

# Annual Bluegrass Control in a Creeping Bentgrass Fairway Using Cutless 50W, Primo MAXX 1EC and Various Tank-mix Combinations, Purdue University, 2006.

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## Objective:

To evaluate the effects of monthly applications of the plant growth regulators (PGRs), Cutless 50W, Primo MAXX 1EC and various tank-mixes for their ability to reduce control annual bluegrass (ABG) in a research fairway consisting of a mixed stand of creeping bentgrass and ABG.

## Experimental Procedures:

This field study was conducted at the W.H. Daniel Turfgrass Research and Diagnostic Center at Purdue University, West Lafayette IN, from May 2004 through Oct. 2005. The study area consisted of mixed stand of creeping bentgrass (*Agrostis stolonifera* 'L-93' Huds.) and annual bluegrass (*Poa annua* L.) grown on a Starks-Fincastle silt-loam (fine-silty, mixed, mesic Aeric Ochraqulf) with pH of 7.2. Based on the visual characteristics, very light green color, upright growth habit and prolific seedheads, the annual bluegrass present was deemed to generally be the annual biotype. The creeping bentgrass was planted in Aug. 2003 in an area with a chronic history of ABG and was fully mature prior initiating the PGR treatments. Throughout the growing season the study area was mowed at 0.5 inch three times per week with clippings returned, irrigated to prevent stress and fertilized with approximately 3.0 lbs N/1000 ft<sup>2</sup> yr<sup>-1</sup>. Insect and disease pests were treated on a curative basis with fungicides (chlorothalonil) and insecticides.

All treatments were applied with a pressurized CO<sub>2</sub> (35 psi) sprayer equipped with TeeJet XR 8003 tips calibrated to deliver 2.0 gallons of spray volume per 1000 ft<sup>2</sup>. Treatments were initiated on 15 May, 2004 and subsequently applied; 14 June, 9 July, 10 Aug., 17 Sept., and 19 Oct., 2004. In 2005 treatments were initiated on 17 May, and reapplied on 13 June, 11 July, 8 Aug., 6 Sept., and 4 Oct. The chemical rates and dates of all applications are also footnoted in the data tables. Plots were 5 ft x 10 ft with 1 ft borders and arranged in a randomized complete block with four replications of each treatment. Following each PGR application, overhead irrigation was applied within twelve hours but not before the PGRs had dried on the leaf surface.

Plots were visually assessed on a regular basis (e.g. twice monthly) during the growing season (May-Oct.) for turfgrass color, quality/appearance, chemical phytotoxicity, and percentage annual bluegrass. Color was assessed on a 0-10 scale with 0=brown turf, 10=dark green and 7=acceptable. Quality was assessed on a 0-10 scale with 0=brown, dead turf, 10= optimum color, density and uniformity and  $\geq 7.5$ =acceptable. Annual bluegrass populations were visually assessed on a linear 0-100 % scale where 0=no annual bluegrass present and 100 = total plot coverage. Due to the large number of color and quality ratings, data for each month were pooled into a single monthly value that was used for statistical analysis. All data was subjected to analysis of variance using the SAS system (Statistical Analysis Systems Institute Inc., Cary, N.C.) and treatment means separated using Fisher's protected least significant difference (LSD) test at the (p=0.05) level.

## Results:

Annual bluegrass (ABG) populations varied from 4 to 56 % depending upon rating date and PGR treatment (Table 1). Annual bluegrass populations in the untreated plots fluctuated seasonally and generally followed the traditional pattern of seasonal development associated with the life-cycle of a winter-annual species. This was especially true in 2004 where the highest ABG populations were observed early in the season, lower populations in late-summer and higher populations in the late autumn. During the first year all PGR treatments significantly reduced ABG on 28 May from 56 % in the untreated plots to 31 – 40 % in PGR treated turf. On 16 July,

