

# Green-Up of Dormant Bermudagrass After Applications of Early Spring Pre-Emergence Herbicides

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## **ABSTRACT**

*Six treatments of pre-emergence herbicides were evaluated for their effects on the spring green-up of dormant non-overseeded bermudagrass turf. Plot composition (percent yellow, percent green, percent straw or dormant turf) components were affected by herbicides to various extents on March 27, April 20, and April 27. Percent plot yellow turf was least in occurrence for BARRICADE, PENDULUM, and SURFLAN at 25 days after the first treatment. At 25 days after the first application (March 27) PENDULUM produced the lowest amount of green turf (13%) among treated turfs. At 50 days after the first application (April 20) PENDULUM treated turf had the greatest amount of yellow turf (63%), and the least amount of green turf present (18%). Turfgrass color was affected by herbicide treatments (on June 2, 30 days after the second treatment). The TEAM-PRO product had the darkest noticeable turf at this time. Herbicides had no affect on: A) visual estimates of turfgrass density B) number of lateral (horizontal) green stolons in the turf mat C) number of subterranean rhizomes D) root pegging of surface stolons. Green-up responses were short-lived from the herbicides evaluated at product rates tested.*

## **Introduction**

Each year, pre-emergence herbicides are applied for the safe and efficacious removal of both grassy and select broadleaf weeds in turf. The selection of the herbicide depends on the following conditions: (1) type of weeds to be controlled and (2) the type of turfgrass present.

Within a desert turfgrass management scheme, pre-emergence herbicides are usually applied in the desert valley areas in late February to early March for cupgrass, crabgrass, goosegrass, and broadleaf spurge control. More often, spring applied pre-emergence herbicides are applied to overseeded turf, which goes through a transition period from ryegrass to bermudagrass. Otherwise, pre-emergence herbicides are applied to dormant bermudagrass (at that time period, for those weeds above). Little is known if pre-emergence herbicides affect the spring green-up of non-overseeded, dormant bermudagrass turf. A group of selected pre-emergence used to control grassy weeds was evaluated for their potential effects on spring green-up of non-overseeded, dormant bermudagrass.

## **Materials and Methods**

A 60' x 60' area of dormant common bermudagrass turf at the Country Club of Green Valley was selected for a field test to evaluate six treatments for potential Spring green-up effects. The six treatments included a representation of typically used pre-emergence herbicides for grassy-weed control. The product or product combinations included the following:

SURFLAN (Oryzalin) applied at 1.5 lbs. ai/a

TEAM-PRO (Trifluralin) applied at 2.0 lbs. ai/a

PENDULUM (Pendimethalin) applied at 1.5 lbs. ai/a

BARRICADE (Prodiamine) applied at 0.5 lbs. ai/a

RONSTAR (Oxadiazon) applied at 1.5 lbs. ai/a

Each of the above treatments was applied to 5' x 10' plots on March 2, and again as repeat applications on May 2, 2000. A split-application (two product) treatment of TEAM-PRO and SURFLAN was also included. This timing sequence would reflect a normal application window, while the second additional application would enhance Summer weed emergence and, perhaps exacerbate any previous effect from the former (first) application event (as far as turf growth was concerned).

Liquid formulations (SURFLAN 4AS, PENDULUM 60 WDG, BARRICADE 65 WDG) were applied using a 3 nozzle boom (five feet spray width) at 72 GPA final spray solutions volume. Other products were applied with a calibrated drop spreader. All treatments plus controls appeared four times in a randomized complete block design.

The turf received no fertilizer until June 2, when 1.0 lb. N/M was applied from a 21.7.14 fertilizer. Treatments were watered-in immediately after application. Regular tri-weekly irrigations for full green-up and use of the bermudagrass (rough) occurred on the April date. The test plots were mowed twice weekly at 1 1/4 inches, with a seven gang reel mower.

Data collection included visual estimates of plot composition comprised of the % yellow turf, % green turf, % straw (dormant) turf, turfgrass color, % weed infestation, and turfgrass density at various times from March 27, to June 23. On July 6, two sub-sample plugs were removed from plots using a 4.0 inch cup-cutter. From the cut edge of each plug, the number of rhizomes was counted. Stolon counts were made as the number of horizontal stolons at the soil surface from the same identical plug. These quantitative counts were made to assess if herbicide treatments affected these growth parameters at the end of the spring season after two herbicide applications.

All data were subjected to the analysis of variance technique using SAS software. Least significant difference values were calculated to compare treatment means only when the F-ratio for the treatment main effect was significant at P=0.10 or less.

