

# Response of Tall Fescue to R.P. - EXP31130A and R.P. - EXP31598A

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## **Abstract**

*EXP31130A and EXP31598A were applied as repeat applications on June 5 and July 23, 1997 to tall fescue turf maintained at 3.0 inches. Application rates were 0.18 and 0.36 lbs. AI/A (31130A) and 7.0 and 14.0 fl. oz/prod/A (31598A). Each treatment was applied with and without Sequestrene 338 iron chelate, at the rate of 0.1 oz/m<sup>2</sup>. Untreated and iron-only controls were included in the test. Neither herbicide compound (either with or without iron) caused discoloration, leaf tip burn, sheath necrosis, or blotchy colored turf at the rates and timing applications performed here for low maintenance tall fescue under desert summer conditions. EXP31598A herbicide, when applied without iron to tall fescue turf, exhibited acceptable levels of turfgrass color at all times when applied at the 7 ounce/prod./acre rate. EXP31598A herbicide, when applied without iron to tall fescue turf, exhibited a lighter, but acceptable color turf, when applied at the 14 ounce/prod./acre rate. When iron was added, the 14 ounce/prod./acre rate of EXP31598A produced in general, a slightly darker turf than the same compound at the 7.0 ounce/prod./acre rate. Improved turf color resulted from the addition of iron at 0.1 ounce/m<sup>2</sup> for tall fescue treated with EXP31130A. This occurred more so for turf treated at the low rate (0.18 lb. AI/A) than for turf treated at the high rate (0.36 lb. AI/A). The addition of iron to EXP31130A did not increase overall quality at either application rate of the herbicide. When iron was added (0.1 ounce/m<sup>2</sup>), turfgrass quality was improved for EXP31598A, especially at the high application rate of 14 ounce/prod./acre.*

## **Introduction**

Two experimental herbicides EXP31130A and EXP31598A were evaluated for herbicide tolerance on turf-type tall fescue (*Festuca aurundinacea*) after two summer applications in 1997. The major objectives were as follows. To assess turfgrass safety between herbicides and the effects of using chelated iron in tank mixes for turf safety.

## **Materials and Methods**

The two experimental herbicides were tested at two application rates, both with and without iron chelate. An untreated control and an iron-only treatment were included. The treatments were as follows.

1	Control	
2	EXP31130A	0.18 lb/A
3	EXP31130A	0.36 lb/A
4	EXP31130A	0.18 lb/A + 0.1 oz Fe/m <sup>2</sup>
5	EXP31130A	0.36 lb/A + 0.1 oz Fe/m <sup>2</sup>
6	EXP31598A	7.0 fl. oz/A

7	EXP31598A	14.0 fl. oz/A
8	EXP31598A	7.0 fl. oz/A + 0.1 oz Fe/m <sup>2</sup>
9	EXP31598A	14.0 fl. oz/A + 0.1 oz Fe/m <sup>2</sup>
10	Iron only	0.1 oz. Fe/m <sup>2</sup>

All treatments were applied to a mature tall fescue turf using back-pack sprayer, and a three nozzle boom (20 inch spacing). Applications were calibrated for 80 GPA (8004 nozzles). Plot size was 5x5, each replicated four times in a RCBD. The tall fescue was mowed 2-3 times a week at 3.0 inches and irrigated to prevent stress. The plots received 2 ½ lbs. -N-/1000 ft<sup>2</sup> from January 1 to April 1, 1997, after which time all fertilization was discontinued.

Applications were made on June 4 and again (same treatments to same plots) on July 23, 1997. Treatments were allowed to dry for twelve hours before being irrigated with the previous days ET requirement.

Plots were evaluated for turfgrass color and quality at 1, 2, 3, 4 and 6 weeks after treatment (WAT), using the National Turfgrass Evaluation Program (NTEP) evaluation scale system. At no time after either application were there signs of injury (discoloration, tip burning, leaf sheath necrosis, turf yellowing or stunted growth) therefore, color and quality are reported. All data were analyzed using the least squares method of the analysis of variance technique, using SAS software. Mean separation was derived from Tukey's Honest LSD values, which are provided only when the treatment effect was significant at the P= 0.05 level, or less. Specific linear contrasts were used to show rate and iron effects and discussed appropriately only when warranted.