however, no treatment differences were observed but ABG populations had declined to 20 – 37 %. By 5 Nov., however, PGR effects were again evident and all PGR treatments reduced ABG to, 21-35%, compared to the untreated control (50 % ABG). On the initial rating date in 2005, 28 Apr., three PGR treatments, flurprimidol, 0.25 or 0.50 lbs. a.i./A alone and the flurprimidol (0.50 lbs. a.i./A) + TE were different than the untreated turf ranging from 18-32% and 52% for PGR treated and untreated respectively. On 27 May, only the flurprimidol (0.50 lbs. a.i./A) + TE tank-mix treatments were different. By 18 July, ABG populations had generally decreased and PGR-treated turf contained significantly lower ABG populations than the untreated turf (39 %). By 26 Dec., ABG populations continued to decline in all plots with only 17 % ABG visible in the untreated turf. On this date, four PGR treatments resulted in < 10 % ABG, however, only the flurprimidol alone (0.25 or 0.50 lbs. a.i./A) and flurprimidol (0.25 lbs. a.i./A) + TE treatments were significantly different from the untreated. On the initial rating date in 2006, the following spring, 11 Apr., ABG populations were very similar to the 26 Dec. rating date. By 5 May, however, more dramatic differences from the untreated turf were observed. Both flurprimidol treatments and the flurprimidol (0.50 lbs. a.i./A) + TE tank-mix contained very low (4-8.5 %) ABG populations compared to 25 % in the untreated.

Conclusion. Three PGR treatments were moderately effective for suppressing or reducing ABG to tolerable levels (< 10%). These treatments were; flurprimidol alone (0.25 or 0.5 lbs. a.i./A) and flurprimidol (0.25 or 0.50 lbs. a.i./A) tank-mixed with TE. The most consistently effective treatment for reducing ABG was flurprimidol (0.5 lbs. a.i./A) tank mixed with TE. This treatment resulted in significantly lower ABG relative to the untreated turf on seven of eleven rating dates (Table 1). Additionally, on several dates throughout the study a darker green color was observed due to PGR applications (Table 2). This response, however, was not consistent throughout the year for any PGR treatment. Although the flurprimidol (0.5 lbs. a.i./A) + TE tank-mix was effective for ABG suppression, caution should be exercised when using this treatment as significant turfgrass discoloration and a subsequent reduction in overall turfgrass appearance was observed on several spring and fall rating dates in both years of this study (Tables 2-4).

### **Acknowledgements**

This research was made possible by grant-in-aid from the Midwest Regional Turf Foundation and SePro Corp.

**Table 1.** Annual bluegrass suppression in a mixed creeping bentgrass/annual bluegrass research fairway as affected by flurprimidol, trinexepac-ethyl and various flurprimidol + trinexepac-ethyl tank-mix combinations.

