to offset the forced ryegrass senescence (Table 4). Again the rapid loss of ryegrass caused by 'Katana' resulted in a greater percentage of straw compared to other treatments and resulted in lowered overall color (and subsequent quality) scores.

In general, all herbicides tested resulted in a decrease in color with lowest average color apparent 28 DAT (June 5) (test mean 4.9). Exceptions to this general trend were observed with TranXit at 0.25 and 0.50 oz. and Manor, both applied alone and which showed there lowest color at 15 DAT (May 23). Although non-significant, decreases in color were observed for TranXit at 0.25 oz., Manor, Corsair, Kerb, Surflan, as well as the UTC at 56 DAT (July 3) compared to observations made 28 DAT (June 5). Again, this trend may be explained by increases in visual straw (Table 5). The general decline in color continued for TranXit (both rates tested), and also for Certainty and the UTC from 56 DAT (July 3) till the conclusion of the test on Aug 8 (92 DAT). Decreases in color observed from 56 DAT (July 3) to 92 DAT (August 8) corresponded to the percent of visual straw and/or the lack of Bermudagrass cover (Table 4).

TranXit applied in combination with nicosulfuron lowered color scores by an average of ~ 0.3 to 0.8 points during the first 28 days following application compared to TranXit applied alone (data not shown). As a group ryegrass receiving TranXit applied alone or in a tank mix with nicosulfuron had overall lower average color scores than the other herbicides tested from 15 DAT (May 23)to 28 DAT (June 5) (data not shown).

Injury:

Injury scores were assigned early on to assess the amount and degree of injusry which occurred before full senescence (dead ryegrass=straw) took place. Degree and percent ryegrass injury increased from 7 DAT (May 15) to 15 DAT (May 23) for TranXit at 0.5 oz., while only the degree injury increased for turfgrass receiving Corsair during the same period (Table 3). Percent ryegrass injury as well as degree injury actually decreased for turf receiving TranXit at 0.25 oz, alone or in the tank mix, as well as Certainty from 7 DAT (May 15) to 15 DAT (May 23) (Table 3). These two treatments had minimal effect on the ryegrass. These two treatments had more ryegrass than the UTC.

Straw:

Straw cover resulted from the dead ryegrass which appeared after application of the herbicides. Straw canopy cover amounts were extreme for Katana ranging from 34% to 81% within the first 56 days after application. Tranxit alone at th 1.0 oz./product/A had 52% straw @ 42 DAT. Surprisingly , Kerb had 45% straw cover at 42 DAT. Certainty at 72 DAT had 51% straw cover after the ryegrass eventually collapsed. Certainty had liitle effect on ryegrass and thus little effect on transition in this trial. As noted increased straw levels were the major cause of decreased turfgrass quality scores.

Quality:

Differences in turfgrass quality were significant on 3 or 7 rating dates (Table 6). All three dates where differences in quality were significant were consecutive and occurred from 15 DAT (May 23) to 42 DAT (June 19). Turfgrass quality was initially marginal for ‘Katana’ 7 DAT (May 15) with a less than acceptable score of 5.3 (Table 6). More

herbicides showed adverse effects on quality 15 DAT (May 23), with only the treatments of TranXit at 0.25 oz., Kerb, Certainty, Surflan and the UTC having turfgrass quality scores of 6.0 or greater. At 28 DAT (June 5) and 42 DAT (June 19), Kerb treatments no longer had acceptable quality while Certainty, Surflan, TranXit at 0.25 oz. and the UTC remained above acceptable.

On July 3 (56 DAT) visual quality for all treatments including the UTC were below acceptable and the treatment main effect was not significant. Overall quality did not improve until 72 DAT (July 19) as TranXit at 0.50 oz., Revolver, both TranXit/Nicosulfuron tank mix combinations and Katana treated turfgrass, all had scores equal to or greater than 6.0 (Table 6). The above treatments also had the least amount of visual straw at 72 DAT (July 19) (Table 5). Monument treated turfgrass also had very little visible straw (11%) at 72 DAT (July 19), but still had a less than acceptable quality of 5.5 (Table 6). Canopy composition (straw) on one of the four replications treated with Monument was 25% on July 19th and may have unfairly influenced the overall average quality on that date.

By the end of the test 92 DAT (Aug 8), turfgrass which received TranXit at 1.0 oz. showed an improvement in quality while the 0.5 oz. rate of TranXit declined in quality. Monument treated turfgrass also showed improvement in quality at 92 DAT (August 8) compared to observations made on July 19. Turfgrass receiving Kerb as well as the UTC also showed a decline in average quality at the end of the test compared to earlier observations made on July 19. Slow transition to a full Bermudagrass cover as well as the presence of later developing straw helped to explain changes in visual quality observed for turfgrass receiving Kerb, TranXit at 0.5 oz., and the UTC on Aug 8 (92 DAT). Comparisons of TranXit applied alone versus the TranXit/nicosulfuron tank mix showed only a slight reduction in quality (~ 0.5 points) on one date (May 23, 15 DAT). In this case the TranXit tank mix combination showed enhanced turf quality over turf receiving TranXit alone.

Percent Ryegrass control:

Ryegrass control is the amount of ryegrass reduced after the application of transition aids compared to the amount of ryegrass in the untreated control (UTC). A negative percent rye 'control' value occured when there was more ryegrass in the treated plot compared to the UTC. Thus, rye 'control' values of zero or less indicated that there was the same or lesser amount of rye in the treated turf compared to the UTC, respectively. Certainty had negative control (more ryegrass than the UTC) on 5 of 6 observation dates (Table 7, Figure 1). TranXit at 0.25 oz., Kerb, Surflan and Revolver also had one or two dates with negative ryegrass control.

The most intense and most rapid removal of ryegrass occurred with the application of Katana (Table 7, Figure 1). A more gradual transition was observed with TranXit/Nico tank mix at the 0.25 oz. rate. Only at 72 DAT (July 19) was there a decrease in 'overall rye control', but still a positive trend was observed with the 0.25 oz rates of TranXit + Nicosulfuron tank mix (Figure 1). Increasing rates of TranXit from 0.25 oz. per acre to 1.0 oz. per acre resulted in more overall ryegrass removal. Combining TranXit with Nicosulfuron improved 'rye control', with the 0.25 oz. rate giving the most steady and gradual transition. The 0.5 oz. tank mix of TranXit + Nicosulfuron showed a similar

trend to that of the 0.25 oz. TranXit + Nicosulfuron tank mix, but had slightly more, (but non-significant) ryegrass cover at the end of the test Aug 8 (Table 8). These observations were made when all plots had less than 3% ryegrass cover regardless of treatment. The Katana treatment completely removed all rye by June 19 (42 DAT) (Table 8). No other transition aid showed complete ryegrass removal until Aug 8 (92 DAT).

The rapid loss of ryegrass caused by some of the products tested did not translate into increased Bermudagrass cover for the first 42 days after initial applications. Instead, injury to the ryegrass produced more visible straw and lowered overall visual quality. Lower quality scores were again most likely due to the contrast in color between the dead/dying ryegrass and the Bermudagrass.

Overall enhancements in transition if based only on the removal of ryegrass alone were most visible at 42 DAT (June 19) (Table 8). Average ryegrass on the UTC was 81% (Table 8) while the visible Bermudagrass ranged from 7.3% (TranXit at 0.25 oz.) to 63.3% for turf treated with Katana (Table 4). By July 19 (72 DAT) differences in observed ryegrass between treatments was non-significant with most treatments at or below the UTC (Table 8). Average ryegrass observed on July 19 was 5%. All products tested, except for Certainty, resulted in enhanced ryegrass transition. Ryegrass removal (aka transition) was essentially complete by July 19 (72 DAT) (Table 8).

Transition and quality combined:

Without the use of any herbicide(s), ryegrass persisted in the canopy well into the summer. On 3 July 2006, the percent plot bermudagrass was 33% for the untreated controls, which had 55% living ryegrass plot cover. Yikes.