## Results and Discussion

### (1 WAT/1) June 10, 1997

The treatment affect was significant for both turfgrass color and quality. Mean turfgrass color scores ranged from 5.0 to 7.0. The lightest color turf was that of EXP31130A at the 0.36 lb. AI/A rate (mean = 5.0) (Table 1). The tall fescue response to this rate was improved with the addition of iron, as the mean color score increased to 6.0. For EXP31130A, the low rate (0.18 lb. AI/A) had a mean score of 6.0, but with the inclusion of iron improved to 6.8. EXP31598A generally had better mean turf color scores than EXP31130A (Table 1). However, at 1 WAT/1, the higher rate (14.0 ounce/prod./acre) ranked above the 7.0 ounce/prod./rate both with and without iron. Iron did improve color for EXP31598A as well. The linear contrasts for 'rate response' was significant for EXP31598A as was the effect of iron vs. no iron (averaged over both chemical application rates) at 1 WAT/1. For EXP31130A the color response was rate dependent, exhibiting decreased color with increased application rate, but the addition of iron was not statistically significant in terms of the linear contrast.

Mean turfgrass quality scores ranged from 5.0 to 7.0 (Table 2). The EXP31130A plots treated with iron had the lowest ranking quality scores, regardless of application rate. Only at the low rate of 0.18 lb. AI/A, without iron, did EXP31130A show a noticeable improvement in turf at one week after treatment (mean = 6.0). EXP31598A seemed to slightly enhance turfgrass quality, which again was enhanced by increased rates, both with and without iron (Table 2). The enhanced quality of EXP31598A over EXP31130A was probably due to a less erect turf from EXP31130A, evident at one week after treatment. This effect was minor and not of concern or noticeable to the average lay person. Again, the linear contrast for a rate dependent response for EXP31598A was significant.

### (2 WAT/1) June 20, 1997

The treatment effect was not significant for turfgrass color, but was significant for quality at two weeks after the first treatment. Mean color scores ranged from 5.5 to 7.3 and only one treatment had a mean score below 6.0. This occurred for EXP31598A at the high application rate of 14 ounce/prod./acre, without iron. The untreated control ranked first for color (7.3), followed closely by the iron only control (7.0). Note here that color responses were not statistically significant, but it is interesting to note the change in rank between both experimental herbicides from one to two weeks after treatment (Table 1).

Turfgrass quality scores ranged from 5.5 (untreated control) to 8.0 (EXP31598A 14 ounce/prod./acre, plus iron) (Table 1). Among herbicide treated plots, the high rate of EXP31598A, with iron, had noticeably the best overall quality. At the lower rate (7.0 ounce/prod./acre), with iron, the turf quality score was 6.3. Generally, the addition of iron improved overall quality at two weeks after the initial applications were made (Table 2).

(3 WAT/1) July 1, 1997

At three weeks after treatment, turfgrass color due to treatments was significant, but quality was not. Turfgrass color scores ranged from 5.8 to 8.0, with all but one treatment having mean color scores of 6.0 or greater. Again, the high rate of EXP31598A (14 ounce/prod./acre) with iron, had the darkest color turf (mean = 8.0) (Table 1). The same treatment, without iron, had the lowest mean color score of 5.8. EXP31130A at the low application rate of 0.18 lb. AI/A, with iron, had a dark color turf (mean = 7.0). This was identical to the iron-only treatment and the untreated control. Uniquely at this point, a favorable iron addition resulted when combined with the high rate of EXP31598A (Table 1). Mean quality scores ranged from 5.5 to 6.5 and the treatment affect was not statistically significant. Note, however, that EXP31130A at the low application rate of 0.18 lb. AI/A, ranked above the 0.36 lb. AI/A rates, regardless of the inclusion of iron (Table 2).

(4 WAT/1) July 7, 1997

Both color and quality responses were significant from treatment application at four weeks after treatment. Mean color scores ranged from 5.3 to 7.3. At this time, the untreated check ranked first in color (mean = 7.3), followed by the iron-only treatment and three other herbicide treatments, all of which contained iron (Table 1). The only treatment which scored a mean color score of less than six was EXP31598A without iron at the high application rate of 14 ounce/prod./acre (mean = 5.3). Overall, the application of iron showed a slight improvement in turfgrass color, especially for EXP31598A. Mean turfgrass quality scores ranged from 5.3 to 7.0. At this time, EXP31598A applied at the high rate (14 ounce) without iron, had the lowest overall quality score (mean = 5.3), which ranked below EXP31130A at the high rate (0.36 lb.) with iron (mean = 5.8) The control scored a mean quality value of 6.3, while the iron-only scored a mean quality value of 7.0 (Table 2).