| Plant Growth Regulator (PGR)‡   | Rate         | Percentage annual bluegrass†            |         |          |        |         |         |         |         |          |          |         |
|---------------------------------|--------------|---|---------|----------|--------|---------|---------|---------|---------|----------|----------|---------|
|                                 |              | 2004                                    |         |          |        | 2005    |         |         |         | 2006     |          |         |
|                                 |              | 28 May                                  | 16 July | 17 Sept. | 5 Nov. | 28 Apr. | 27 May  | 18 July | 26 Dec. | 11 Apr.  | 25 Apr.  | 5 May   |
|                                 | lbs ai/A     | ----- Visual percentage (0-100 %) ----- |         |          |        |         |         |         |         |          |          |         |
| Flurprimidol                    | 0.25         | 40.0 b*                                 | 20.0 a  | 14.8 a   | 22.5 b | 32.5 bc | 32.5 ab | 25.0 bc | 4.3 b   | 4.0 bc   | 5.8 bc   | 8.3 b   |
| Flurprimidol                    | 0.50         | 38.8 b                                  | 28.8 a  | 17.3 a   | 25.0 b | 18.0 c  | 20.0 ab | 28.0 b  | 7.0 b   | 5.0 abc  | 7.3 abc  | 8.5 b   |
| Flurprimidol + Trinexepac-ethyl | 0.125 + 0.05 | 36.3 b                                  | 37.5 a  | 26.0 a   | 31.3 b | 45.7 ab | 31.7 ab | 22.3 bc | 21.7 a  | 19.0 a   | 22.7 a   | 26.0 a  |
| Flurprimidol + Trinexepac-ethyl | 0.25 + 0.05  | 31.3 b                                  | 26.3 a  | 20.5 a   | 27.5 b | 50.0 a  | 26.5 ab | 16.3 cd | 4.5 b   | 7.3 abc  | 9.8 abc  | 15.8 ab |
| Flurprimidol + Trinexepac-ethyl | 0.50 + 0.05  | 34.6 b                                  | 27.5 a  | 18.3 a   | 21.3 b | 22.5 c  | 11.3 b  | 10.3 d  | 9.3 ab  | 2.3 c    | 3.5 c    | 4.0 b   |
| Trinexepac-ethyl                | 0.10         | 32.5 b                                  | 27.5 a  | 14.3 a   | 35.0 b | 62.5 a  | 25.5 ab | 18.3 cd | 23.8 a  | 16.8 ab  | 22.0 ab  | 31.8 a  |
| Untreated                       | ---          | 56.3 a                                  | 29.2 a  | 15.4 a   | 50.0 a | 52.9 a  | 36.7 a  | 39.6 a  | 17.0 ab | 11.4 abc | 15.7 abc | 25.8 a  |

† Annual bluegrass populations were visually assessed on a 0 to 100 percent linear scale where 100 is complete plot coverage.

‡ PGR treatments were applied on in 2 gallons spray volume on 15 May, 14 June, 9 July, 10 Aug., 17 Sept., 19 Oct., 2004 and 17 May, 13 June, 11 July, 8 Aug., 6 Sept., and 4 Oct., 2005.

\* Means in the same column followed by the same letter are not significantly different according to Fisher's protected LSD t-test (p=0.05).

**Table 2.** Turfgrass color of a mixed creeping bentgrass/annual bluegrass research fairway as affected by flurprimidol, trinexepac-ethyl and various flurprimidol + trinexepac-ethyl tank-mix combinations.

| Plant Growth Regulator (PGR)‡   | Rate         | Turfgrass color rating†                |        |        |       |        |       |       |        |        |        |       |        | Study Mean |
|---------------------------------|--------------|--|--------|--------|-------|--------|-------|-------|--------|--------|--------|-------|--------|------------|
|                                 |              | 2004                                   |        |        |       |        |       | 2005  |        |        |        |       |        |            |
|                                 |              | June                                   | July   | Aug.   | Sept. | Oct.   | Mean  | June  | July   | Aug.   | Sept.  | Oct.  | Mean   |            |
|                                 | lbs ai/A     | ----- Visual rating (0-10 scale) ----- |        |        |       |        |       |       |        |        |        |       |        |            |
| Flurprimidol                    | 0.25         | 6.4 a*                                 | 5.7 ab | 6.4 ab | 6.8 a | 6.0 a  | 6.3 a | 7.0 a | 8.3 ab | 7.4 ab | 8.3 ab | 8.1 a | 7.8 ab | 7.0 a      |
| Flurprimidol                    | 0.50         | 6.2 a                                  | 5.2 ab | 6.0 ab | 6.4 a | 3.8 c  | 5.7 a | 6.9 a | 8.5 a  | 7.6 a  | 9.0 a  | 8.0 a | 8.1 a  | 6.8 a      |
| Flurprimidol + Trinexepac-ethyl | 0.125 + 0.05 | 5.3 a                                  | 5.1 ab | 5.9 b  | 5.6 a | 5.8 ab | 5.7 a | 6.4 a | 8.3 ab | 7.5 ab | 9.0 a  | 7.4 b | 7.7 ab | 6.7 a      |
| Flurprimidol + Trinexepac-ethyl | 0.25 + 0.05  | 5.8 a                                  | 5.4 ab | 6.4 ab | 6.3 a | 4.9 b  | 6.0 a | 7.1 a | 8.3 ab | 7.3 ab | 8.9 a  | 7.1 b | 7.7 ab | 6.7 a      |
| Flurprimidol + Trinexepac-ethyl | 0.50 + 0.05  | 6.3 a                                  | 5.0 b  | 6.9 a  | 6.5 a | 3.1 c  | 5.7 a | 7.1 a | 8.9 a  | 7.6 a  | 8.6 ab | 7.4 b | 8.0 ab | 6.7 a      |
| Trinexepac-ethyl                | 0.10         | 6.6 a                                  | 6.2 a  | 6.0 ab | 6.3 a | 6.6 a  | 6.5 a | 6.3 a | 8.8 a  | 7.5 ab | 8.8 a  | 7.3 b | 7.7 ab | 7.0 a      |
| Untreated                       | ---          | 6.5 a                                  | 5.4 ab | 5.7 b  | 6.2 a | 6.0 a  | 5.8 a | 6.8 a | 7.8 a  | 6.9 b  | 7.8 b  | 8.3 a | 7.6 b  | 6.5 a      |