Treatments which quickly removed perennial ryegrass included Katana, both tank mixes of TranXit and nicosulfuron, and Revolver. These treatments did produce considerable amounts of necrotic ryegrass (%-straw) which decreased the overall quality of the turf during the first half of the transition. If early transition is desired, then some loss of quality would be expected up until mid-July from a single application of the treatments at their respective applied rates. Conversely, other treatments like TranXit applied at 0.25 oz. per acre, produced necrotic ryegrass later in the season (from early July to early August). In this case, quality scores were lower at the second half of transition than the first half of transition. Corsair produced a moderate amount of straw by June 19, which lingered on up to and including the end of the trial on August 8, 2006.

The first treatment to reach 70% bermudagrass cover was that of the tank mix of TranXit at 0.25 oz./A + nicosulfuron at 0.25 oz./A on July 3. Note that the turfgrass quality score previous to July 3 for this treatment was not acceptable. The first treatments to essentially reach 90% bermudagrass cover were Katana and the tank mix of TranXit at 0.25 oz./A + nicosulfuron at 0.25 oz./A on July 19, 2006. The quality scores of these treatments were fully acceptable by that time, noting that quality prior to July 19 was much less than acceptable, because of the ryegrass straw present.

Quality index:

Because of the vast degrees of responses to transition and in some cases straw production (big quality detractor) a quality index was devised. This index was used to determine the relative value of treatments which had quality scores greater or equal to a marginal turf quality score of 5.5 or greater , and again as a tally for those which had fully acceptable values of 6.0 or greater. These events are not mutually exclusive, and are recognized as separate events. The number of times these events occurred in each case for each treatment was added together to produce a summed index quality value. Treatments were then numerically ranked based on their index value (higher index values = better turf quality). From that point, quality can be compared with actual transition to realize treatments which perform at a suitable level in each category (quality and transition).

Given these facts, Certainty (index 9, [rank 1]) had the best quality, but had little effect on ryegrass removal which was similar to that of the untreated control (index 9, [rank1]).

Other treatments which provided some level of transition and still had generally acceptable quality turf included Surflan and TranXit alone when applied at 0.25 oz./A. Surflan did not enhance the Bermudagrass content any more than the untreated control. TranXit at 0.25 oz./A also had essentially similar percent Bermudagrass cover (or less) than that of the UTC. Both of those treatments had quality index scores of 8 [rank 2], but in essence yielded no beneficial transition.

Therefore, treatments with some increased transition and some lesser degree in loss of overall turf quality would include the tank mix of TranXit at 0.25 oz./A + nicosulfuron at 0.25 oz./A ((index 7, [rank 3]) and Monument applied at 0.35 oz./A. Both of these treatments had over 80% actual Bermudagrass cover on 19 July, and over 90% cover on 8 August. Of these two treatments, the TranXit / nicosulfuron tank mix had 97% bermudagrass cover. The TranXit / nicosulfuron tank mix (both at higher rates of 0.5 oz. product per acre) had 93% Bermudagrass at the close of the test, but it's quality index was 6 9which ranked 4th for quality index among treatments).

Therefore, the TranXit / nicosulfuron tank mix at 0.25 oz./A each, as well as Monument applied at 0.35 oz./A produced an enhanced transition with nominal quality. Other treatments had either too slow of a transition or had poor and extended low quality turf scores from rapid development of dead ryegrass (straw) and subsequent slow bermudagrass re-establishment.

When no herbicide treatments were applied, the perennial ryegrass/bermudagrass plot composition was 55% / 33% on 3 July and roughly 8%/68% by 19 July, respectively. On 8 August, percent plot Bermudagrass for untreated turf averaged 76% Bermudagrass cover, 7% ryegrass cover and a season low quality average score of 4.8.

This test demonstrated that (at rates and timing practiced here) certain chemical treatments enhance transition (with some loss of turfgrass quality), while others induce a rapid transition with abrupt and extended periods of low quality turf performance after the ryegrass died quickly (and the re-introduction of Bermudagrass was sometimes slow). Even when no chemical transition aid was applied, a period occurred where 'quality' was low for the untreated controls which never received any herbicides (8 August). Thus, no turf goes without some loss of quality during the transition phase, whether chemically or naturally induced.

Conclusions:

1. Thirteen herbicide treatments were applied on May 8 2006, on a golf course fairway to assess transition and turf quality effects.

2. Initial injury to perennial ryegrass was most extreme for Tranxit GTA when applied at 1.0 oz/prod/acre and Katana applied at 2.0 oz/prod/acre.

3. Katana resulted in the total elimination of ryegrass and resulted in a fully necrotic canopy (straw cover) from two weeks after application to July 19, 2006. (72 Days after treatment).

4. The development and persistence of necrotic leaf tissue of perennial ryegrass(straw) had the greatest impact on overall turfgrass quality ratings.

5. No treatment went through the summer without some loss of quality at some point, including the untreated control.

6. Certainty had little or no effect on transition when applied once at the rate of 1.25 oz/prod/acre.

7. Surflan was not effective in ryegrass transition.

8. The tank mix of Transit and nicosulfuron applied at the rate of 0.25 oz/prod./A each, produced an enhanced transition with nominal – to good turfgrass quality.

9. In similar fashion, Monument applied at 0.35 oz./A produced an enhanced transition with nominal – to good turfgrass quality.

10. A rates used in this test, other treatments had either too slow of a transition or had poor and extended low quality turf scores from rapid development of dead ryegrass (straw) and subsequent slow bermudagrass re-establishment.

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Table 1. Treatment sheet with plot randomization

Ryegrass Transition Spring 2006
Tucson Country Club – fwy # 5

Treatments applied once on May 8 2006.
All rates applied in" product amounts".

Plot #	Trt #	Plot #	Trt #	Plot #	Trt #	Plot #	Trt #
1	***12***	15	***3***	29	***8***	43	***10***
2	***11***	16	***6***	30	***10***	44	***12***
3	***4***	17	***2***	31	***12***	45	***1***
4	***3***	18	***11***	32	***2***	46	***6***
5	***1***	19	***4***	33	***9***	47	***5***
6	***9***	20	***12***	34	***4***	48	***11***
7	***14***	21	***5***	35	***5***	49	***2***
8	***6***	22	***1***	36	***7***	50	***8***
9	***10***	23	***8***	37	***3***	51	***9***
10	***13***	24	***9***	38	***1***	52	***14***
11	***8***	25	***14***	39	***13***	53	***3***
12	***5***	26	***7***	40	***11***	54	***13***
13	***2***	27	***10***	41	***6***	55	***4***
14	***7***	28	***13***	42	***14***	56	***7***

Treatments:

1) Rimsulfuron-25DF (DPX-E9636) 'TranXit GTA' @ 0.25 oz./A –or- 0.163 grams/M
   Plot size = 5' x 11' (4 reps)
2) Trt #1 + Nicosulfuron-75WDG (DPX-L1D57) @ 0.25 oz./A –or- 0.163 grams/M
   Application rate = 1500 ml/275 ft^2
3) Rimsulfuron-25DF (DPX-E9636) 'TranXit GTA' @ 0.50 oz./A –or- 0.325 grams/M
   w/ 3 nozzle boom w/ 8004 @ 28 psi
4) Trt #3 + Nicosulfuron-75WDG (DPX-L1D57) @ 0.50 oz./A –or- 0.325 grams/M
5) Rimsulfuron-25DF (DPX-E9636) @ 1.00 oz./A –or- 0.65 grams/M
6) Flazasulfuron-25WG 'Katana' or' Mission' @ 2.0 oz/A or 1.3 grams/M
7) Sulfosulfuron-75WDG 'Certainty' @ 1.25 oz/A –or- 0.81 grams/M
8) Trifloxysulfuron-75WG 'Monument' @ 0.35 oz./A –or- 0.23 grams/M
9) Metsulfuron-60WDG 'Manor' @ 0.50 oz/A –or- 0.33 grams/M
10) Chlorsulfuron-75DF 'Corsair' @ 1.5 oz/A –or- 0.98 grams/M
11) Pronamide-50WP 'Kerb' @ 2 lb./A –or- 20.83 grams/M
12) Oryzalin-4AS 'Surflan' @ 2 qrts/A –or- 43.4 ml/M
13) Foramsulfuron-35WDG 'Revolver' @ 17.4 oz./A –or- 11.83 grams/M
14) UTC

Note: Treatments 1-10 get 0.25 % v/v nonionic surfactant

Table 2. Visual turfgrass COLOR as effected by select transition aids.
Tucson Country Club (Fairway #5), Spring 2006.
The University of Arizona, Turfgrass Research.

