

COMPARISON OF MULTIPLE RATES OF APOGEE® AND PALISADE™ FOR 'CHEYENNE' BERMUDAGRASS SEED PRODUCTION

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ABSTRACT

Usage of gibberellic acid inhibitors have been documented to increase seed harvest of grasses in the Pacific Northwest, but had not been evaluated for bermudagrass seed production in the low desert. Four rates of Palisade™ (1-4 pts/acre) and three rates of Apogee® (7-29 oz) were applied to 'Cheyenne' bermudagrass (*Cynodon dactylon*) to evaluate their effects on seed production. Treatments were applied just prior to inflorescence appearance, and lowest two rates of both chemistries included both single as well as double applications with second application approximately two weeks after experiment initiation. All Palisade™ treatments significantly reduced plant heights and inflorescence heights, as did twice applied Apogee® treatments for plant heights. Most Palisade™ treatments also significantly reduced total inflorescence length as well as opened 'heads'. Data indicate that higher rates of both chemistries and especially Palisade™ significantly reduced seeds per unit area. Of the treatments, only the lowest rate of Apogee® (1 pt/acre) resulted in a numeric increase of seeds/acre compared with the untreated check.

INTRODUCTION

Apogee® (active ingredient = prohexadione calcium; BASF Corp.) and Palisade™ EC (active ingredient = trinexapac-ethyl; Syngenta Crop Protection) are two gibberellic acid inhibitor products that have recently been registered and used on perennial ryegrass production in Oregon and has been shown to increase harvestable yields (Young et al., 2002). This yield increase was thought due to greater number of seeds/unit area at harvest, as well as improvements in seed yield components and improved seed set, likely a benefit of reduced lodging (Young et al., 2002). Additional data have been collected from creeping red fescue, tall fescue and Chewings fescue. All of these species are cool season (C-3 photosynthesis pathway) grasses.

Bermudagrass (*Cynodon dactylon*) is a warm season (C-4 photosynthetic pathway) grass species, and has a different photosynthetic pathway than C-3 grass species. Apogee® and Palisade™ have not previously been evaluated for their effects on bermudagrass seed production in the desert southwest. It is unknown if similar effects to those documented on C-3 pathway grasses will be documented when used on bermudagrass.

Potential benefits of gibberellic acid inhibition products on bermudagrass seed production include increased seed production as well as decreased leaf/stem volume at time of harvest. The latter is important as it would increase harvest efficiency in fields as less material would be needed to be threshed thereby decreasing manhours and machine hours associated with harvest, especially with a tall common bermudagrass variety such as 'Cheyenne'. Some potential negative effects for seed production are known for the active ingredient in one product however.

Trinexapac-ethyl, the active ingredient in Palisade™ EC, is also the active ingredient in Primo MAXX, which is registered for turf growth management purposes, including various varieties of bermudagrass. The Primo MAXX label notes that high rates will result in seed

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suppression of hybrid bermudagrass. Label information for common bermudagrass indicated usage rates more than 2x higher than those for hybrid bermudagrass, indicating that common bermudagrass varieties may be less sensitive in their response to trinexapac-ethyl than hybrid bermudagrass varieties.

METHODS AND MATERIALS

Plots were 25 ft long x 6 ft wide and treatments were replicated four times using a randomized complete block design. Treatments were first applied the morning of Sept. 18, 2004, with a backpack battery powered sprayer calibrated to deliver 22.3 gpa. First Choice BreakThru (a non-ionic wetter/spreader/penetrant surfactant consisting of 100% polyether-polymethylsiloxane-copolymer, Plant Health Technologies) was added to all treatments at the rate of 0.0625% (8 oz/100 gal).

Initial treatments consisted of three rates (7, 14 and 29 oz/acre) of Apogee® and four rates (1, 2, 3, and 4 pts/acre) of Palisade™ EC. Two sets of plots were treated with the two lowest rates of both chemistries, with half of these plots receiving a second application of the same rate and material on Oct. 3 using the same methods previously stated.