† Turfgrass color was visually assessed on a 0 to 10 scale where 0 = brown, dead turf and 10 = dark green and  $\geq 6$  equals acceptable fairway color. coverage.

‡ PGR treatments were applied on in 2 gallons spray volume on 15 May, 14 June, 9 July, 10 Aug., 17 Sept., 19 Oct., 2004 and 17 May, 13 June, 11 July, 8 Aug., 6 Sept., and 4 Oct., 2005.

\* Means in the same column followed by the same letter are not significantly different according to Fisher's protected LSD t-test (p=0.05).

**Table 3.** Turfgrass quality of a mixed creeping bentgrass/annual bluegrass research fairway as affected by flurprimidol, trinexepac-ethyl and various flurprimidol + trinexepac-ethyl tank-mix combinations.

| Plant Growth Regulator (PGR)‡   | Rate         | Turfgrass quality rating†              |        |        |       |        |       |        |        |       |         |        |       | Study Mean |
|---------------------------------|--------------|--|--------|--------|-------|--------|-------|--------|--------|-------|---------|--------|-------|------------|
|                                 |              | 2004                                   |        |        |       |        |       | 2005   |        |       |         |        |       |            |
|                                 |              | June                                   | July   | Aug.   | Sept. | Oct.   | Mean  | June   | July   | Aug.  | Sept.   | Oct.   | Mean  |            |
|                                 | lbs ai/A     | ----- Visual rating (0-10 scale) ----- |        |        |       |        |       |        |        |       |         |        |       |            |
| Flurprimidol                    | 0.25         | 6.6 a*                                 | 5.8 ab | 6.0 ab | 6.5 a | 5.6 ab | 6.1 a | 7.1 ab | 8.1 ab | 7.1 a | 8.1 bc  | 7.9 a  | 7.8 a | 6.9 a      |
| Flurprimidol                    | 0.50         | 6.4 a                                  | 5.1 ab | 5.3 ab | 6.1 a | 3.8 c  | 5.4 a | 7.1 ab | 8.3 a  | 6.8 a | 9.0 a   | 7.8 a  | 7.8 a | 6.6 a      |
| Flurprimidol + Trinexepac-ethyl | 0.125 + 0.05 | 5.7 a                                  | 4.8 b  | 5.0 b  | 5.0 a | 5.3 c  | 5.3 a | 6.4 b  | 8.3 a  | 6.9 a | 8.9 a   | 7.3 bc | 7.6 a | 6.4 a      |
| Flurprimidol + Trinexepac-ethyl | 0.25 + 0.05  | 5.8 a                                  | 5.4 ab | 5.9 ab | 6.3 a | 4.9 b  | 5.7 a | 7.3 a  | 8.4 a  | 7.4 a | 8.8 ab  | 7.1 c  | 7.6 a | 6.6 a      |
| Flurprimidol + Trinexepac-ethyl | 0.50 + 0.05  | 6.0 a                                  | 4.7 b  | 6.3 a  | 6.4 a | 3.1 c  | 5.3 a | 7.0 ab | 8.5 a  | 7.3 a | 8.4 abc | 7.1 c  | 7.6 a | 6.5 a      |
| Trinexepac-ethyl                | 0.10         | 6.7 a                                  | 6.1 a  | 5.6 ab | 6.1 a | 6.5 a  | 6.3 a | 7.0 ab | 8.4 a  | 7.0 a | 8.5 ab  | 7.3 bc | 7.5 a | 6.9 a      |
| Untreated                       | ---          | 6.5 a                                  | 5.6 ab | 5.5 ab | 6.1 a | 5.8 ab | 5.7 a | 7.0 ab | 7.6 b  | 6.9 a | 7.7 c   | 8.3 a  | 7.5 a | 6.7 a      |