	15-May	*23-May*	*5-Jun*	*3-Jul*	*8-Aug*
days after treatment, DAT	*7*	*15*	*28*	*56*	*92*
Treatments applied on May 8, 2006					
TranXit GTA @ 0.25 oz./A	6.0	5.3	6.0	5.3	4.5
TranXit GTA @ 0.25 oz./A + nicosulfuron @ 0.25 oz./A	5.5	5.5	4.8	5.3	6.0
TranXit GTA @ 0.50 oz./A	5.8	5.3	5.5	6.0	5.3
TranXit GTA @ 0.50 oz./A + nicosulfuron @ 0.50 oz./A	5.3	4.3	3.8	5.3	5.8
TranXit GTA @ 1.00 oz./A	5.5	4.5	3.5	4.8	6.0
Katana or Mission @ 2.0 oz/A	4.3	2.3	1.5	4.8	6.3
Certainty @ 1.25 oz/A	6.8	5.3	5.3	6.0	4.8
Monument @ 0.35 oz./A	5.8	5.5	4.8	5.3	5.8
Manor @ 0.50 oz/A	5.5	5.0	5.8	5.0	6.5
Corsair @ 1.5 oz/A	6.3	4.5	5.5	4.8	5.3
Kerb @ 2 lb./A	8.0	7.3	4.3	4.8	5.0
Surflan @ 2 qrts/A	8.0	7.5	7.3	4.5	5.0
Revolver @ 17.4 oz./A	5.5	4.3	3.5	5.3	6.3
UTC	8.0	8.3	7.3	5.8	5.5
test mean	6.1	5.3	4.9	5.2	5.6
LSD	0.9	1.0	1.0	ns	ns

Table 3. PERCENT PLOT INJURY & DEGREE INJURY as effected by select transition aids.
Tucson Country Club (Fairway #5), Spring 2006.
The University of Arizona, Turfgrass Research.

	15-May		*23-May*	
	%-Plot Injury	*Degree Injury*	*%-Plot Injury*	*Degree Injury*
Days after treatment, DAT	7	7	15	15
Treatments applied on May 8, 2006				
TranXit GTA @ 0.25 oz./A	32.5	2.3	7.5	2.0
TranXit GTA @ 0.25 oz./A + nicosulfuron @ 0.25 oz./A	23.8	2.5	11.3	2.0
TranXit GTA @ 0.50 oz./A	8.8	1.8	12.5	2.3
TranXit GTA @ 0.50 oz./A + nicosulfuron @ 0.50 oz./A	30.0	3.0	20.0	3.5
TranXit GTA @ 1.00 oz./A	42.5	2.5	17.5	3.0
Katana or Mission @ 2.0 oz/A	55.0	3.8	66.3	6.0
Certainty @ 1.25 oz/A	8.8	1.5	2.5	1.3
Monument @ 0.35 oz./A	10.0	2.0	15.0	2.5
Manor @ 0.50 oz/A	17.5	2.3	16.3	2.8
Corsair @ 1.5 oz/A	22.5	2.3	12.5	3.5
Kerb @ 2 lb./A	0.0	1.0	0.0	1.0
Surflan @ 2 qrts/A	0.0	1.0	0.0	1.0
Revolver @ 17.4 oz./A	18.8	2.0	25.0	2.8
UTC	0.0	1.0	2.5	1.3
test mean	19.3	2.1	14.9	2.5
LSD	23.9	1.0	12.3	1.1

Table 4. PERCENT visible BERMUDAGRASS as effected by select transition aids.
Tucson Country Club (Fairway #5), Spring 2006.
The University of Arizona, Turfgrass Research.

	23-May	*5-Jun*	*19-Jun*	*3-Jul*	*19-Jul*	*8-Aug*
Days after treatment, DAT	*15*	*28*	*42*	*56*	*72*	*92*
Treatments applied on May 8, 2006						
TranXit GTA @ 0.25 oz./A	5.5	5.3	7.3	24.8	47.5	70.0
TranXit GTA @ 0.25 oz./A + nicosulfuron @ 0.25 oz./A	19.3	26.3	43.8	71.3	88.8	97.0
TranXit GTA @ 0.50 oz./A	17.8	18.0	43.3	57.0	74.5	77.0
TranXit GTA @ 0.50 oz./A + nicosulfuron @ 0.50 oz./A	16.5	26.3	61.7	65.0	76.8	93.3
TranXit GTA @ 1.00 oz./A	9.8	18.3	30.0	55.0	67.5	87.5
Katana or Mission @ 2.0 oz/A	12.0	17.3	63.3	65.0	88.8	96.3
Certainty @ 1.25 oz/A	5.0	6.5	9.5	23.5	40.0	53.3
Monument @ 0.35 oz./A	16.3	21.3	27.5	55.0	83.8	91.5
Manor @ 0.50 oz/A	8.5	15.8	23.3	34.8	56.3	73.8
Corsair @ 1.5 oz/A	8.3	11.3	16.3	35.0	58.8	73.3
Kerb @ 2 lb./A	13.5	20.3	27.3	52.0	68.8	78.0
Surflan @ 2 qrts/A	10.0	12.5	13.0	26.8	48.0	70.3
Revolver @ 17.4 oz./A	17.0	26.5	51.0	65.3	78.8	81.0
UTC	7.5	13.3	10.0	33.5	67.5	76.3
test mean	11.9	17.0	30.5	47.4	67.5	79.9
LSD	ns	ns	24.7	ns	ns	ns

Table 5. PERCENT visible STRAW as effected by select transition aids.
Tucson Country Club (Fairway #5), Spring 2006.
The University of Arizona, Turfgrass Research.

	23-May	*5-Jun*	*19-Jun*	*3-Jul*	*19-Jul*	*8-Aug*
Days after treatment, DAT	*15*	*28*	*42*	*56*	*72*	*92*
Treatments applied on May 8, 2006						
TranXit GTA @ 0.25 oz./A	2.3	3.8	24.0	34.5	47.0	28.3
TranXit GTA @ 0.25 oz./A + nicosulfuron @ 0.25 oz./A	12.5	20.0	25.0	20.3	9.0	3.0
TranXit GTA @ 0.50 oz./A	7.0	14.5	19.3	14.3	22.3	21.5
TranXit GTA @ 0.50 oz./A + nicosulfuron @ 0.50 oz./A	17.5	47.5	26.7	26.3	20.3	6.5
TranXit GTA @ 1.00 oz./A	20.0	28.8	51.7	32.0	30.0	12.3
Katana or Mission @ 2.0 oz/A	73.8	80.5	36.7	34.3	11.3	3.8
Certainty @ 1.25 oz/A	1.5	2.8	15.5	17.8	51.3	44.5
Monument @ 0.35 oz./A	7.5	16.3	30.0	11.3	10.8	8.0
Manor @ 0.50 oz/A	12.0	15.0	28.3	35.3	36.3	25.8
Corsair @ 1.5 oz/A	9.8	15.0	32.5	25.0	33.8	26.0
Kerb @ 2 lb./A	1.3	31.3	45.3	34.8	25.0	20.3
Surflan @ 2 qrts/A	1.0	0.0	9.5	28.3	46.5	28.5
Revolver @ 17.4 oz./A	16.3	42.5	37.8	23.5	16.0	18.3
UTC	1.0	2.5	8.8	11.5	25.0	22.8
test mean	13.1	22.9	27.9	24.9	27.4	19.2
LSD	7.6	14.5	24.8	ns	ns	ns

Table 6. Visual turfgrass QUALITY as effected by select transition aids.