Leaf and inflorescence heights as well as opened inflorescences were obtained on both Oct. 3 and Nov. 7-8. Sampling on Oct. 3 consisted of obtaining leaf heights (nearest cm) of five plants/plot of one replicate and five inflorescence heights/plot from all plots. Opened inflorescences were obtained by placing a square (approximately 12.5 x 12.5 inches) in each plot in two locations and counting the numbers of opened/expanded inflorescences contained therein.

Sampling on Nov. 7-8 consisted of 10 leaf height and 10 inflorescence height measurements per plot in addition to the two squares of opened/ extended inflorescences. Ten inflorescences were also collected from each plot, placed in marked plastic bags and returned to the laboratory where measurements were made of numbers of arms/branches for each panicle, length of each arm/branch, and developing seeds were counted using a dissecting microscope.

After data for each parameter of each plot were obtained, seeds per area were then calculated by multiplying developing seeds/inflorescence x inflorescences per unit area. Data were then analyzed with Fisher's least significant difference (Statgraphics Plus for Windows; Manugistics, Inc.) to determine if significant statistical differences existed between treatments for the various plant parameters.

RESULTS

All Palisade™ treatments significantly reduced plant heights and inflorescence heights, as did twice applied Apogee® treatments for plant leaf heights (Table 1), although the single earlier application did not have this effect. A rate effect for plant leaf height reduction was noted for Palisade™ treatments, especially Nov. 7-8 sampling. Greatest reduction occurred with the 4 pint/acre rate, which resulted in a decrease in plant leaf height of 27.7%, and a decrease in plant inflorescence height of 33.2%.

Most Palisade™ treatments also significantly reduced opened panicles at both sample dates (Table 2). The 1 pt/acre rate was not statistically different on Nov. 7-8 but had 15.6% fewer open/extended inflorescences per unit area. Rate responses for this plant parameter were noted with both chemistries, although Palisade™ treatments had much more pronounced effect than Apogee® at the rates evaluated in this experiment. Of the Apogee® treatments, only the 29 oz/acre rate resulted in a statistical reduction when compared with the untreated check. The 7 oz/acre rate of this chemistry had little effect on this plant parameter.

Almost every Palisade™ treatment also significantly reduced total inflorescence spike length (Table 3), with the exception being the lowest rate. The 14 oz/acre treatment of Apogee® resulted in slight less total spike length than the untreated check, but other rates had little effect. Numbers of spikes/inflorescence were similar.

Treated bermudagrass had similar numbers of seeds/inflorescence to that noted in the untreated check (Table 3), although one treatment (7 oz + 7 oz/acre of Apogee®) did have statistically more seeds. Fewest seeds/inflorescence were noted from plots treated with the two highest Palisade™ rates. Data indicate that higher rates of both chemistries and especially Palisade™ significantly reduced seeds per unit area. Of the treatments, only the lowest rate of Apogee® (1 pt/acre) resulted in a numeric increase of embryonic seeds/acre (60,000,000, a 7.1% increase) compared with the untreated check.

As seed in plots did not mature, the effects of these treatments on seed weight and resulting seed tonnage is unknown. Data indicate that the potential for increasing seed production with these chemistries exists, but probably at lower rates than those evaluated in this experiment.

LITERATURE CITED

Young, WC III, TB Silberstein, TG Chastain and CJ Garbacik. 2002. Grass Seed Production in Oregon: Challenges and Opportunities. Proc. 14th Western Plant Growth Regulator Society Conference. 14:3-7.

Table 1. Inflorescence and plant leaf heights (cm) of 'Cheyenne' bermudagrass seed on October 3 and Nov. 7-8 following application on Sept. 18, 2003.