Percent plot composition tables were constructed in order to best interpret plot composition between treatments across dates to observe biological performance trends in Spring-green-up patterns. Note that plot data, collected on March 27, April 20, and April 27, reflect data from the first application only, while data collected on June 2, June 23, and July 6 reflect responses after the second repeat application.

## **Results and Discussion**

### **Turfgrass Green-up and Plot Composition After Application #1 (applied March 2, 2000)**

After the first application, plots were rated for percent plot yellow, green, and dormant foliage (0-100%). The turf at green-up first appeared somewhat chlorotic, which is typical for bermudagrass in the early spring. This is due to cool soil temperatures and cool night air temperatures (below 60° F). Percent live turf cover was calculated as the sum of both the percents of "green" and "yellow" turf. The percent "straw" represented dormant bermudagrass leaves and carryover of previous seed heads.

The percent plot "yellow" turf for untreated control plots on March 27 and April 20 was 7% and 60% plot cover, respectively (Table 1).

The percent plot "green" turf for the untreated control plots for March 27, April 20, and April 27 was 18%, 25%, and 81%, respectively. This demonstrates that a large portion of the turf was very light green (or yellow) at 'spring green-up', before becoming darker in color as temperatures increased (Tables 1,2).

For the March 27 ratings, turfs treated with TEAM-PRO products were more yellow in color than the control. SURFLAN had a minimal effect on leaf yellowing (1%). Percent “green” turf ranged from 18% to 29% plot cover, and were not significant due to treatments. The plots were largely dormant at this time, ranging from 69% to 84% dormant. TEAM-PRO treated turf had the greatest amounts of non-dormant turf (40%-41%), followed by BARRICADE (31%) (Table 1).

As of April 20, the turf continued in green-up rate. The percent live cover ranged from 76% to 80% among all treated turf, but there were large differences between treated turfs based on the relative amounts of yellow versus green foliage. For example, PENDULUM caused 63% yellow turf, and 18% green turf. SURFLAN had 47% yellow, and 29% green turf. TEAM-PRO products had the largest amount of green turf (45%-55%), followed by RONSTAR (40%). All treatments had less yellow foliage than the controls, as the untreated turf averaged 60% yellow foliage on April 20. Also of interest, is the fact that most treated turfs had larger percent green turf values than the control on April 20 (with the exception of PENDULUM (18% green turf versus the control having 25% green plot surface). The percent dormant bermuda (%straw) was not affected by treatments, and ranged from 15% to 25% of the plot composition. Therefore, the major responses in April for green-up were differences between relative amounts of green versus yellow canopy foliage, while the total amount of non-dormant foliage was not affected (Table 1).

On April 27, percent plot “green”, percent total live vegetative cover, and turfgrass color responses were not affected by “herbicide treatments”. TEAM-PRO products had the darkest color turf, even though in this low maintenance situation, it achieved mean color scores of only 5.5 to 5.7. There was no yellow foliage present at this time. The “percent straw” at this time represented old bermudagrass seed heads, and not foliage. The sum of the foliage and seed heads represented the percent “live cover” for April 27. There was very little difference between treatments, or among all treated turf when compared to the controls. TEAM-PRO containing products did have about 50% less seed heads versus the untreated control, however (Table 2).

The second treatment applications were made on May 2 (eight weeks after the first treatment). Therefore, plot evaluations made on June 2, June 23, and July 6 represent turf responses after two applications.

#### **Turfgrass Responses After Application #2 (May 2, 2000)**

On June 2, plots were rated for turfgrass color, and percent plot composition variables. The “treatment” main effect was significant only for turfgrass color. The TEAM-PRO repeat treatment was the darkest, with a mean color score of 8.0. SURFLAN, PENDULUM, and BARRICADE treated turfs were very light green in color (4.3 and 4.5). Scores within 4.0 to 5.0 would be very noticeable to the lay person as being pale green in appearance. The large amount of percent plot straw present originated from seed head stalks and foliage which was not mowed off, since fertilizer was not yet applied to the plots in 2000. The first application of fertilizer was applied on June 3 (1 lb. N/M from a 21-7-14 grade fertilizer) (Table 2).

Approximately three weeks later, on June 23, plots were rated for percent straw turf, percent green turf, overall turfgrass color, and visual estimates of shoot density. The treatment main effect was significant for percent straw and percent green turf composition, but not for color or density ratings. At this time (after the first fertilization), all plots (with the exception of BARRICADE) were slightly lighter in color than the control plots, which after fertilization had a mean color score of 6.3. The BARRICADE turf was numerically darkest (mean = 6.5), noting, however, that statistically no difference, existed due to herbicide treatments (Table 3).