(6 WAT/1) July 18, 1997

At six weeks after treatment, the treatment effect was not statistically significant for either turfgrass color or overall quality. Color scores now occurred within a narrow range from 6.0 to 7.3 (Table 1). Overall quality scores ranged from 5.5 (control) to 7.0 (EXP31598A 14 ounce/prod./acre plus iron) (Table 2).

### **The applications were made to the same plots at the same rates on July 23, 1997.**

(1 WAT/2) July 30, 1997

The treatment effect at one week after the second application was statistically significant for turfgrass color only. EXP31130A at the low rate (0.18 lb. AI/A) with iron ranked highest along with the control for color (mean = 7.3). With iron, EXP31130A at the high rate (0.36 lb. AI/A) had an acceptable mean color score of 6.0. EXP31598A at the low rate (7 ounce/prod./acre) had identical mean color scores of 6.8, both with and without iron. Essentially, EXP31598A at the high rate (14 ounce/prod./acre) without iron, would be noticeable as the lightest color turf to the lay person (Table 1). In terms of overall turfgrass quality, the difference between treatments was minimal and was not statistically significant. In terms of rank, EXP31598A at the low rate (7 ounce/prod./acre) did not show better quality than the same compound at the high rate (14 ounce/prod./acre). Without iron, these two treatments had mean quality scores of 5.8 and 6.5, respectively (Table 2). With iron, the same treatment levels scored mean quality values of 6.8 and 7.0, respectively. The application level contrast was significant for EXP31598A, showing enhanced turf quality at increased rates, regardless of iron application.

(2 WAT/2) August 6, 1997

At two weeks after the second application, turfgrass quality was statistically significant among treatments, but color was not. Turfgrass quality mean scores ranged from 5.3 to 7.0. Both rate treatments of EXP31598A had mean quality scores of 6.8 or above when iron was added (Table 2). Here again, a synergistic effect occurred from iron and the elevated rate of EXP31598A. EXP31130A showed decreased quality performance with an increase in application rate, which showed

minimal benefit from iron in the tank mix. Color scores were non-significant among treatments and ranged from 5.5 to 7.3 (Table 1). Note, however, that EXP31598A without iron at the high rate (14 ounce/prod./acre) ranked lowest in color (mean = 5.5). The same compound/rate combination, when tank mixed with iron, had improved color (mean = 6.5) (Table 1).

(3 WAT/2) August 13, 1997

The treatment effect was not statistically significant for turfgrass color, or quality, at three weeks after the second treatment. Mean quality scores ranged from 6.0 (control) to 7.0 (EXP31598A 14 ounce/prod./acre, plus iron) (Table 2). Mean color scores ranged from 5.8 to 7.0. The iron-only treatment ranked first for color (mean = 7.0) while the EXP31130A 0.36 lb. AI/A, without iron treatment ranked lowest (mean = 5.8) (Table 1).

(4 WAT/1) August 22, 1997

The overall treatment effect was not statistically significant for turfgrass color or quality at four weeks after the second application. Mean color scores ranged from 5.8 to 7.0. The iron-only treatment, as well as EXP31130A 0.18 lb. AI/A, plus iron, and EXP31598A at 14 ounce/prod./acre, plus iron had mean color scores of 7.0 (Table 1). Turfgrass quality mean scores ranged from 5.5 to 7.5. The iron only treatment ranked first for quality (mean = 7.5), while EXP31130A 0.36 lb. AI/A, plus iron ranked lowest (mean = 5.5) (Table 2). Note that these differences were subtle and all treatments were acceptable for tall fescue turf in late August.

(6 WAT/2) September 8, 1997

The overall treatment effect was not significant for either turfgrass color, or overall quality at the close of the test, six weeks after the repeat applications were made. Mean color scores ranged from 6.0 (control) to 7.5, for both the iron-only treatment and the EXP31598A 14 ounce/prod./acre, plus iron treatment. These two treatments would be slightly, but noticeably darker than the other remaining treatments (Table 1). Overall quality scores (again, non-statistically significant) ranged from 5.5 to 6.8. Note that at the close of the test, EXP31130A at the high rate of 0.36 lb. AI/A, had a higher quality mean score than the same treatment when iron was added (means = 6.5 (no iron) and 5.8 (iron), respectively). As usual EXP31598A showed enhanced performance from elevated rates of this compound, when iron was added. Seven treatments finished higher in rank than the untreated control, while two treatments had slightly numerically higher quality scores than the iron-only treatment at the very end of the test (Table 2).