Tucson Country Club (Fairway #5), Spring 2006.

The University of Arizona, Turfgrass Research.

	15-May	*23-May*	*5-Jun*	*19-Jun*	*3-Jul*	*19-Jul*	*8-Aug*	*frequency > 5.5*	*frequency > 6.0*	*sum of indexes*	*rank*
Days after treatment, DAT	*7*	*15*	*28*	*42*	*56*	*72*	*92*				
Treatments applied on May 8, 2006											
TranXit GTA @ 0.25 oz./A	6.8	6.0	6.5	7.0	4.5	4.8	4.8	4	4	8	2
TranXit GTA @ 0.25 oz./A + nicosulfuron @ 0.25 oz./A	6.3	4.8	5.0	4.8	5.8	6.3	6.5	4	3	7	3
TranXit GTA @ 0.50 oz./A	7.0	5.0	5.3	5.8	5.8	6.0	5.3	4	2	6	4
TranXit GTA @ 0.50 oz./A + nicosulfuron @ 0.50 oz./A	6.3	4.5	3.8	3.8	5.0	6.0	6.3	3	3	6	4
TranXit GTA @ 1.00 oz./A	6.3	4.3	3.8	4.7	4.8	4.8	6.3	2	2	4	5
Katana or Mission @ 2.0 oz/A	5.3	2.5	1.8	3.7	5.3	6.5	6.8	2	2	4	5
Certainty @ 1.25 oz/A	7.5	6.8	7.0	6.5	5.8	4.0	4.0	5	4	9	1
Monument @ 0.35 oz./A	7.3	5.5	5.0	5.3	5.5	5.5	6.0	5	2	7	3
Manor @ 0.50 oz/A	6.8	5.0	5.8	5.3	4.5	4.3	5.3	2	1	3	6
Corsair @ 1.5 oz/A	6.5	5.3	5.0	5.0	5.3	4.3	5.5	2	1	3	6
Kerb @ 2 lb./A	7.3	6.3	4.5	4.0	5.5	5.8	5.0	4	2	6	4
Surflan @ 2 qrts/A	7.8	7.5	7.8	6.3	4.5	4.5	5.0	4	4	8	2
Revolver @ 17.4 oz./A	7.0	4.8	3.3	4.3	5.3	6.0	6.0	3	3	6	4
UTC	7.8	8.0	7.5	7.0	5.8	5.0	4.8	5	4	9	1
test mean	6.8	5.4	5.1	5.2	5.2	5.3	5.5				
LSD	ns	1.0	1.1	1.3	ns	ns	ns				

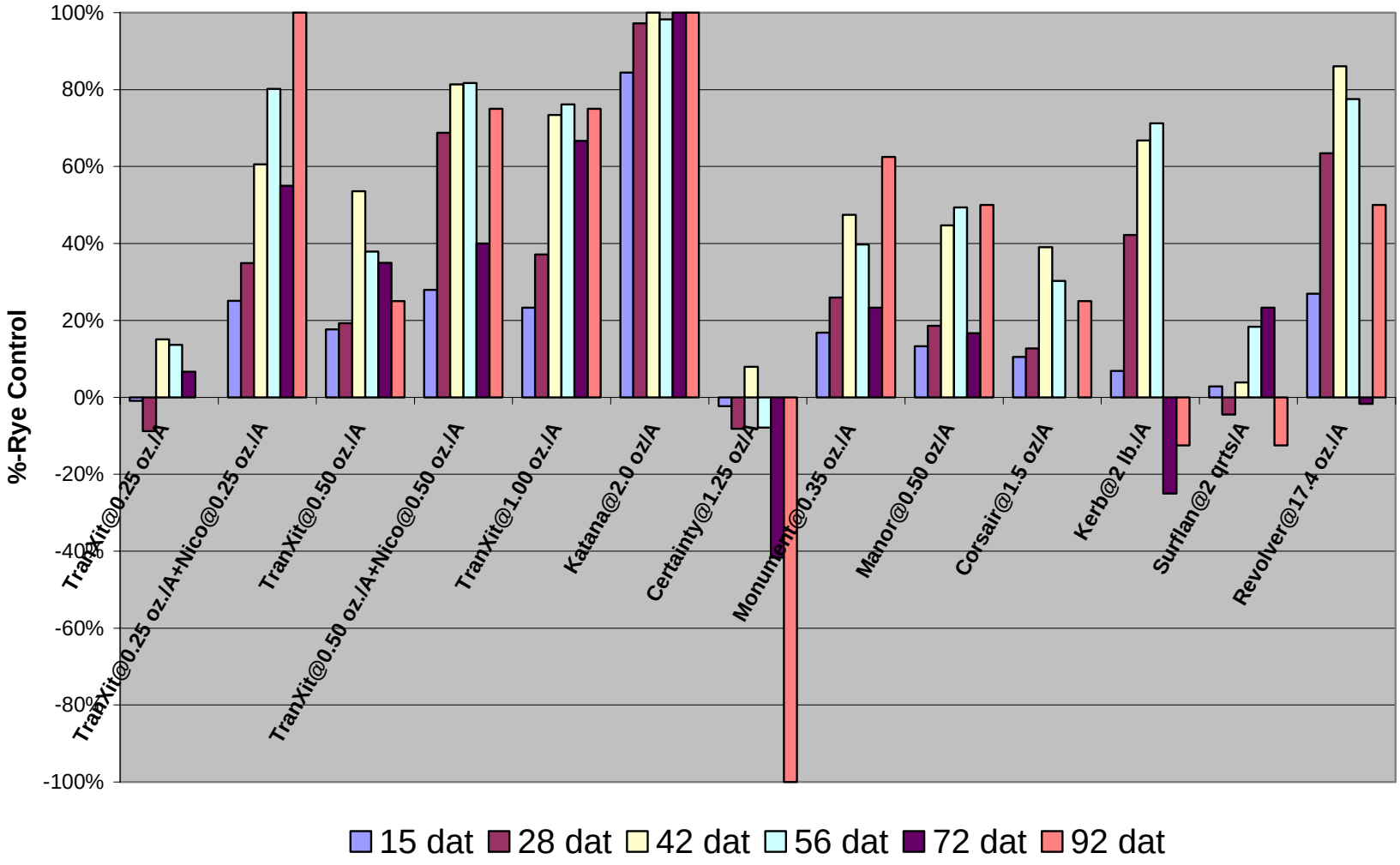
Table 7. Percent 'RYEGRASS CONTROL' as effected by select transition aids.
Tucson Country Club (Fairway #5), Spring 2006.
The University of Arizona, Turfgrass Research.

