Selective Removal of Annual Bluegrass (*Poa annua* L.) from Creeping Bentgrass (*Agrostis palustris* H.) Greens and Fairways with Cumyluron in the Upper Midwest

R. N. Calhoun* and A. D. Hathaway
Michigan State University, East Lansing, MI 48824

Abstract

Annual bluegrass (*Poa annua* L.) [AB] can be found anywhere in the world where human disturbance is present. AB is a particular problem on golf courses where turfgrass managers endeavor to limit infestation into putting greens and fairways. Cumyluron [1-(2-chlorobenzyl)-3-(1-methyl-1-phenylethyl)urea] is a phenylurea herbicide under development by Helena Chemical Co. for the selective postemergence removal of AB in creeping bentgrass (*Agrostis palustris* H.) [CB]. Sequential cumyluron applications were made spring and fall to untrafficked, greens-height CB maintained at 3 mm and to untrafficked, fairway-height CB maintained at 1.5 cm. Visual observations were used to estimate the initial percent cover of the existing AB populations. Three levels of Factor A, herbicide rate, were used to represent approximately 0.5, 1, and 1.5X the proposed label rate for either green or fairway use. Factor B, application method, had three levels, herbicide only, surfactant tankmix, or immediate post-treatment irrigation. Both trials were conducted between 2007-2008 in East Lansing, Michigan. Percent control was determined 1-year after initiation of the studies. Cumyluron applications resulted in 53-98 and 26-80 percent reduction of AB for the green and fairway trials, respectively. Percent control generally increased as application rate increased. The addition of a surfactant or immediate post-treatment irrigation did not result in improved annual bluegrass control in either trial as compared to cumyluron applied alone.

Objectives

- Evaluate effect of sequential cumyluron applications for selective removal of annual bluegrass from creeping bentgrass putting greens and fairways
- Identify the optimum application rate of cumyluron
- Determine the benefit, if any, from tankmixing cumyluron with a surfactant or following application with irrigation
- Quantify turfgrass injury and surface disruption related to treatment programs

Site Description

Turfgrass Species: Creeping bentgrass (*Agrostis palustris* H.), 'L-93' putting green and 'Penncross' fairway.

Site Description: Green: High sand content root zone consisting of 93 percent sand, 6.5 percent silt, and 0.5 percent clay. Fairway: Sandy loam soil consisting of 73 percent sand, 21 percent silt, and 6 percent clay.

Site History: continuous CB for four and 15 years prior to this study for green and fairway site, respectively.

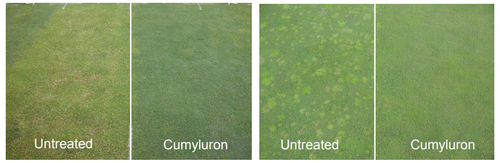
Management: Green: 3 mm, irrigated, 146 kg N ha^{-1} yr^{-1}, bi-weekly topdressing, mowed six days wk^{-1}; Fairway: 1.5 cm, irrigated, 198 kg N ha^{-1} yr^{-1}, mowed three days wk^{-1}.

Materials and Methods

Application Equipment: CO_2-pressurized four-nozzle backpack sprayer calibrated to deliver 518 L ha^{-1} at 276 kPa using TeeJet 8002VS flat-fan nozzles.

Treatment Protocol: Green: Factor A (cumyluron rate) three levels, either 0.25, 0.5, or 0.75 g ai m^{-1}. Factor B (application method) three levels, cumyluron only, surfactant tankmix, or immediate post-treatment irrigation. Treatments were applied 24 April, and 13 September of 2007. Fairway: Factor A (cumyluron rate) three levels, either 0.5, 0.75, or 1.0 g ai m^{-1}. Factor B (application method) three levels, herbicide only, addition of non-ionic surfactant [HM0716] @ 0.25 percent v/v, or immediate post-treatment irrigation. Treatments were applied 26 March, and 13 September of 2007. Both protocols included non-factorial untreated comparison.

Evaluations: AB populations were visually estimated at trial inception, immediately prior to the second application date, and at the conclusion of the trial. Initial AB populations ranged from 10 to 25 percent for both trials. Turfgrass injury and quality ratings were recorded monthly throughout the growing season.



Preliminary research demonstrated the potential of cumyluron for selective removal of AB over multiple years from fairway (l) and greens (r) height turf. MSU 2000-2003

Statistical Analysis

The treatment design consisted of two factors – herbicide rate, a fixed variable with three levels approximating 0.5X, 1X, and 1.5X the proposed labeled rate and application method, a random variable with three levels, namely, herbicide only (none), herbicide with surfactant (adjuvant), and post treatment irrigation (irrigation). The experimental design was a randomized complete block design with three replications. Percent annual bluegrass control was determined 374 and 408 days after initial treatment using pre-count, post-count of each plot for the green and fairway site, respectively.

The data from each trial were analyzed using PROC MIXED (SAS Institute, 2006). Normality of the residuals was assessed by visual inspection of stem-and-leaf and normal probability plots. The residuals were approximately normally distributed and variances were determined to behave within model assumptions with less than a 3 fold magnitude of variance differences. The alpha of 0.05 was used for all statistical tests.