SURFLAN, PENDULUM, and BARRICADE turfs had the lowest amount of percent straw turf (6% to 9%, on average). TEAM-PRO as a repeat treatment ranked highest, with 18% of the plot cover being straw colored. This may be from scalping former growth. There were no visible or statistical differences for visual turfgrass density, as all treatments scored mean density values of 5.5 to 6.0. This is a function of the lower shoot density of common bermudagrass, when mowed at a golf course rough height of 1.25 inches.

#### **Weed Control**

Weed control was not an objective of this test, and there were no natural infestations of summer annual grassy weeds or spurge present. However, there was a naturally occurring stand of wild celery, A.K.A wild parsley,

A.K.A. parsley piert. This weed is believed to be biennial in life cycle. Percent plot weed infestation levels (0-100% of plot cover) were assigned to plots on June 2 and June 23. The “treatment” effect was not significant for the amount of weed present on either date. Treatments ranged from 16% to 24% plot cover wild celery on June 2, and from 10% to 18% on June 23. It was interesting that the untreated control averaged lesser amounts of wild celery versus most of the herbicide treated turfs. This was not statistically significant, however (Table 4).

### **Plant Growth**

Nodal rooting of stolons (using a subjective scale of 1=no pegging, 3 = strong pegging) was used to assess potential treatment effects on stolon rooting of the common bermudagrass. This proved difficult to assess since most stolons were upright in stature exhibiting a strong vertical elongation preference. Rooting index values for stolons ranged from 1.8 to 2.5, with the untreated controls having a mean of 2.0. PENDULUM and BARRICADE seemed to promote the most pegging, but differences within each plot demonstrated a great degree of within-plot variation. The products containing TEAM-PRO seemed to have slightly less pegging of the stolons at 30 days after the second treatment (Table 5).

Two plugs (4.0 inch diameter) were randomly sampled from each plot on July 6. The vertical stolons were sheared off with hand clippers only. The number of horizontal green stolons within the grass mat was then counted within the 360° edge of the plug. Within the same plug, the number of white rhizomes was counted at the lower base of the turf mat.

There were between two and three times more rhizomes than lateral creeping stolons present (Table 7). However, there was no “herbicide treatment” effect for the numbers of stolons or rhizomes. Mean horizontal stolon numbers ranged from 7.6 to 11.0 stolons per plug. The untreated control had 8.5 stolons per plug, on average. Rhizome numbers per plug ranged (on average) from 17.7 to 25.3. The control averaged 22.2 rhizomes per plot. Again, these field growth responses were not affected by any herbicide treatments (Table 5).

### **Conclusion**

1. Six commercially available pre-emergence herbicides were applied to non-overseeded bermudagrass on March 2 and again on May 2 to assess any potential affects on spring green-up and early summer growth of common bermudagrass on a golf course rough.
2. Plot composition (percent yellow, percent green, percent straw or dormant turf) components were affected by herbicides to various extents on March 27, April 20, and April 27.
3. Percent plot yellow turf was least for BARRICADE, PENDULUM, and SURFLAN at 25 days after the first treatment.
4. At 25 days after the first application (March 27) PENDULUM produced the lowest amount of green turf (13%) among treated turfs.
5. At 50 days after the first application (April 20) PENDULUM treated turf had the greatest amount of yellow turf (63%), and the least amount of green turf present (18%).
6. At 50 days after the first treatment (April 20), percent live plot cover was not affected by treatment.
7. Turfgrass color was affected by herbicide treatments (on June 2, 30 days after the second treatment). The TEAM-PRO product had the darkest noticeable turf by this time.
8. By June 23 (50 days after the second treatment) SURFLAN treated common bermudagrass had the least amount of percent plot green turf (86%) among herbicide treated turf.
9. Herbicides had no affect on:
  - A) visual estimates of turfgrass density
  - B) number of lateral (horizontal) green stolons in the turf mat
  - C) number of subterranean rhizomes
  - D) root pegging of surface stolons