## Conclusions

1. EXP31598A herbicide, when applied without iron to tall fescue turf, exhibited acceptable levels of turfgrass color at all times when applied at the 7 ounce/prod./acre rate.
2. EXP31598A herbicide, when applied without iron to tall fescue turf, exhibited a lighter, but acceptable color turf, when applied at the 14 ounce/prod./acre rate.
3. With the application of Sequestrene 338 iron applied at 0.1 ounce/m<sup>2</sup>, turfgrass color was improved dramatically on tall fescue turf. The greatest enhanced effect occurred when iron was tank mixed with EXP31598A at the high rate of 14 ounce/prod./acre.
4. When iron was added, the 14 ounce/prod./acre rate of EXP31598A produced in general, a slightly darker turf than the same compound at the 7.0 ounce/prod./acre rate.
5. Turf treated with EXP31598A at the 14 ounce/prod./acre rate with iron, had turf color similar to that of the iron-only treated tall fescue.
6. EXP31130A herbicide produced good color turf on all occasions when applied without iron at the 0.18 lb. AI/A rate.
7. At the high application rate of 0.36 lb. AI/A, EXP31130A alone caused a slightly lighter color turf at one week after the first application, but caused no significant color changes after that time.
8. Improved turf color resulted from the addition of iron at 0.1 ounce/m<sup>2</sup> for tall fescue treated with

EXP31130A. This occurred more so for turf treated at the low rate (0.18 lb. AI/A) than for turf treated at the high rate (0.36 lb. AI/A).

9. For overall turfgrass quality, the treatment effect was statistically significant on only four of ten evaluation date during the June of 1997, demonstrating tolerance by tall fescue.
10. EXP31130A had fully acceptable turfgrass quality (for tall fescue) when applied at the 0.18 lb. AI/A rate, without iron and a somewhat lower performance quality at the high rate of 0.36 lb. AI/A , when applied without iron. At the high rate, the turf was still acceptable (for low maintenance tall fescue turf in a desert environment).
11. The addition of iron to EXP31130A did not increase overall quality at either application rate of the herbicide.
12. Turfgrass quality was generally slightly lower from two to six weeks after the first application for EXP31598A as rates increased from 7 to 14 ounce/prod./acre, without iron. The difference between these treatments was not statistically significant, however.
13. When iron was added (0.1 ounce/m<sup>2</sup>), turfgrass quality was improved for EXP31598A, especially at the high application rate of 14 ounce/prod./acre.
14. Neither herbicide compound (either with of without iron) caused discoloration, leaf tip burn, sheath necrosis, or blotchy colored turf at the rates and timing applications performed here for low maintenance tall fescue under desert summer conditions.

Table 1. Mean turfgrass color<sup>1</sup> scores of tall fescue turf after applications<sup>2</sup> of EXP31130A and EXP31598A herbicides with and without iron. University of Arizona, Summer 1997.

TREATMENT	RATE <sup>3</sup> HERB	RATE <sup>3</sup> IRON	JUNE 10 1 WAT/1	JUNE 20 2 WAT/1	JULY 1 3 WAT/1	JULY 7 4 WAT/1	JULY 18 6 WAT/1	JULY 30 1 WAT/2	AUG 6 2 WAT/2	AUG 13 3 WAT/2	AUG 22 4 WAT/2	SEPT 8 6 WAT/2
Control	--	--	5.8	7.3	7.0	7.3	6.3	7.3	6.5	6.0	6.0	6.0
EXP31130A	.18 lb/AI/A	--	6.0	6.8	6.8	6.3	6.3	6.5	6.8	6.5	6.5	6.3
EXP31130A	.36 lb/AI/A	--	5.0	6.3	6.8	6.3	6.3	5.8	6.3	5.8	6.0	6.3
EXP31130A	.18 lb/AI/A	0.1 oz/m <sup>2</sup>	6.8	6.5	7.0	7.0	7.0	7.3	7.0	6.3	7.0	6.5
EXP31130A	.36 lb/AI/A	0.1 oz/m <sup>2</sup>	6.0	6.5	6.5	6.5	6.5	6.0	6.0	6.3	5.8	6.3
EXP31598A	7 fl. oz/A	--	5.8	6.3	6.3	6.0	6.8	6.8	6.5	6.5	6.0	6.5
EXP31598A	14 fl. oz/A	--	6.3	5.5	5.8	5.3	7.3	5.5	5.5	6.0	5.8	6.0
EXP31598A	7 fl. oz/A	0.1 oz/m <sup>2</sup>	6.8	6.3	6.8	7.0	7.0	6.8	7.3	6.5	6.5	7.0
EXP31598A	14 fl. oz/A	0.1 oz/m <sup>2</sup>	7.0	7.0	8.0	7.0	6.0	6.5	6.5	6.5	7.0	7.5
Iron Only	--	0.1 oz/m <sup>2</sup>	7.0	7.0	7.0	7.0	6.5	7.0	6.5	7.0	7.0	7.5
TEST MEAN <sup>4</sup>			6.2	6.5	6.8	6.6	6.6	6.5	6.1	6.3	6.4	6.6
LSD VALUE <sup>5</sup>			1.0	NA	0.9	1.3	NA	1.0	NA	NA	NA	NA