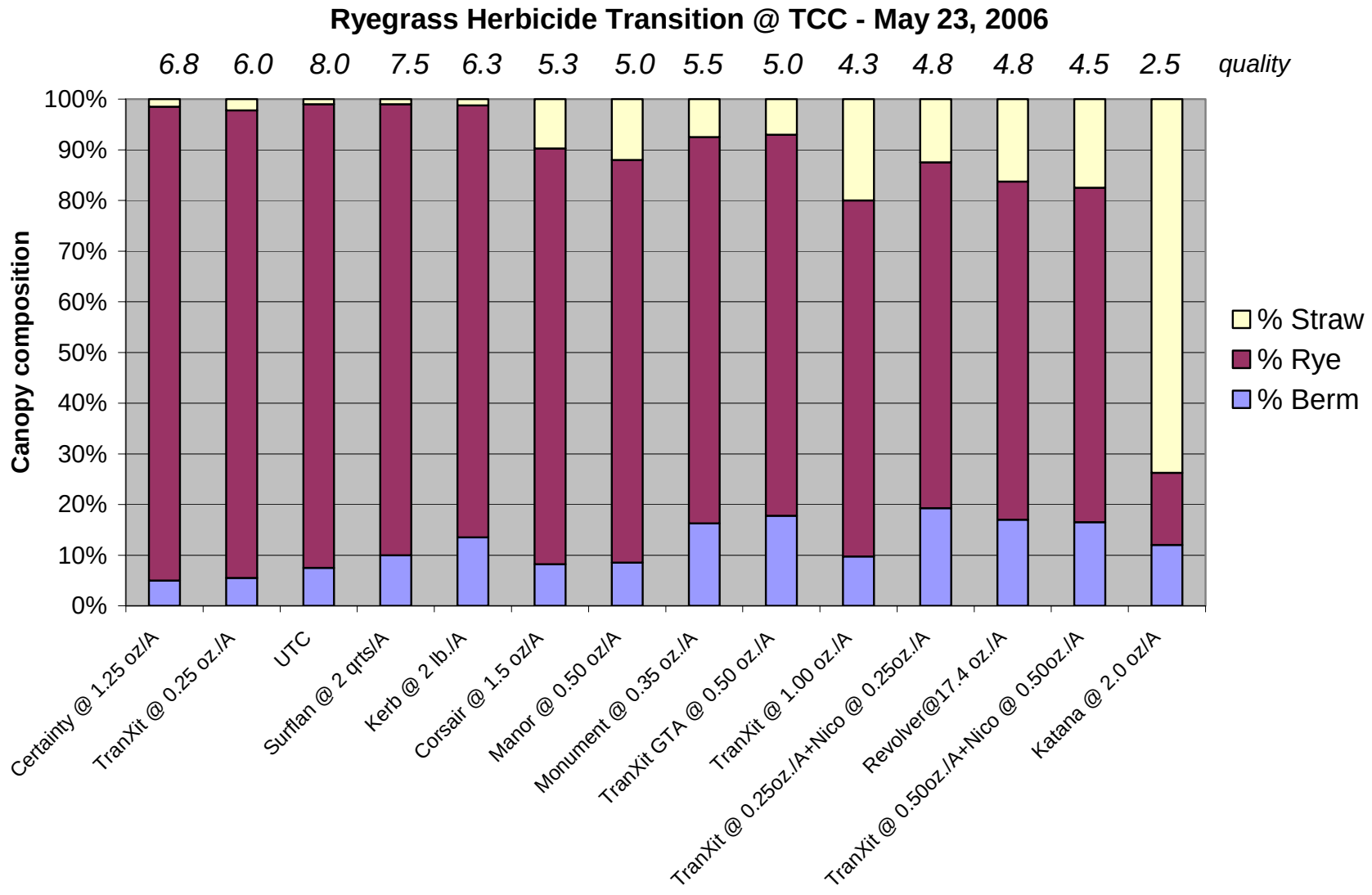
	23-May	*5-Jun*	*19-Jun*	*3-Jul*	*19-Jul*	*8-Aug*
Days after treatment, DAT	*15*	*28*	*42*	*56*	72	*92*
Treatments applied on May 8, 2006						
TranXit GTA @ 0.25 oz./A	-0.9	-8.8	15.1	13.6	6.7	0.0
TranXit GTA @ 0.25 oz./A + nicosulfuron @ 0.25 oz./A	25.1	34.9	60.6	80.2	55.0	100.0
TranXit GTA @ 0.50 oz./A	17.6	19.3	53.6	37.9	35.0	25.0
TranXit GTA @ 0.50 oz./A + nicosulfuron @ 0.50 oz./A	28.0	68.8	81.4	81.7	40.0	75.0
TranXit GTA @ 1.00 oz./A	23.3	37.1	73.4	76.1	66.7	75.0
Katana or Mission @ 2.0 oz/A	84.4	97.2	100.0	98.3	100.0	100.0
Certainty @ 1.25 oz/A	-2.3	-8.2	7.9	-7.9	-41.7	-100.0
Monument @ 0.35 oz./A	16.8	25.9	47.4	39.7	23.3	62.5
Manor @ 0.50 oz/A	13.3	18.6	44.7	49.4	16.7	50.0
Corsair @ 1.5 oz/A	10.5	12.7	39.0	30.2	0.0	25.0
Kerb @ 2 lb./A	6.8	42.2	66.8	71.2	-25.0	-12.5
Surflan @ 2 qrts/A	2.8	-4.5	3.9	18.3	23.3	-12.5
Revolver @ 17.4 oz./A	27.0	63.5	86.1	77.5	-1.7	50.0
UTC	-	-	-	-	-	-
test mean	19.4	30.7	52.3	51.3	22.9	33.7
LSD	16.0	15.9	24.2	46.4	ns	ns

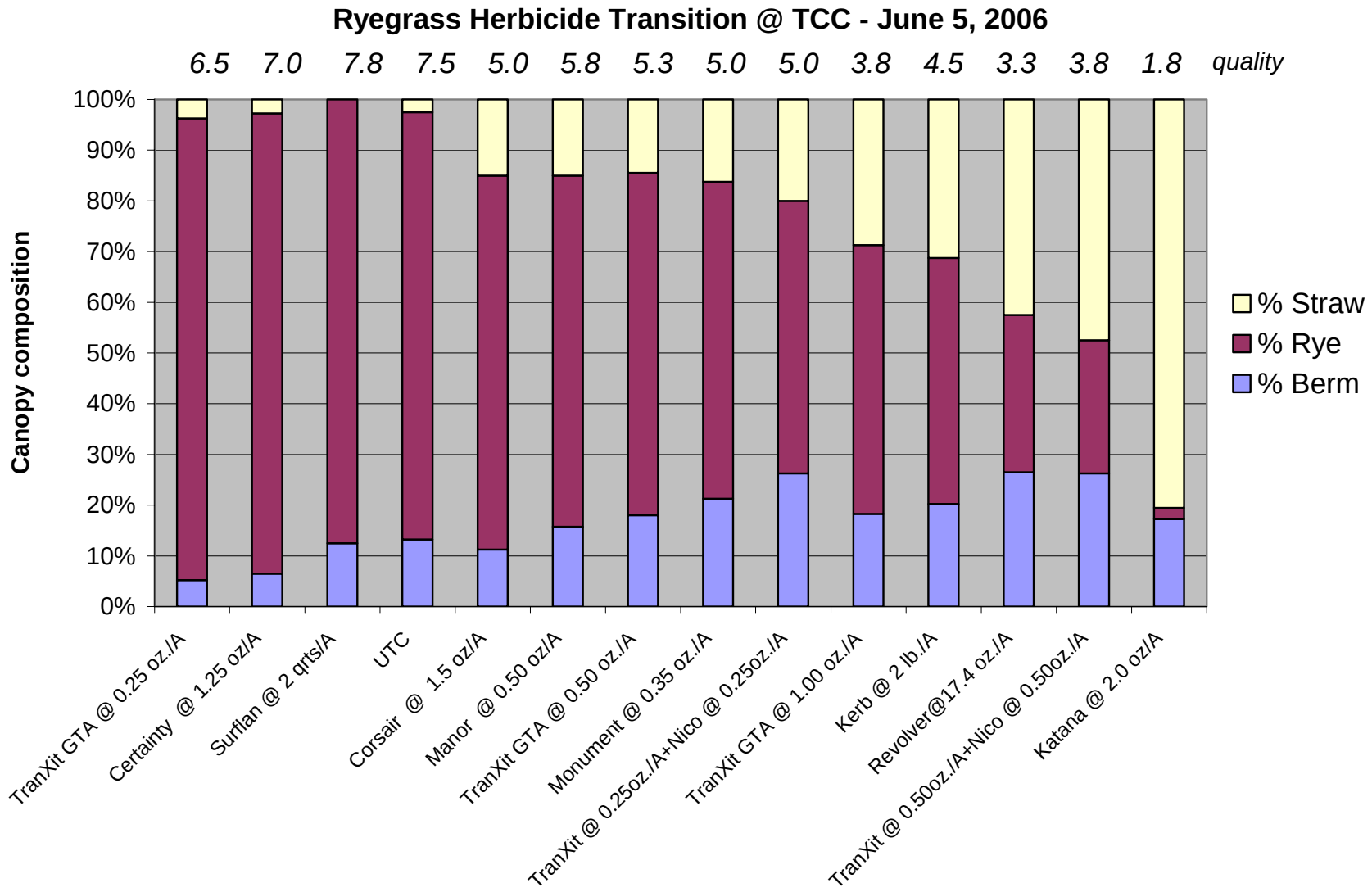
Table 8. PERCENT visible perennial RYEGRASS as effected by select transition aids.
Tucson Country Club (Fairway #5), Spring 2006.
The University of Arizona, Turfgrass Research.