10. Green-up responses were short-lived from the herbicides evaluated at product rates tested.

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TABLE 1: MEAN TURFGRASS COMPOSITION VALUES FOR NON-OVERSEEDED DORMANT BERMUDAGRASS AFTER TREATMENTS WITH SELECT PRE-EMERGENCE HERBICIDES  
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<u>HERBICIDE</u> <u>TREATMENT</u>	<u>RATE</u> <u>lb. ai/a</u>	<u>APPLICATION</u> <u>DATES</u>	<u>MARCH 27</u>				<u>APRIL 20</u>				<u>% LIVE</u> <u>COVER</u>
			<u>% YELLOW</u>	<u>% GREEN</u>	<u>% STRAW</u>	<u>% LIVE COVER</u>	<u>% YELLOW</u>	<u>% GREEN</u>	<u>% STRAW</u>	<u>% LIVE COVER</u>	
SURFLAN	1.5	3/2 : 5/2	1	23	76	24	47	29	25	75	
TEAM-PRO	2.0	3/2 : 5/2	13	29	59	41	35	45	20	80	
TEAM-PRO	2.0	3/2									
SURFLAN	1.5	: 5/2	15	25	61	40	21	55	24	76	
PENDULUM	1.5	3/2 : 5/2	3	13	84	16	63	18	20	80	
BARRICADE	0.5	3/2 : 5/2	4	27	69	31	40	38	23	78	
RONSTAR	1.5	3/2 : 5/2	8	18	74	26	36	40	24	76	
CONTROL	-	-	7	18	74	25	60	25	15	85	
TEST MEAN	<sup>5</sup>		7	22	71	29	43	36	21	79	
LSD VALUE	<sup>6</sup>		8	NA	17	17	27	22	NA	NA	

% Yellow Turf = (0 - 100% of plot surface.) Values are the mean of four replications.

% Green Turf = (0 - 100% of plot surface.) Values are the mean of four replications.

% Straw Turf = (0 - 100% of plot surface.) Values are the mean of four replications.

% Live Cover = Sum of both % Yellow and % Green Turf (0 - 100% of plot surface). Values are the mean of four replications.

Test Mean = Mean of all plots on each test date.

LSD Value = Least significant difference mean separation statistic. Absolute value between two means must be larger than the LSD value for treatment differences to occur.

TABLE 2: MEAN TURFGRASS COLOR AND COMPOSITION VALUES FOR NON-OVERSEEDED DORMANT BERMUDAGRASS AFTER TREATMENTS WITH SELECT PRE-EMERGENCE HERBICIDES  
UNIVERSITY OF ARIZONA, 2000

<u>HERBICIDE</u> <u>TREATMENT</u>	<u>RATE</u> <u>lb. ai/a</u>	<u>APPLICATION</u> <u>DATES</u>	<u>APRIL 27</u>				<u>JUNE 02</u>			
			<u>COLOR</u>	<u>% GREEN</u>	<u>% STRAW</u>	<u>% LIVE COVER</u>	<u>COLOR</u>	<u>% GREEN</u>	<u>% STRAW</u>	<u>% LIVE COVER</u>
SURFLAN	1.5	3/2 : 5/2	4.8	75	11	86	4.5	71	29	100
TEAM-PRO	2.0	3/2 : 5/2	5.7	83	6	89	8.0	86	14	100
TEAM-PRO	2.0	3/2								
SURFLAN	1.5	: 5/2	5.5	89	6	95	5.5	75	25	100
PENDULUM	1.5	3/2 : 5/2	3.7	72	15	87	4.3	78	23	100
BARRICADE	0.5	3/2 : 5/2	4.8	83	10	92	4.5	73	28	100
RONSTAR	1.5	3/2 : 5/2	4.5	86	10	96	5.3	71	28	100
CONTROL	-	-	4.3	81	11	93	5.3	74	26	100
TEST MEAN			4.7	82	10	91	5.3	75	25	100
LSD VALUE			NA	NA	5	NA	1.0	NA	NA	NA

Color = (1 - 9) 1 = dead, 9 = darkest possible. Values are the mean of four replications.

% Green Turf = (0 - 100% of plot surface.) Values are the mean of four replications.

% Straw Turf = (0 - 100% of plot surface.) Values are the mean of four replications.

% Live Cover = Sum of both % Yellow and % Green Turf (0 - 100% of plot surface). Values are the mean of four replications.

Test Mean = Mean of all plots on each test date.

LSD Value = Least significant difference mean separation statistic. Absolute value between two means must be larger than the LSD value for treatment differences to occur.

