

2017 PGR Options for Turf Management (Turf Research Center)

Introduction

Seasonal management of cool-season turf can include application of plant growth regulators (PGRs) to suppress growth and reduce the number of time consuming and costly mowings. PGRs may also be a good option on steep slopes where it is difficult to cut the grass safely. However, PGRs can cause turf discoloration, which is undesirable, but is temporary in many cases. We have tested PGRs for suppressing seedheads and growth in forage type tall fescue (see 2012 Research Report). We also tested a number of PGR treatments in combination with a synthetic auxin (2,4-D) as a “safener” to reduce damage to the grasses in 2015 at the Turf Research Center. There are concerns with using volatile growth regulator herbicides during hot conditions and in this current trial so in this trial we did not use any. Further, a number of older products (Embark and Stronghold) are no longer commercially available. The current question is, how do the available PGRs compare with each other for fescue growth reduction and safety?

There are a number of PGR products available for turf and the early classification of these placed them into two groups. Type I PGRs slow cellular division and include some herbicides. Our previous trials only included Type 1 PGRs. Type II PGRs are gibberellic acid (GA) inhibitors and slow cell elongation. The current classification has 6 groups, Classes A – F. This trial included a number of Type 1 PGRs which are now Class C (mitotic inhibitors) (cell division) (foliar absorbed) and Class D (herbicidal mode) PGRs. Mefluidide (in the products Envoy and Stronghold) is in Class C but is no longer commercially available. Imazethapyr + imazapyr (Stronghold), imazapic (Plateau), chlorsuluron (Telar and Perspective) and metsulfuron methyl (Escort and Opensight) are in Class D. Anuew (prohexadione calcium) is a Class A (late GA synthesis blocker) (foliar absorbed).

Materials and Methods

The trials were established at the Turfgrass Research Center at Spindletop Research Farm in Lexington KY with 10 treatments replicated 3 times arranged in a randomized complete block design on each of two turf types. They were part of a trial conducted by Kenneth Cropper (see reference) from 2013 to 2014. The turf type tall fescue plot was under high maintenance management during that time and the mixed species endemic polystand (endemic) plot was under low maintenance management. Since that trial ended, the only maintenance on these plots has been regular mowing at 3.5 inches. Plot sizes for the PGR trial were 3.5 ft by 20 ft with running unsprayed checks (1.5 ft) between each of the plots. Application was at 25 gallons per acre spray volume on July 8, 2017 and included a non-ionic surfactant (Activator 90) at 0.25% v/v. Table 1 lists the PGR treatments with their active ingredients and application rates. The Anuew label calls for the addition of AMS (ammonium sulfate) if the water has more than 40 ppm calcium. Table 2 lists the PGR treatments with their classification groups.

Turf color in the two sets of plots, turf fescue and endemic turf, was assessed by comparison to the running check strips 8 (7/16/2017), 16 (7/24/2017), 23 (7/31/2017), 32 (8/9/2017), 38 (8/15/2017), and 47 (8/24/2017) days after treatment (DAT). The color rating ranges from 0 (dead) to 9 (full green). The color of the check strips was set at 8. It should be noted that the

color and condition of the plots had decreased since the end of the 2014 season when all chemical and fertilizer inputs ceased. Canopy heights were measured at 8, 16, 23, 32, 38, and 47 DAT. Broadleaf weed (% control) ratings were taken on 8, 16, 23, and 32 DAT. A rating (0-4) of the density of crabgrass seedheads was taken on the turf type fescue plots 47 DAT. Data were analyzed using ARM software and treatment means were compared using Fisher's LSD at $p = 0.05$.

Results and Discussion

There was not much growth (height change) in the control turf fescue plots over the course of the trial (Tables 3, 4, and 5). The lack of inputs, such as nitrogen, may be why. However, 38 DAT almost all turf in all the PGR treated plots was shorter than that in the control plots (Table 5). With the slow fescue growth rate, it took longer for the PGR caused growth reductions to become evident. Plateau (Treatment 3) had the most consistent decrease in fescue height (Tables 3, 4, and 5) which is summarized in Figure 2.