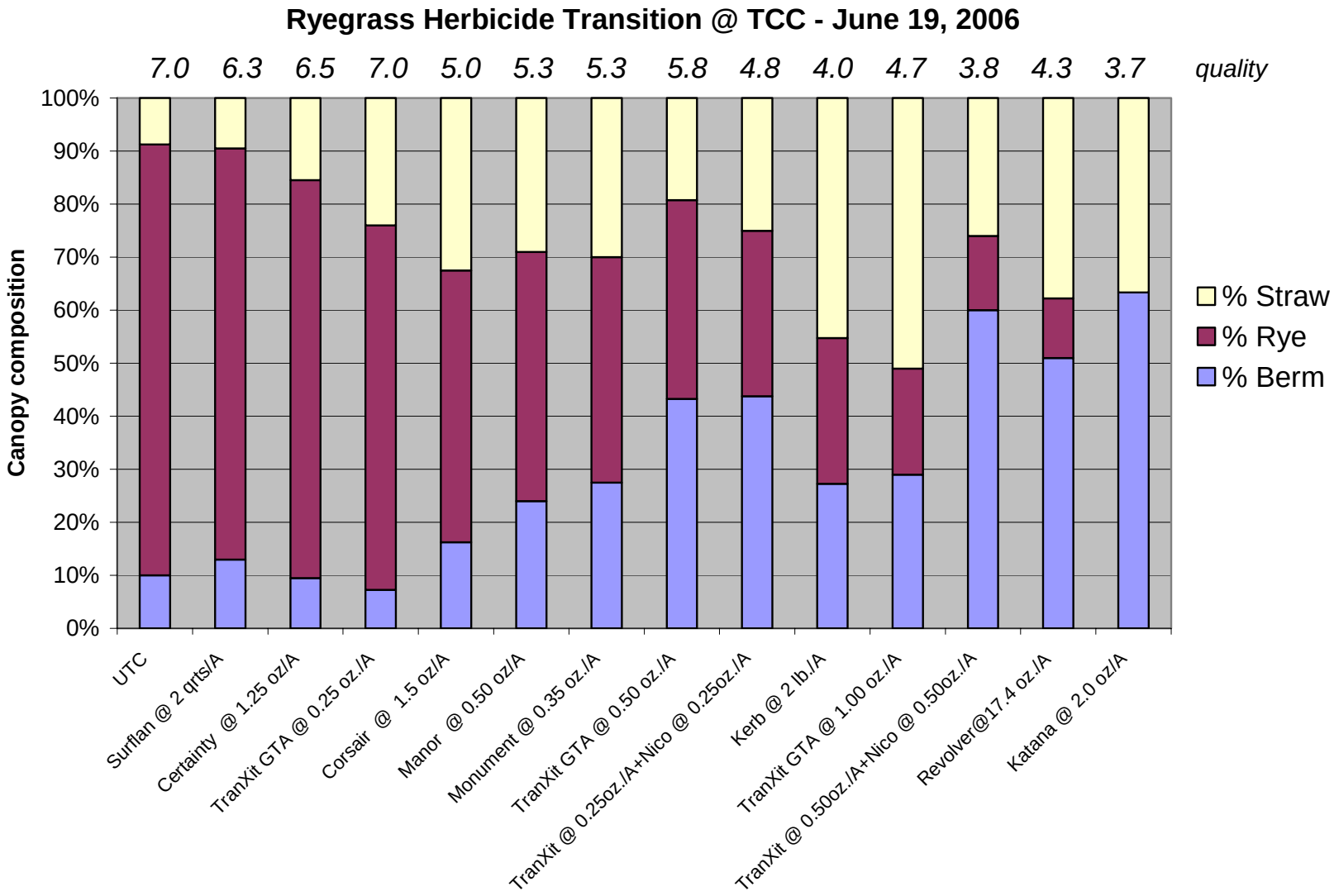
	23-May	*5-Jun*	*19-Jun*	*3-Jul*	*19-Jul*	*8-Aug*
Days after treatment, DAT	*15*	*28*	*42*	*56*	*72*	*92*
Treatments applied on May 8, 2006						
TranXit GTA @ 0.25 oz./A	92.3	91.0	68.8	40.8	5.5	1.8
TranXit GTA @ 0.25 oz./A + nicosulfuron @ 0.25 oz./A	68.3	53.8	31.3	8.5	2.3	0.0
TranXit GTA @ 0.50 oz./A	75.3	67.5	37.5	28.8	3.3	1.5
TranXit GTA @ 0.50 oz./A + nicosulfuron @ 0.50 oz./A	66.0	26.3	15.0	8.8	3.0	0.3
TranXit GTA @ 1.00 oz./A	70.3	53.0	21.3	13.0	2.5	0.3
Katana or Mission @ 2.0 oz/A	14.3	2.3	0.0	0.8	0.0	0.0
Certainty @ 1.25 oz/A	93.5	90.8	75.0	58.8	8.8	2.3
Monument @ 0.35 oz./A	76.3	62.5	42.5	33.8	5.5	0.5
Manor @ 0.50 oz/A	79.5	69.3	46.3	30.0	7.5	0.5
Corsair @ 1.5 oz/A	82.0	73.8	51.3	40.0	7.5	0.8
Kerb @ 2 lb./A	85.3	48.5	27.5	13.3	6.3	1.8
Surflan @ 2 qrts/A	89.0	87.5	77.5	45.0	5.5	1.3
Revolver @ 17.4 oz./A	66.8	31.0	11.3	11.3	5.3	0.8
UTC	91.5	84.3	81.3	55.0	7.5	1.5
test mean	75.0	60.1	41.9	27.7	5.0	0.9
LSD	14.3	12.7	20.5	25.3	ns	ns