TABLE 3: MEAN TURFGRASS COLOR, PLOT COMPOSITION AND VISUAL DENSITY OF NON-OVERSEEDED BERMUDAGRASS AFTER TREATMENT WITH SELECT PRE-EMERGENCE HERBICIDES

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JUNE 23

1 2 3 4

<u>HERBICIDE TREATMENT</u>	<u>RATE lb. ai/a</u>	<u>APPLICATION DATES</u>	<u>COLOR</u>	<u>% STRAW</u>	<u>% GREEN</u>	<u>DENSITY</u>
SURFLAN	1.5	3/2 : 5/2	5.8	8	93	5.8
TEAM-PRO	2.0	3/2 : 5/2	5.5	18	83	5.5
TEAM-PRO SURFLAN	2.0 1.5	3/2 : 5/2	5.5	14	86	5.5
PENDULUM	1.5	3/2 : 5/2	5.8	9	91	5.8
BARRICADE	0.5	3/2 : 5/2	6.5	6	94	5.8
RONSTAR	1.5	3/2 : 5/2	5.5	10	90	5.5
CONTROL	-	-	6.3	11	89	6.0
TEST MEAN	<sup>5</sup>		5.8	11	89	5.7
LSD VALUE	<sup>6</sup>		NA	7	8	NA

Color = (1 - 9) 1 = dead, 9 = darkest possible. Values are the mean of four replications.

% Straw Turf = (0 - 100% of plot surface.) Values are the mean of four replications.

% Green Turf = (0 - 100% of plot surface.) Values are the mean of four replications.

Density = (1 - 9) 1=dead, 9 = best possible, most dense.

Test Mean = Mean of all plots on each test date.

LSD Value = Least significant difference mean separation statistic. Absolute value between two means must be larger than the LSD value for treatment differences to occur.

TABLE 4: MEAN WEED PERCENT INFESTATION LEVELS OF NON-OVERSEEDED DORMANT BERMUDAGRASS AFTER TREATMENTS WITH SELECT HERBICIDES

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<u>HERBICIDE</u> <u>TREATMENT</u>	<u>RATE</u> <u>lb. ai/a</u>	<u>APPLICATION</u> <u>DATES</u>	<u>PERCENT WILD CELERY</u>	
			<u>JUNE 02</u>	<u>JUNE 23</u>
SURFLAN	1.5	3/2 : 5/2	24	14
TEAM-PRO	2.0	3/2 : 5/2	24	10
TEAM-PRO	2.0	3/2		
SURFLAN	1.5	: 5/2	23	17
PENDULUM	1.5	3/2 : 5/2	25	18
BARRICADE	0.5	3/2 : 5/2	16	14
RONSTAR	1.5	3/2 : 5/2	20	14
CONTROL	-	-	12	14
TEST MEAN	<sup>2</sup>		21	14
LSD VALUE	<sup>3</sup>		NA	NA

<sup>1</sup> % Wild Celery = (0 - 100% of plot infested). Values are the mean of eight replications.

<sup>2</sup> Test Mean = Mean of all plots on each test date.

<sup>3</sup> LSD Value = Least significant difference mean separation statistic. Absolute value between two means must be larger than the LSD value

TABLE 5: MEAN NODAL ROOTING INDEX VALUES, STOLON AND RHIZOME COUNTS OF NON-OVERSEEDED DORMANT BERMUDAGRASS AFTER TREATMENT WITH SELECT PRE-EMERGENCE HERBICIDES

UNIVERSITY OF ARIZONA, 2000

<u>HERBICIDE TREATMENT</u>	<u>RATE lb. ai/a</u>	<u>APPLICATION DATES</u>	1		
			NODAL ROOTING INDEX	# STOLONS/PLUG	# RHIZOMES/PLUG
			JUNE 02	JULY 06	JULY 06
SURFLAN	1.5	3/2 : 5/2	2.0	6.0	18.8
TEAM-PRO	2.0	3/2 : 5/2	1.5	8.3	21.1
TEAM-PRO	2.0	3/2			
SURFLAN	1.5	: 5/2	1.8	7.6	18.5
PENDULUM	1.5	3/2 : 5/2	2.5	8.3	20.5
BARRICADE	0.5	3/2 : 5/2	2.5	11.0	25.3
RONSTAR	1.5	3/2 : 5/2	2.0	8.3	17.7
CONTROL			2.0	8.5	22.2
TEST MEAN	4		2.0	8.3	20.6
LSD VALUE	5		NA	NA	NA

Nodal rooting index of above ground stolons = (1 - 3). 1 = no pegging, 3 = full pegging at all nodes. Values are the mean of 24 observations per treatment.

Number of lateral horizontal stolons per 4.0 inch round plug. Values are the mean of eight observations.

Number of subterranean rhizomes per 4.0 inch round plug. Values are the mean of eight replications.

Test Mean = Mean of all plots on each test date.

LSD Value = Least significant difference mean separation statistic. Absolute value between two means must be larger than the LSD value for treatment differences to occur.