The tall fescue in the turf plots fescue treated with Anuew had the same turf color as that in the control 16 DAT plots (Table 3). Embark and Escort reduced turf color less than the Stronghold and Plateau treatments. No PGR affected turf color 8 DAT (Table 3) but by 23 DAT (Table 4) fescue in all the PGRs plots except those for Anuew (Treatments 8 and 9) was less green than that in the control plots. Color had largely recovered by 47 DAT (Table 5) except fescue treated with Embark (Treatment 1). Color of fescue treated with Anuew Treatments 8 and 9 was consistently not different than that of the control fescue (Tables 3, 4, and 5) (Figure 1).

The Class A (Anuew) and Class C (Embark) PGRs did little to control broadleaves, as was expected. The lowest amount of broadleaves were found in plots treated with Telar, Escort, Perspective or Opensight (Treatments 4, 5, 6, and 7 respectively) 23 DAT (Table 4). By the end of the trial, crabgrass seedheads were evident in many of plots but were less than control in those treated with Plateau (Treatment 3) or Perspective (Treatment 6) (Table 5).

There was growth in the endemic turf plots (6 inches to 7.2 inches in the control plots) over the course of the trial (Tables 6 to 8) (Figure 4) than in the turf type tall fescue plots (Tables 3 to 5). A greater proportion of the canopy in the endemic turf plots was dominated by warm-season grasses such as bermudagrass and nimblewill. PGR effects on height in the endemic turf plots were sporadic but, by the end of the season (47 DAT), the Embark (Treatment 1), height of the turf in the Stronghold (Treatment 2) and Perspective (Treatment 6) treated plots was less than control (Table 8) (Figure 4). Perspective also had less nimblewill in the canopy than other plots at that time.

PGR effects on turf color were also sporadic (Figure 3) but turf in the Embark and Stronghold (Treatments 1 and 2) treated plots was less green 23 (Table 7) and 38 DAT (Table 8). The best

treatments for broadleaf control were Escort, Perspective and Opensight (Treatments 5, 6, and 7) 16 (Table 6), 23 and 32 DAT (Table 7).

There are a number of PGR options for use on cool season turf which will temporarily reduce **turf** height and color rating. These responses can vary depending on the level of inputs. These effects are reduced if the turf is not growing. Anuew did not affect turf color but still temporarily reduced turf height.

Cropper, Kenneth L., "INVESTIGATIONS INTO THE HOME LAWN CARBON BALANCE AND IMPROVING THE EFFICACY OF T-PHYLLOPLANINS FOR COMBATING TURFGRASS DISEASES" (2015). *Theses and Dissertations--Plant and Soil Sciences*. 63.

http://uknowledge.uky.edu/pss_etds/63

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Table 1. PGR treatments, active ingredients, and application rates.

Treatment	Product Names	Rate (per Acre)	Rate Unit	Active Ingredient(s)	ai Rate (per acre)
1	Embark	24	fl oz/a	mefluidide	6 oz ae
2	Stronghold	12	fl oz/a	mefluidide + imazethapyr + imazapyr	2.20 oz ae + 0.53 oz ae + 0.01 oz ae
3	Plateau	2	fl oz/a	imazapic	0.5 oz ae
4	Telar	0.25	oz/a	chlorsulfuron	0.19 oz
5	Escort	0.5	oz/a	metsulfuron methyl	0.3 oz
6	Perspective	4.5	oz/a	aminocyclopyrachlor + chlorsulfuron	1.8 oz + 0.7 oz
7	Opensight	2.5	oz/a	aminopyralid + metsulfuron methyl	1.3 oz ae + 0.23 oz
8	Anuew	8	oz/a	prohexadione calcium	2.2 oz
	AMS	8	oz/a	ammonium sulfate	
9	Anuew	16	oz/a	prohexadione calcium	4.4 oz
	AMS	16	oz/a	ammonium sulfate	
10	Untreated Check				

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

Table 2. PGR treatments, active ingredients, and mechanism of action classification(s).