<sup>1</sup>Color (1-9). 1 = dead, 6 = acceptable, 9 = best possible. Values are the means of four replications.

<sup>2</sup>Applications to all plots made on June 5 and again on July 23, 1997.

<sup>3</sup>Rates EXP31130A = lbs. AI/A; EXP31598A = oz/product/acre; iron = oz/product/meter<sup>2</sup> of Sequestrene 138, iron chelate.

<sup>4</sup>Test Mean = Mean of all treatments on each evaluation date.

<sup>5</sup>LSD Value = Treatments mean separation statistic. Difference between two treatment means must be larger than the corresponding LSD value for two treatments to be statistically different from each other.

Table 2. Mean turfgrass quality<sup>1</sup> scores for tall fescue turf after applications<sup>2</sup> of EXP31130A and EXP31598A herbicides with and without iron. University of Arizona, Summer 1997.

TREATMENT	RATE <sup>3</sup> HERB	RATE <sup>3</sup> IRON	JUNE 10 1 WAT/1	JUNE 20 2 WAT/1	JULY 1 3 WAT/1	JULY 7 4 WAT/1	JULY 18 6 WAT/1	JULY 30 1 WAT/2	AUG 6 2 WAT/2	AUG 13 3 WAT/2	AUG 22 4 WAT/2	SEPT 8 6 WAT/2
Untreated	--	--	6.0	5.5	6.5	6.3	5.5	7.3	6.3	6.0	5.8	5.8
EXP31130A	.18 lb/AI/A	--	6.0	5.5	6.5	7.0	6.3	6.8	6.3	6.5	6.5	6.8
EXP31130A	.36 lb/AI/A	--	5.5	6.0	5.8	6.5	6.0	6.0	5.3	6.0	6.0	6.5
EXP31130A	.18 lb/AI/A	0.1 oz/m <sup>2</sup>	5.3	6.3	6.5	6.5	6.3	6.5	6.3	6.8	6.8	6.8
EXP31130A	.36 lb/AI/A	0.1 oz/m <sup>2</sup>	5.0	6.3	6.0	5.8	5.8	6.3	5.8	6.0	5.5	5.8
EXP31598A	7 fl. oz/A	--	5.8	5.8	6.5	6.8	6.5	5.8	6.0	6.3	6.5	6.3
EXP31598A	14 fl. oz/A	--	6.0	5.5	5.5	5.3	5.8	6.5	5.3	6.0	6.0	5.5
EXP31598A	7 fl. oz/A	0.1 oz/m <sup>2</sup>	6.8	6.3	6.5	7.0	6.5	6.8	6.8	6.5	6.3	6.3
EXP31598A	14 fl. oz/A	0.1 oz/m <sup>2</sup>	7.0	8.0	6.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5
Iron Only	--	0.1 oz/m <sup>2</sup>	6.5	7.0	6.0	7.0	6.5	6.5	6.5	6.5	7.5	6.5
TEST MEAN <sup>4</sup>			6.0	6.2	6.2	6.5	6.2	6.5	6.1	6.4	6.4	6.3
LSD VALUE <sup>5</sup>			1.0	1.2	NA	1.2	NA	NA	1.0	NA	NA	NA

<sup>1</sup>Quality (1-9). 1 = dead, 6 = acceptable, 9 = best possible. Values are the means of four replications.

<sup>2</sup>Applications to all plots made on June 5 and again on July 23, 1997.

<sup>3</sup>Rates EXP31130A = lbs. AI/A; EXP31598A = oz/product/acre; iron = oz/product/meter<sup>2</sup> of Sequestrene 138, iron chelate.

<sup>4</sup>Test Mean = Mean of all treatments on each evaluation date.

<sup>5</sup>LSD Value = Treatments mean separation statistic. Difference between two treatment means must be larger than the corresponding LSD value for two treatments to be statistically different from each other.