† Turfgrass quality was visually assessed on a 0 to 10 scale where 0 = brown, dead turf and 10 = dark green color, optimum uniformity and shoot density values  $\geq 7.5$  equals acceptable golf course fairway quality.

‡ PGR treatments were applied on in 2 gallons spray volume on 15 May, 14 June, 9 July, 10 Aug., 17 Sept., 19 Oct., 2004 and 17 May, 13 June, 11 July, 8 Aug., 6 Sept., and 4 Oct., 2005.

\* Means in the same column followed by the same letter are not significantly different according to Fisher's protected LSD t-test (p=0.05).

**Table 4.** Chemical phytotoxicity of a mixed creeping bentgrass/annual bluegrass research fairway as affected by flurprimidol, trinexapac-ethyl and various flurprimidol + trinexapac-ethyl tank-mix combinations.

| Plant Growth Regulator (PGR)‡   | Rate         | Chemical phytotoxicity†              |            |           |                  |            |
|---------------------------------|--------------|--------------------------------------|------------|-----------|------------------|------------|
|                                 |              | Creeping bentgrass                   |            |           | Annual bluegrass |            |
|                                 |              | 25 June 04                           | 16 July 04 | 23 May 05 | 25 June 04       | 16 July 04 |
|                                 | lbs ai/A     | -----Visual rating (0-10 scale)----- |            |           |                  |            |
| Flurprimidol                    | 0.25         | 0.3 c*                               | 0.5 bc     | 0.5 b     | 0.3 a            | 1.5 bc     |
| Flurprimidol                    | 0.50         | 0.8 bc                               | 1.0 b      | 2.5 a     | 1.0 a            | 2.8 abc    |
| Flurprimidol + Trinexapac-ethyl | 0.125 + 0.05 | 0.3 c                                | 0.3 bc     | 1.3 ab    | 1.5 a            | 3.0 ab     |
| Flurprimidol + Trinexapac-ethyl | 0.25 + 0.05  | 2.0 a                                | 0.5 bc     | 0.3 b     | 1.5 a            | 3.0 ab     |
| Flurprimidol + Trinexapac-ethyl | 0.50 + 0.05  | 1.5 ab                               | 2.5 a      | 1.0 ab    | 1.3 a            | 4.0 a      |
| Trinexapac-ethyl                | 0.10         | 0.5 bc                               | 0.0 c      | 2.5 a     | 2.3 a            | 0.5 c      |
| Untreated                       | ---          | 0.0 c                                | 0.0 c      | 1.1 ab    | 0.0 a            | 0.7 bc     |

† Chemical phytotoxicity was visually assessed on a 0 to 10 scale where 0 = no injury and 10 = completely brown, dead turf.

‡ PGR treatments were applied on in 2 gallons spray volume on 15 May, 14 June, 9 July, 10 Aug., 17 Sept., 19 Oct., 2004 and 17 May, 13 June, 11 July, 8 Aug., 6 Sept., and 4 Oct., 2005.

\* Means in the same column followed by the same letter are not significantly different according to Fisher's protected LSD t-test (p=0.05).