Treatment	Product Names	Active Ingredient(s)	Mechanism of PGR Action Classification(s)
1	Embark	mefluidide	Class C (mitotic/cell division inhibitor)
2	Stronghold	mefluidide + imazethapyr + imazapyr	Class F (PGR combination) (C + D + D)
3	Plateau	imazapic	Class D (herbicidal)
4	Telar	chlorsulfuron	Class D (herbicidal)
5	Escort	metsulfuron methyl	Class D (herbicidal)
6	Perspective	aminocyclopyrachlor + chlorsulfuron	Class D (herbicidal)
7	Opensight	aminopyralid + metsulfuron methyl	Class D (herbicidal)
8	Anuew AMS	prohexadione calcium ammonium sulfate	Class A (late GA synthesis blocker)
9	Anuew AMS	prohexadione calcium ammonium sulfate	Class A (late GA synthesis blocker)
10	Untreated Check		

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

Table 3. Results from Turf Fescue Plots (8 and 16 Days After Treatment (DAT))

Treatment	Product Names	Rate (per Acre)	Rate Unit	July 16, 2017			July 24, 2017		
				Color (0-9)	Ht (in)	Broadleaf Control (%)	Color (0-9)	Ht (in)	Broadleaf Control (%)
				8 DAT			16 DAT		
1	Embark	24	fl oz/a	7.8	3.8 abc ¹	2 c	7.2 cde	4.0	8 cd
2	Stronghold	12	fl oz/a	7.9	3.7 bc	5 bc	7.0 de	3.8	5 cd
3	Plateau	2	fl oz/a	7.8	3.5 c	13 bc	7.0 de	4.0	15 cd
4	Telar	0.25	oz/a	8.0	3.7 bc	8 bc	7.3 bcde	4.2	33 bc
5	Escort	0.5	oz/a	7.9	3.8 abc	12 bc	7.0 de	4.2	53 ab
6	Perspective	4.5	oz/a	7.8	3.8 abc	18 ab	7.7 abc	4.2	70 a
7	Opensight	2.5	oz/a	7.9	3.7 bc	28 a	6.8 e	4.3	60 ab
8	Anuew	8	oz/a	8.0	4.0 ab	2 c	7.5 abcd	3.8	10 cd
	AMS	8	oz/a						
9	Anuew	16	oz/a	8.0	4.0 ab	0 c	7.8 ab	3.8	13 cd
	AMS	16	oz/a						
10	Untreated Check			8.0	4.2 a	0 c	8.0 a	4.3	0 d

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

¹ Means within a column followed by the same letter are not different according to Fisher's LSD at $P < 0.05$.

Table 4. Results from Turf Fescue Plots (23 and 32 Days After Treatment (DAT))

Treatment	Product Names	Rate (per Acre)	Rate Unit	July 31, 2017			August 9, 2017		
				Color (0-9)	Ht (in)	Broadleaf Control (%)	Color (0-9)	Ht (in)	Broadleaf Control (%)
				23 DAT			32 DAT		
1	Embark	24	fl oz/a	6.8 c ¹	4.0 ab	7 cd	6.3 d	3.7 bc	3 c
2	Stronghold	12	fl oz/a	6.8 c	3.8 ab	12 cd	7.0 cd	4.0 ab	2 c
3	Plateau	2	fl oz/a	6.6 c	3.5 b	33 bc	6.3 d	3.5 c	28 b
4	Telar	0.25	oz/a	7.2 bc	3.7 ab	60 ab	8.0 a	3.8 abc	15 bc
5	Escort	0.5	oz/a	6.8 c	4.0 ab	80 a	7.3 bc	3.8 abc	85 a
6	Perspective	4.5	oz/a	6.8 c	3.8 ab	73 a	7.2 bc	4.0 ab	77 a
7	Opensight	2.5	oz/a	7.0 c	3.8 ab	75 a	7.8 ab	4.0 ab	85 a
8	Anuew	8	oz/a	7.8 ab	3.7 ab	25 cd	8.0 a	4.0 ab	5 c
	AMS	8	oz/a						
9	Anuew	16	oz/a	7.8 ab	4.0 ab	15 cd	8.0 a	3.7 bc	2 c
	AMS	16	oz/a						
10	Untreated Check			8.0 a	4.2 a	0 d	8.0 a	4.2 a	0 c

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

¹ Means within a column followed by the same letter are not different according to Fisher's LSD at $P < 0.05$.