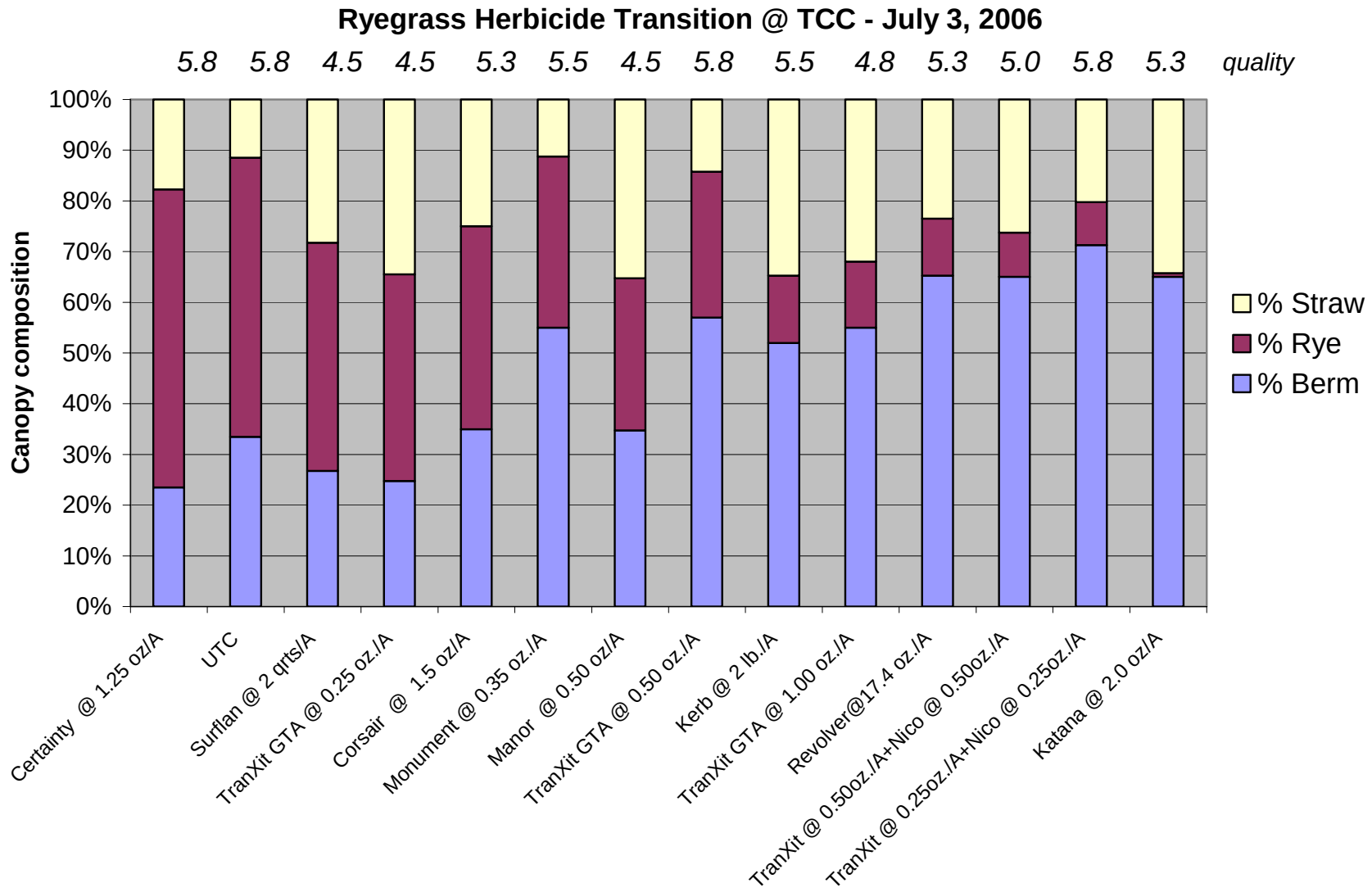
Figure 1. 'Ryegrass Control' Ryegrass Herbicide Transition @ TCC, Spring 2006