Results

Putting Green Trial: The main effect of herbicide rate was statistically significant. The main effect of application method and the interaction term were not significant. Means for herbicide rate were averaged over application method and comparisons between herbicide rates were conducted using t-tests (Figure 1). In this trial, sequential applications of cumyluron, spring and fall resulted in 58, 74, and 88 percent AB control 374 DA-A for the 0.5X, 1X, and 1.5X rate, respectively. AB populations in the untreated control plots increased from 12 to 18 percent cover over the same time period. Turfgrass color and quality ratings for treated plots were never significantly different from the untreated control.

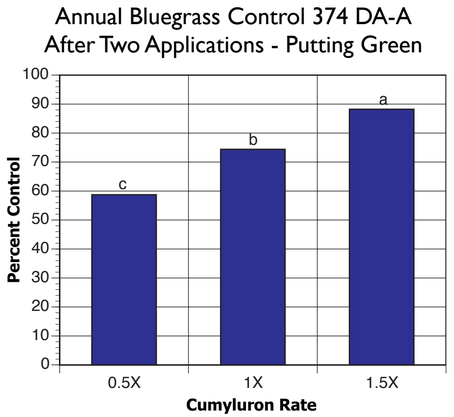


Figure 1: Annual bluegrass control in a creeping bentgrass putting green as affected by cumyluron rate 374 days after initial treatment. Means separation significant at alpha=0.05.

Conclusions - Green

Plots receiving sequential applications of cumyluron, spring followed by fall, exhibited significant decrease in AB population at 374 DA-A. Percent control increased as rate increased. It was hypothesized that adding an adjuvant or post-treatment irrigation would be important to maximize herbicide activity of cumyluron. However, application method did not play a significant role in this trial. AB populations diminished slowly over time and were not evident until the following spring. Surface uniformity and quality ratings were never diminished.

Fairway Trial: When the interaction term was found to be significant, all pairwise comparisons between cell means were conducted using t-tests. The effect of herbicide rate is dependent on application method.

The addition of an adjuvant or immediate post treatment irrigation increased AB control as compared to herbicide only at the 0.75X rate of herbicide. Sequential applications of the 0.75X rate resulted in 24, 74, and 80 percent AB control for herbicide alone, adjuvant, and post treatment irrigation methods, respectively. The sequential applications of the 1X label rate resulted in high levels of control (62-80 percent) regardless of application method. Post treatment irrigation resulted in diminished AB control as compared to herbicide alone or adjuvant tankmix at the 1.5X rate. Sequential applications of the 1.5X rate provided 80, 63, and 26 percent AB control for herbicide alone, adjuvant tankmix, and immediate post treatment irrigation, respectively.

Sequential applications, spring followed by fall, resulted in 26 to 80 percent reduction in AB populations in this trial. AB populations in the untreated control plots increased from 21 to 26 percent cover over the same time period.

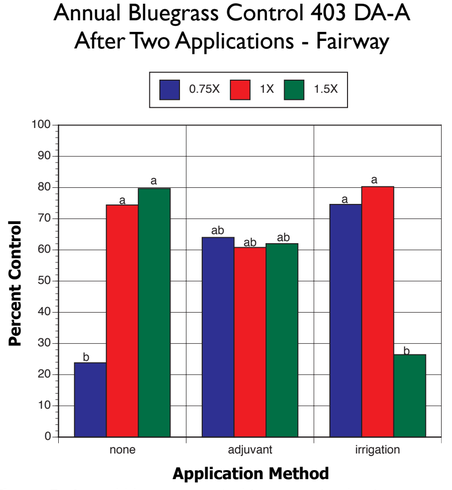


Figure 2: Annual bluegrass control in a creeping bentgrass fairway as affected by three cumyluron rates and three application methods 403 days after initial treatement (DA-A). Means identified with the same letter are not statistically different at alpha=0.05 level.

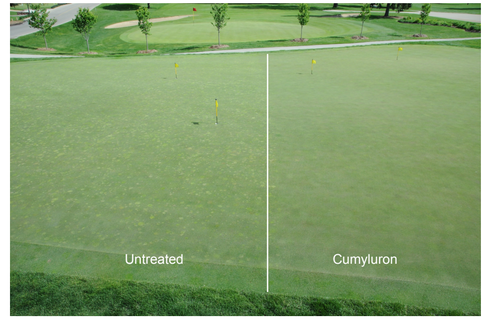
Conclusions - Fairway

Plots receiving sequential applications of cumyluron, spring followed by fall, exhibited significant decrease in AB population at 403 DA-A. Herbicide rate interacted with application method at the 0.75X and 1.5X rate. It was hypothesized that adding an adjuvant or post-treatment irrigation would be important to maximize herbicide activity of cumyluron. The addition of an adjuvant or immediate post treatment irrigation improved the performance of the lowest 0.75X rate. The 1X herbicide rate worked equally well regardless of application method. Immediate post treatment irrigation reduced the activity of the 1.5X rate as compared to the other two application methods. This was unexpected as the proposed site of uptake is through the roots.

All treatment combinations resulted in reductions in AB populations as compared to initial levels. AB populations in the control plots increased over the same time period.

AB populations diminished slowly over time and were not evident until the following spring. Surface uniformity and quality ratings were never diminished.

On Course Demonstration



The eastern half of this four year old G-2 creeping bentgrass putting green was treated with cumyluron in 6 September 2006 and 14 April 2007. Photo taken 19 May 2008.

*Corresponding author: calhoun@msu.edu

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HELENA People... Products... Knowledge...