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Table 5. Results from Turf Fescue Plots (38 and 47 Days After Treatment (DAT))

Treatment	Product Names	Rate (per Acre)	Rate Unit	August 15, 2017		August 24, 2017		
				Color (0-9)	Ht (in)	Color (0-9)	Ht (in)	Crabgrass Seedheads (0-4)
				38 DAT		47 DAT		
1	Embark	24	fl oz/a	6.8 c ¹	3.5 de	6.7 b	3.5 c	2.0 ab
2	Stronghold	12	fl oz/a	7.4 abc	4.0 bc	7.3 ab	3.8 bc	1.7 ab
3	Plateau	2	fl oz/a	6.9 c	3.3 e	7.3 ab	3.5 c	0.3 c
4	Telar	0.25	oz/a	7.7 ab	4.0 bc	7.6 a	4.0 ab	2.7 a
5	Escort	0.5	oz/a	7.8 a	3.7 cde	7.7 a	4.3 a	2.3 a
6	Perspective	4.5	oz/a	7.2 bc	3.7 cde	7.3 ab	4.0 ab	1.0 bc
7	Opensight	2.5	oz/a	7.9 a	3.8 bcd	8.0 a	4.3 a	2.7 a
8	Anuew	8	oz/a	8.0 a	4.0 bc	8.0 a	3.8 bc	2.0 ab
	AMS	8	oz/a					
9	Anuew	16	oz/a	8.0 a	4.2 ab	8.0 a	4.0 ab	2.0 ab
	AMS	16	oz/a					
10	Untreated Check			8.0 a	4.5 a	8.0 a	4.3 a	2.0 ab

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

¹ Means within a column followed by the same letter are not different according to Fisher's LSD at $P < 0.05$.

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Table 6. Results from Endemic Turf Plots (8 and 16 Days After Treatment (DAT))

Treatment	Product Names	Rate (per Acre)	Rate Unit	July 16, 2017			July 24, 2017		
				Color (0-9)	Ht (in)	Broadleaf Control (%)	Color (0-9)	Ht (in)	Broadleaf Control (%)
				8 DAT			16 DAT		
1	Embark	24	fl oz/a	8.0 a ¹	5.7	2 bc	7.5 ab	5.8 ab	10 c
2	Stronghold	12	fl oz/a	7.9 b	5.7	3 bc	8.0 a	5.8 ab	8 c
3	Plateau	2	fl oz/a	8.0 a	5.8	5 bc	7.3 ab	6.0 ab	13 c
4	Telar	0.25	oz/a	8.0 a	5.8	2 bc	7.7 ab	6.7 a	8 c
5	Escort	0.5	oz/a	8.0 a	5.8	7 b	7.5 ab	6.3 a	37 b
6	Perspective	4.5	oz/a	8.0 a	5.8	20 a	7.7 ab	6.2 ab	62 a
7	Opensight	2.5	oz/a	8.0 a	5.8	15 a	7.0 b	6.5 a	67 a
8	Anuew	8	oz/a	8.0 a	6.0	2 bc	7.8 a	6.3 a	13 c
	AMS	8	oz/a						
9	Anuew	16	oz/a	8.0 a	6.3	1 c	7.3 ab	5.2 b	5 c
	AMS	16	oz/a						
10	Untreated Check			8.0 a	6.0	0 c	8.0 a	6.3 a	0 c

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

¹ Means within a column followed by the same letter are not different according to Fisher's LSD at $P < 0.05$.