Treatment	Rate/acre ¹	October 3		November 7-8	
		Leaf Height	Inflorescence	Leaf ht	Inflorescence
Apogee	7 oz	19.6	33.7 ab	26.9 a	34.5 a
Apogee	7 + 7 oz	19.4	33.0 ab	24.1 bc	32.7 ab
Apogee	14 oz	21.6	32.6 ab	24.8 ab	33.1 ab
Apogee	14 + 14 oz	22.2	33.6 ab	23.9 bcd	31.7 b
Apogee	29 oz	18.6	31.2 bc	25.9 ab	34.5 a
Palisade	1 pt	23.4	28.3 de	23.9 bc	30.7 bc
Palisade	1 pt + 1 pt	17.8	29.5 cd	21.7 def	27.8 d
Palisade	2 pts	20.6	25.8 f	22.6 cde	28.6 cd
Palisade	2 pts + 2 pts	19.8	27.6 def	20.6 ef	25.0 ef
Palisade	3 pts	18.6	26.2 ef	21.6 ef	27.0 de
Palisade	4 pts	16.8	22.8 g	19.5 f	23.5 f
Untreated	----	24.0	34.8 a	26.6 a	34.9 a

¹ Second application on Oct. 3, 2003.

Means in columns followed by the same letter are not statistically different at the p<0.05 level (Fisher's LSD test).

Table 2. Opened/extended bermudagrass seed inflorescences per square foot following initial application on Sept. 18, 2003, Palo Verde, CA.

Treatment	Rate/acre ¹	October 3	Nov. 7-8
Apogee	7 oz	41.5 ab	86.5 a
Apogee	7 + 7 oz		65.3 ab
Apogee	14 oz	35.5 bc	64.6 ab
Apogee	14 + 14 oz		71.2 ab
Apogee	29 oz	29.4 bcd	58.7 bc
Palisade	1 pt	28.6 c	73.0 a
Palisade	1 pt + 1 pt		59.2 bc
Palisade	2 pts	17.2 de	52.0 bcd
Palisade	2 pt + 2 pts		36.6 cd
Palisade	3 pts	11.7 e	48.5 bcd
Palisade	4 pints	10.2 e	33.0 d
Untreated Check	---	48.8 a	86.5 a

¹ Second treatment Oct. 3, 2003.

Means in columns followed by the same letter are not statistically different at the p<0.05 level (Fisher's LSD test).

Table 3. Numbers of spikes/inflorescence and total spike length, developing seeds/inflorescence and calculated seeds/acre on Nov. 7-8, 2003, Palo Verde, CA.

Treatment	Rate/acre ¹	Spikes	Total spike Length (cm)	Seeds per inflorescence	Seeds/acre (100,000,000s)
Apogee	7 oz	4.73abc	23.65a	240.7ab	9.03a
Apogee	7 + 7 oz	4.98ab	24.35a	255.1a	7.22ab
Apogee	14 oz	4.70abc	22.05abc	230.5a-d	6.15 bcd
Apogee	14 + 14 oz	4.68 bc	21.97abc	224.5 bcd	6.91abc
Apogee	29 oz	5.03a	24.08a	246.0ab	6.13 bcd
Palisade	1 pt	4.78abc	22.30ab	228.5a-d	7.28ab
Palisade	1 pt + 1 pt	4.85abc	20.73 bcd	232.8abc	6.02 bcd
Palisade	2 pts	4.625 c	18.97 cd	218.5 bcd	4.95 cde
Palisade	2 pt + 2 pts	4.95abc	19.32 bcd	234.3abc	3.78 e
Palisade	3 pts	4.85abc	17.51 d	203.5 d	4.33 de
Palisade	4 pints	4.70abc	16.96 d	206.5 cd	2.97 e
Untreated Check	---	4.75abc	24.02a	224.3 bcd	8.43a

¹ Second application on Oct. 3, 2003.

Means in columns followed by the same letter are not statistically different at the p<0.05 level (Fisher's LSD test).