Evaluation of the Differential Responses of Common Bermudagrass (*Cynodon dactylon*) Varieties to Aryloxyphenoxypropionate Herbicide Fenoxaprop-p-Ethyl

Enzhan Song and Xi Xiong
Division of Plant Sciences, University of Missouri, Columbia, MO 65211
Corresponding author: Xiongx@missouri.edu

Introduction

- Bermudagrass (*Cynodon* spp.) is common in Missouri and difficult to manage. Suppression is reported with aryloxyphenoxypropionate (AOPP) herbicides such as fenoxaprop and fluazifop (Doroh et al., 2011; Lewis et al., 2010).
- Genetic variation among varieties of the same species (Wu et al. 2004) may result in intra-species differences in response to AOPP herbicides.
- Our previous study found that the 'Riviera' and 'Quickstand', two common bermudagrass (*C. dactylon*) varieties, exhibited differential tolerance to fenoxaprop.

Objectives

- The objective of this research was to evaluate the variation among older and newer common bermudagrass varieties in response to fenoxaprop-p-ethyl.

Materials and Methods

Research location and conditions:

- Experiments were conducted in a greenhousej environment at the University of Missouri, with 30/25° C (day/night) temperatures and 12 h photoperiod at a light intensity of 600 µmol s^{-1} m^{-2}.

Figure 1. Representative bermudagrass plants in greenhouse.

Materials:

- Five common bermudagrass varieties, 'Celebration', 'NuMexSahara', 'Princess 77', 'Riviera', and 'Yukon' were propagated in 13 by 13 cm pots with Pro-mix (Premier Tech Horticulture, Quakertown, PA) potting soil (Fig. 1).
- Plants were maintained at 3 cm height and fertilized weekly with an all-purpose fertilizer (Miracle Gro; The Scotts Company LLC, Marysville, Ohio) at 12.2 kg N ha^{-1}.
- Single applications of fenoxaprop-p (0.2 kg a.i. ha^{-1}) were made using an air-driven hydraulic sprayer (Fig. 2) calibrated to deliver 140 L ha^{-1} at a spray pressure of 234 kPa using TeeJet XR8001E (TeeJet Technologies, Springfield, Illinois) spray tips.

Measurements:

- Herbicide activity was visually assessed weekly at 0-100%, where 0 indicates no discoloration, and 100 indicates total discoloration (brown).
- Discoloration is expressed as area under percentage discoloration curves (AUPDC), which was calculated based on the following equation:

$$AUPDC = \sum_{i=1}^{n-1} [(X_{i+1} + X_i) / 2] \times (t_{i+1} - t_i)$$

where X_i = percent discoloration at i^{th} observation, t_i = days after treatments at the i^{th} observation, and n = number of total observations (Campbell and Madden, 1990).

- Clipping biomass was collected weekly at 3 cm cutting height through 8 weeks after treatment (WAT) (Fig. 3), and was expressed as early (1-4 weeks) or late (5-8 weeks) stage.

Experimental Design and Data Analysis

- Experiment was arranged as randomized complete block design with 4 replications. Data were analyzed by ANOVA using Proc GLM in SAS (9.2 version by SAS Institute Inc., Cary, North Carolina).

Figure 2. Air-driven hydraulic sprayer.

Figure 3. Clipping collection process.

Results

- 'Riviera' and 'Yukon' exhibited significantly less discoloration (Fig. 4 and 5) than other varieties. The variety 'Celebration' displayed the most discoloration compared to the other varieties tested (Fig. 5).
- Production of clippings from all varieties was reduced by more than 90% in the early stage, except 'Riviera' and 'Yukon', which maintained >30% PCB (Table 1). At 4 to 8 WAT, both 'Riviera' and 'Yukon' recovered to ≥80% PCB; the PCB for other varieties was <65% (Table 1).

Before treatment:

2 weeks after treatment:

Figure 4. Upper panel represents bermudagrass varieties before and lower panel 2 weeks after treatment with fenoxaprop (0.2 kg a.i. Ha^{-1}). Varieties from left to right include: 'Riviera', 'Celebration', 'Princess 77', 'Yukon', and 'NuMexSahara'.

Table 1. Treatment effect on percent clipping biomass[a] (PCB) of five common bermudagrass varieties in early (1-4 WAT) or late (5-8 WAT) stages.

varieties	Early stage	Late stage
	PCB, %	
Celebration	6.9 b[b]	39.4 b
NuMex Sahara	10.1 b	62.2 b
Princess 77	7.4 b	48.7 b
Riviera	33.8 a	79.7 b
Yukon	31.4 a	131.9 a

[a] Percent clipping biomass (PCB) was calculated by comparing the clipping biomass of treated plants to control plants in early or late stages for each variety; early and late stages were defined as 1-4 weeks after treatment (WAT) and 5-8 WAT, respectively.
[b] Means within each stage in the same columns labeled by the same letters are not significantly different according to Fisher's Protected LSD (P = 0.05).

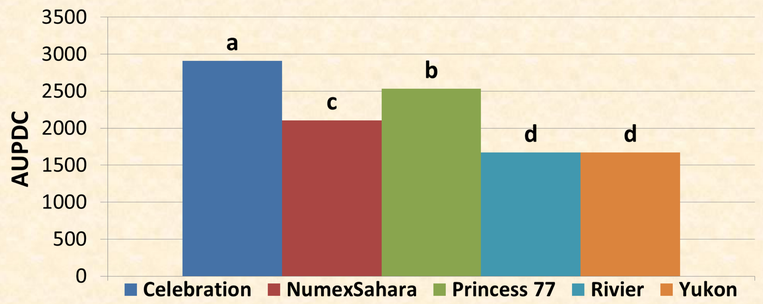

Figure 5. Mean area under percentage discoloration curves (AUPDC) of five common bermudagrass varieties during the 8 week period in response to fenoxaprop (0.2 kg ai ha^{-1}) application. Bars labeled with the same letters are not significantly different according to the Fisher's Protected LSD (P = 0.05).

Conclusions

- Significant intra-species variation among common bermudagrass varieties to the herbicide fenoxaprop exists.
- Among the 5 varieties, 'Riviera' and 'Yukon' appeared to be more tolerant to fenoxaprop, while 'Celebration' was assessed most susceptible.
- Turfgrass managers are recommended to consider the variation among bermudagrass varieties when developing a management program for unwanted bermudagrasses.

References

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