Table 7. Results from Endemic Turf Plots (23 and 32 Days After Treatment (DAT))

Treatment	Product Names	Rate (per Acre)	Rate Unit	July 31, 2017			August 9, 2017		
				Color (0-9)	Ht (in)	Broadleaf Control (%)	Color (0-9)	Ht (in)	Broadleaf Control (%)
				23 DAT			32 DAT		
1	Embark	24	fl oz/a	7.2 c ¹	6.3 ab	5 cd	7.3	5.0 d	10 c
2	Stronghold	12	fl oz/a	7.5 bc	6.0 b	8 cd	7.8	5.0 d	8 c
3	Plateau	2	fl oz/a	7.7 ab	6.0 b	18 c	7.9	6.0 c	15 c
4	Telar	0.25	oz/a	8.0 a	6.2 ab	10 cd	8.0	6.7 ab	5 c
5	Escort	0.5	oz/a	7.8 ab	6.3 ab	65 ab	7.8	6.0 c	55 ab
6	Perspective	4.5	oz/a	7.7 ab	6.3 ab	53 b	7.5	6.0 c	70 a
7	Opensight	2.5	oz/a	7.9 ab	7.2 a	68 a	8.0	6.8 a	51 b
8	Anuew	8	oz/a	7.8 ab	6.7 ab	8 cd	7.8	6.3 abc	5 c
	AMS	8	oz/a						
9	Anuew	16	oz/a	7.7 ab	6.2 ab	10 cd	7.8	6.2 bc	5 c
	AMS	16	oz/a						
10	Untreated Check			8.0 a	6.5 ab	0 d	8.0	6.3 abc	0 c

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

¹ Means within a column followed by the same letter are not different according to Fisher's LSD at $P < 0.05$.

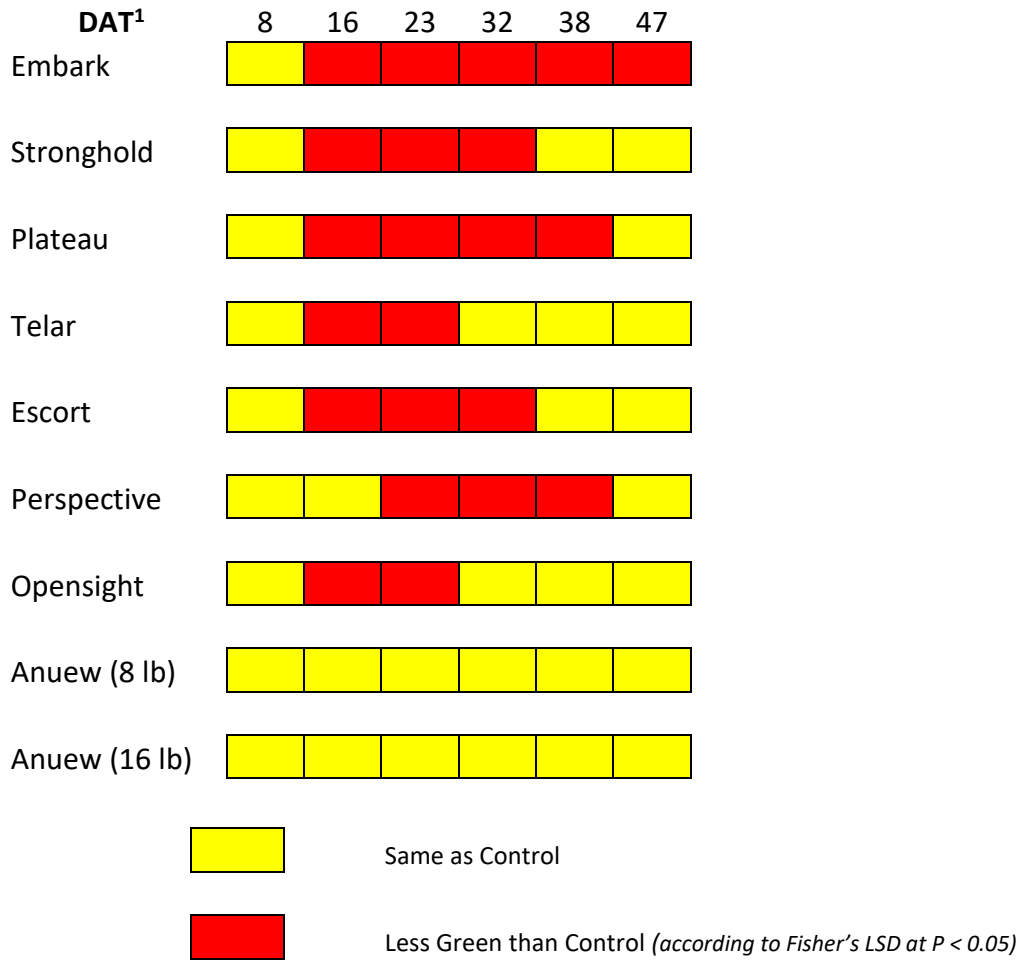
Table 8. Results from Endemic Turf Plots (38 and 47 Days After Treatment (DAT))