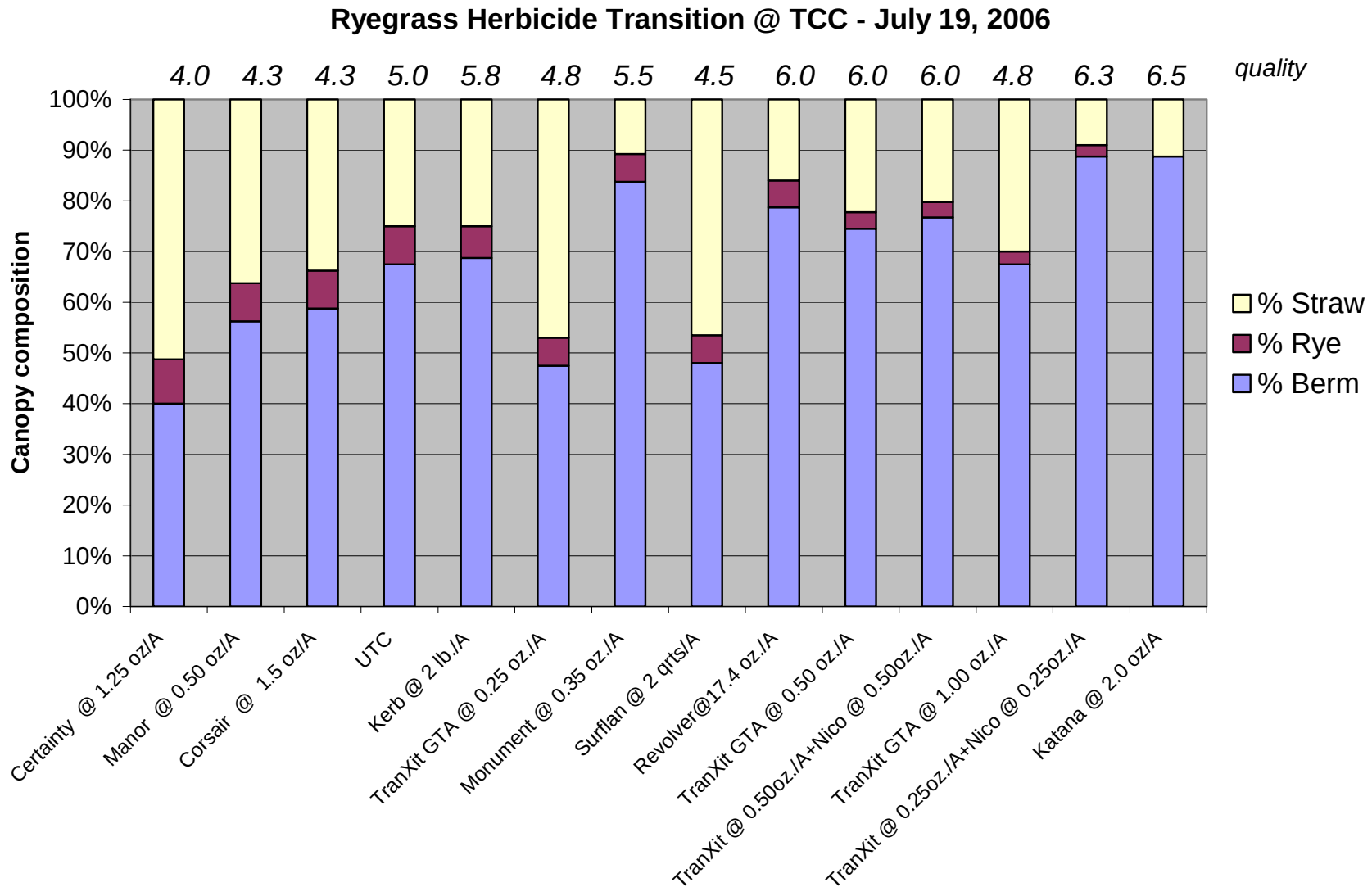


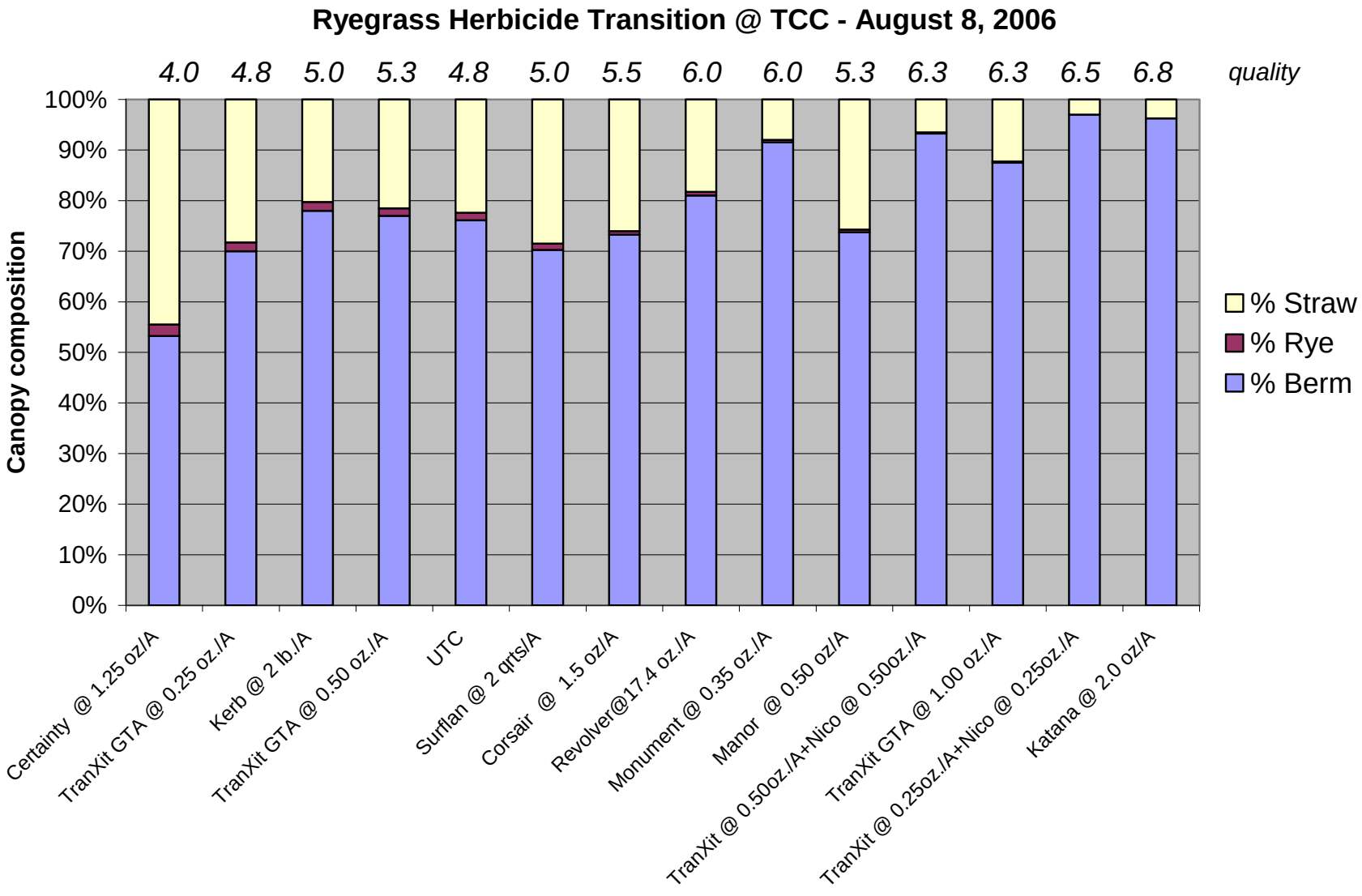

Ryegrass Herbicide Transition @ TCC - May 23, 2006
6.8 6.0 8.0 7.5 6.3 5.3 5.0 5.5 5.0 4.3 4.8 4.8 4.5 2.5 quality
Canopy composition
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Straw
% Rye
% Berm
Certainty @ 1.25 oz/A
TranXit @ 0.25 oz./A
UTC
Surflan @ 2 qrts/A
Kerb @ 2 lb./A
Corsair @ 1.5 oz/A
Manor @ 0.50 oz/A
Monument @ 0.35 oz./A
TranXit GTA @ 0.50 oz./A
TranXit @ 1.00 oz./A
TranXit @ 0.25oz./A+Nico @ 0.25oz./A
Revolver@17.4 oz./A
TranXit @ 0.50oz./A+Nico @ 0.50oz./A
Katana @ 2.0 oz/A


Ryegrass Herbicide Transition @ TCC - June 5, 2006
6.5 7.0 7.8 7.5 5.0 5.8 5.3 5.0 5.0 3.8 4.5 3.3 3.8 1.8 quality
Canopy composition
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Straw
% Rye
% Berm
TranXit GTA @ 0.25 oz./A
Certainty @ 1.25 oz/A
Surflan @ 2 qrts/A
UTC
Corsair @ 1.5 oz/A
Manor @ 0.50 oz/A
TranXit GTA @ 0.50 oz./A
Monument @ 0.35 oz./A
TranXit @ 0.25oz./A+Nico @ 0.25oz./A
TranXit GTA @ 1.00 oz./A
Kerb @ 2 lb./A
Revolver@17.4 oz./A
TranXit @ 0.50oz./A+Nico @ 0.50oz./A
Katana @ 2.0 oz/A


Ryegrass Herbicide Transition @ TCC - June 19, 2006
7.0 6.3 6.5 7.0 5.0 5.3 5.3 5.8 4.8 4.0 4.7 3.8 4.3 3.7
quality
Canopy composition
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Straw
% Rye
% Berm
UTC
Surflan @ 2 qrts/A
Certainty @ 1.25 oz/A
TranXit GTA @ 0.25 oz./A
Corsair @ 1.5 oz/A
Manor @ 0.50 oz/A
Monument @ 0.35 oz./A
TranXit GTA @ 0.50 oz./A
TranXit @ 0.25oz./A+Nico @ 0.25oz./A
Kerb @ 2 lb./A
TranXit GTA @ 1.00 oz./A
TranXit @ 0.50oz./A+Nico @ 0.50oz./A
Revolver@17.4 oz./A
Katana @ 2.0 oz/A


Ryegrass Herbicide Transition @ TCC - July 3, 2006
5.8 5.8 4.5 4.5 5.3 5.5 4.5 5.8 5.5 4.8 5.3 5.0 5.8 5.3 quality
Canopy composition
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Straw
% Rye
% Berm
Certainty @ 1.25 oz/A
UTC
Surflan @ 2 qrts/A
TranXit GTA @ 0.25 oz./A
Corsair @ 1.5 oz/A
Monument @ 0.35 oz./A
Manor @ 0.50 oz/A
TranXit GTA @ 0.50 oz./A
Kerb @ 2 lb./A
TranXit GTA @ 1.00 oz./A
Revolver@17.4 oz./A
TranXit @ 0.50oz./A+Nico @ 0.50oz./A
TranXit @ 0.25oz./A+Nico @ 0.25oz./A
Katana @ 2.0 oz/A


Ryegrass Herbicide Transition @ TCC - July 19, 2006
quality
4.0 4.3 4.3 5.0 5.8 4.8 5.5 4.5 6.0 6.0 6.0 4.8 6.3 6.5
Canopy composition
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Straw
% Rye
% Berm
Certainty @ 1.25 oz/A
Manor @ 0.50 oz/A
Corsair @ 1.5 oz/A
UTC
Kerb @ 2 lb./A
TranXit GTA @ 0.25 oz./A
Monument @ 0.35 oz./A
Surflan @ 2 qrts/A
Revolver@17.4 oz./A
TranXit GTA @ 0.50 oz./A
TranXit @ 0.50oz./A+Nico @ 0.50oz./A
TranXit GTA @ 1.00 oz./A
TranXit @ 0.25oz./A+Nico @ 0.25oz./A
Katana @ 2.0 oz/A


Ryegrass Herbicide Transition @ TCC - August 8, 2006
4.0 4.8 5.0 5.3 4.8 5.0 5.5 6.0 6.0 5.3 6.3 6.3 6.5 6.8
quality
Canopy composition
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% Straw
% Rye
% Berm
Certainty @ 1.25 oz/A
TranXit GTA @ 0.25 oz./A
Kerb @ 2 lb./A
TranXit GTA @ 0.50 oz./A
UTC
Surflan @ 2 qrts/A
Corsair @ 1.5 oz/A
Revolver@17.4 oz./A
Monument @ 0.35 oz./A
Manor @ 0.50 oz/A
TranXit @ 0.50oz./A+Nico @ 0.50oz./A
TranXit GTA @ 1.00 oz./A
TranXit @ 0.25oz./A+Nico @ 0.25oz./A
Katana @ 2.0 oz/A