Treatment	Product Names	Rate (per Acre)	Rate Unit	August 15, 2017		August 24, 2017	
				Color (0-9)	Ht (in)	Color (0-9)	Ht (in)
				38 DAT		47 DAT	
1	Embark	24	fl oz/a	7.5 c	5.5 c	7.4 b	5.5 c
2	Stronghold	12	fl oz/a	7.8 b ¹	6.0 bc	7.7 ab	6.2 bc
3	Plateau	2	fl oz/a	8.0 a	6.7 ab	8.0 a	6.7 ab
4	Telar	0.25	oz/a	8.0 a	6.7 ab	8.0 a	7.0 ab
5	Escort	0.5	oz/a	8.0 a	7.0 ab	7.9 a	7.3 a
6	Perspective	4.5	oz/a	8.0 a	6.3 bc	7.9 a	6.2 bc
7	Opensight	2.5	oz/a	8.0 a	7.7 a	8.0 a	7.5 a
8	Anuew	8	oz/a	7.9 ab	6.7 ab	8.0 a	6.7 ab
	AMS	8	oz/a				
9	Anuew	16	oz/a	7.9 ab	6.3 bc	7.8 ab	6.7 ab
	AMS	16	oz/a				
10	Untreated Check			8.0 a	6.3 bc	8.0 a	7.2 a

All herbicide treatments contained the adjuvant, Activator 90 at 0.25% v/v.

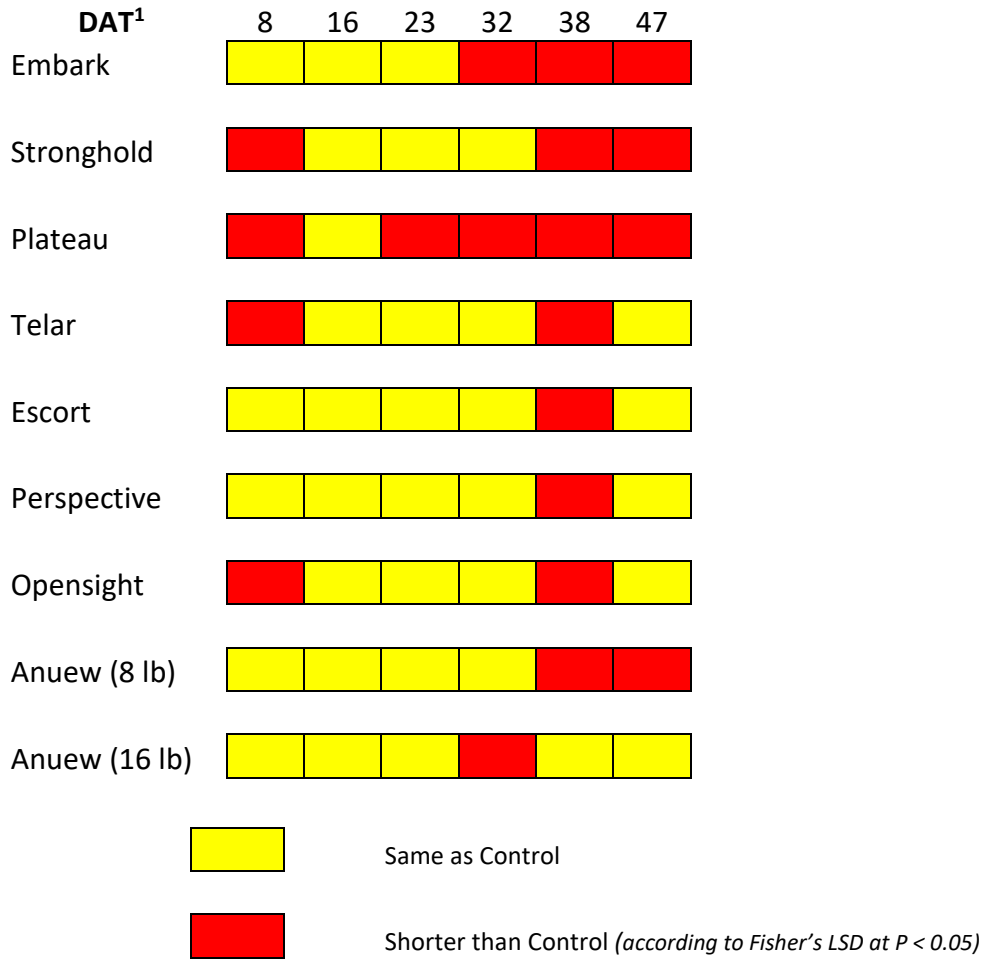
¹ Means within a column followed by the same letter are not different according to Fisher's LSD at $P < 0.05$.

Figure 1. Summary of Turf Type Fescue Color



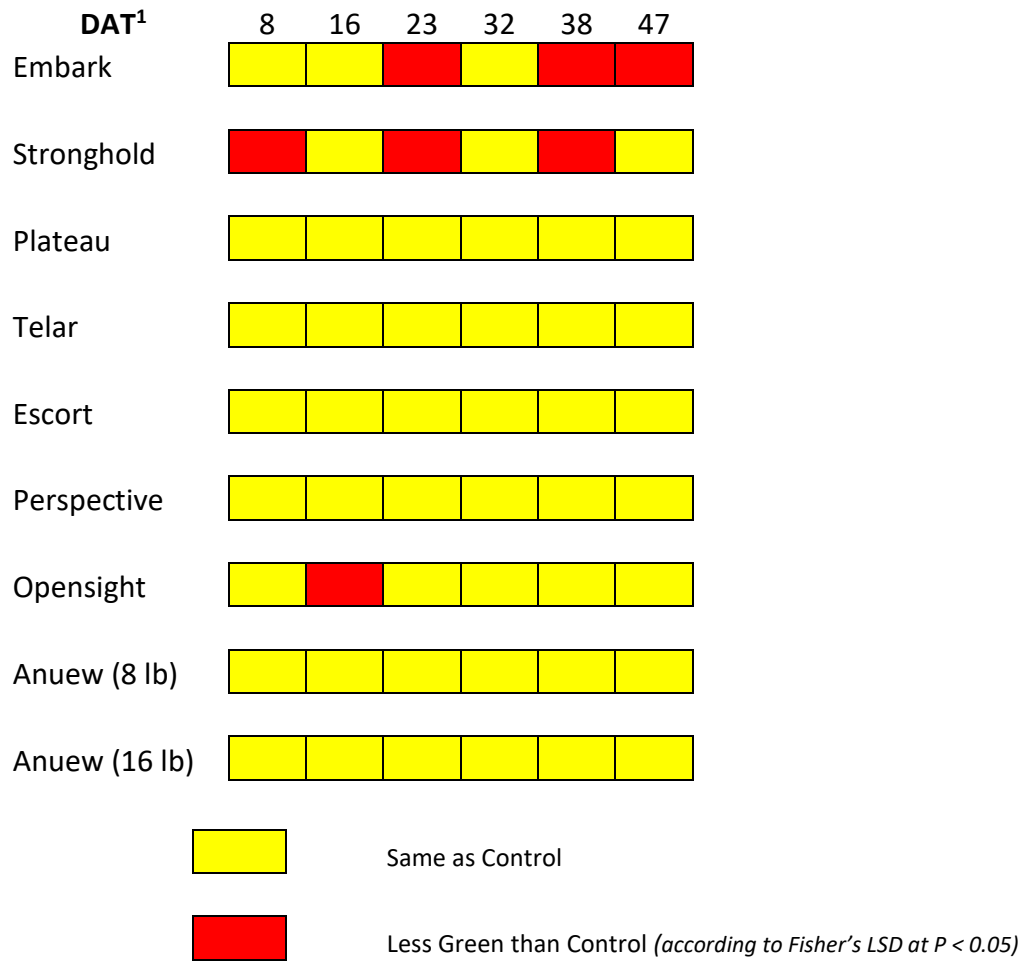
¹ DAT = Days after treatment

Figure 2. Summary of Turf Type Fescue Height



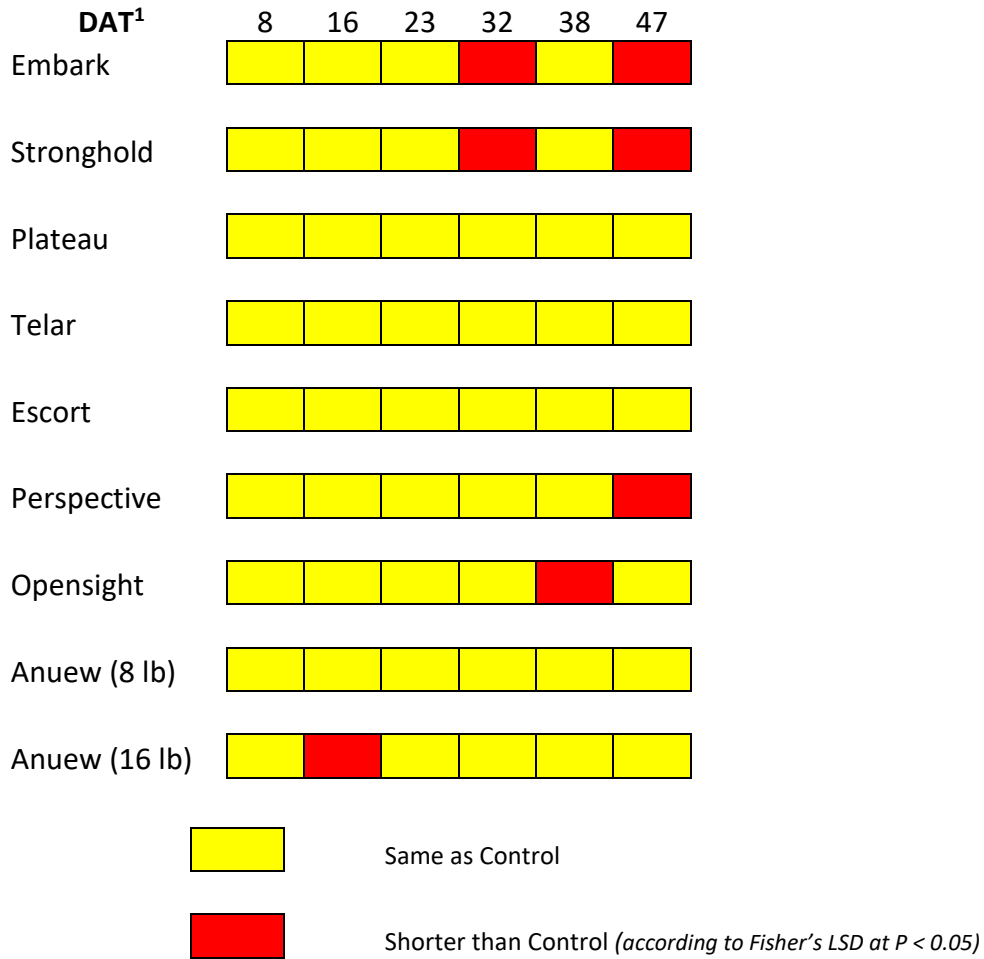
¹ DAT = Days after treatment

Figure 3. Summary of Endemic Turf Color



¹ DAT = Days after treatment

Figure 4. Summary of Endemic Turf Height



¹ DAT = Days after treatment