Preemergence Herbicide Effects on Hybrid Bermudagrass Root Architecture and Establishment

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Introduction

Hybrid bermudagrass (*Cynodon dactylon* (L.) Pers. × *C. transvaalensis* Burtt-Davy) is commonly produced as sod in the southern US and other warm-season climates around the world. Preemergence herbicides are sometimes used to control annual weeds. However, these herbicides may negatively affect hybrid bermudagrass establishment from sprigs and/or sod.

Objective

★ **Determine the effects of commonly used PRE herbicides on hybrid bermudagrass root architecture and establishment.**

Materials and Methods

A climate controlled greenhouse (26° C) experiment was conducted at Mississippi State University from April to September, 2016. The experiment was repeated in time as a completely randomized design (4 reps). 'Latitude 36' hybrid bermudagrass plugs (32 cm^2, 2 cm soil depth) were planted in 126 cm^2 pots containing native fine sandy loam soil. Foliar and granular herbicide treatments (Table 1) were applied 1 day after planting. Response variables included weekly digital image analysis of hybrid bermudagrass cover (SigmaScan Pro), in addition to root mass, root length (WinRHIZO Pro), and total non-starch carbohydrates (TNSC) 10 weeks after treatment (WAT).

Table 1. Preemergence herbicide treatments.

WSSA No.	Trade Name	Active Ingredient	kg ai ha^{-1}
--	Nontreated	--	--
3	Barricade 4L	prodiamine	0.59
3	Pendulum AquaCap 3.8L	pendimethalin	1.66
3	Dimension 2EW	dithiopyr	0.56
5	AAtrex 4L	atrazine	1.12
5	Princep 4L	simazine	2.24
5 15	AAtrex 4L + Pennant Magnum 7.6L	atrazine + *S*–metolachlor	1.12 0.86
14	Ronstar 50 WSP	oxadiazon	2.24
14	Ronstar 2G	oxadiazon	2.24
14	SureGuard 51 WDG	flumioxazin	0.29
15	Pennant Magnum 7.6L	*S*–metolachlor	2.78
29	Specticle FLO	indaziflam	0.03

Statistical Analysis

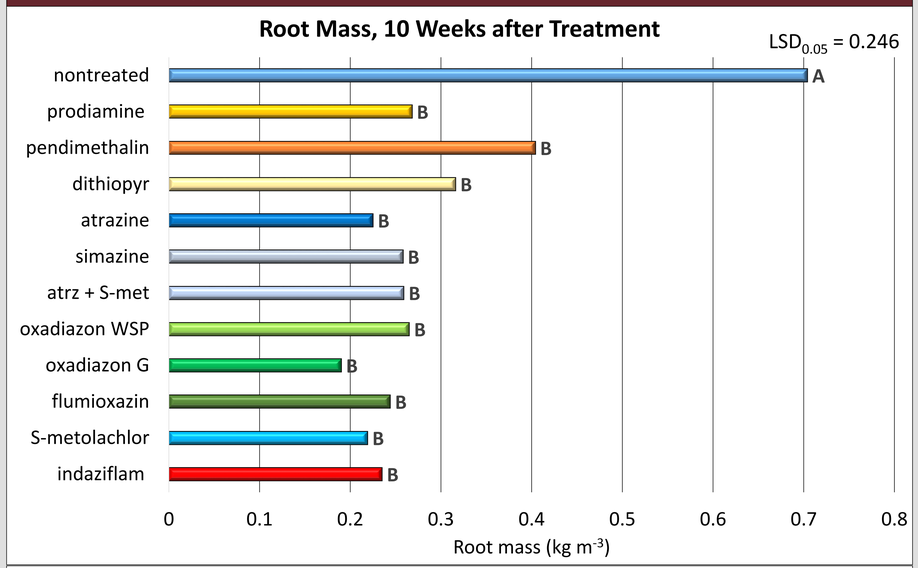
- Hybrid bermudagrass cover data were log transformed and subject to a non-linear sigmoidal variable slope regression to determine time to 50% cover:

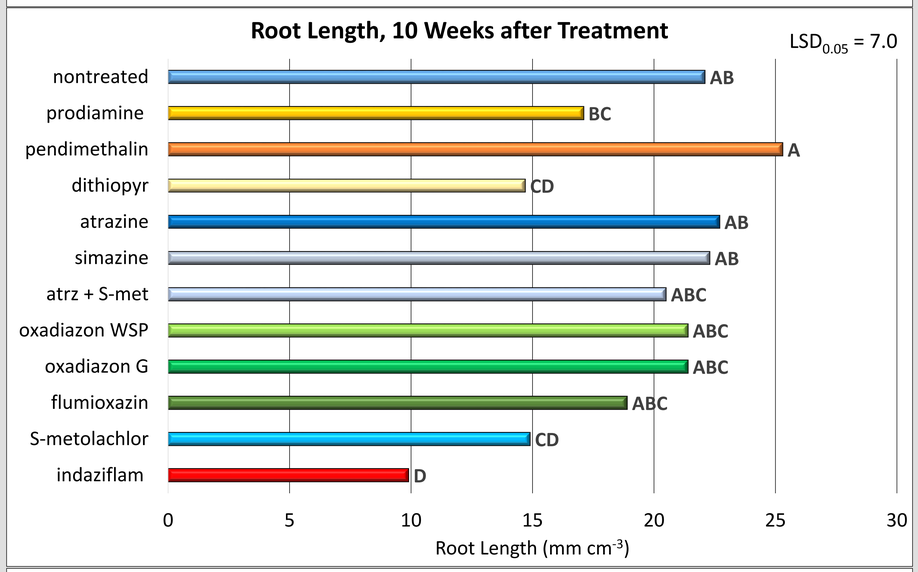
$$\%\ Cover = \frac{100}{1+10^{[(logDays_{50}-logDAT)slope]}}$$

- Root parameters and carbohydrate analysis data were subject to analysis of variance (α = 0.05) within SAS Proc GLM. Run × treatment interaction was not significant; therefore, data were pooled across runs. Means were separated using Fisher's Protected LSD.

Photo 1: Hybrid bermudagrass sample before and after analysis in SigmaScan Pro to determine hybrid bermudagrass percentage cover.

Figure 1, 2, and 3. Root mass, length, and total non-starch carbohydrates (TNSC) evaluated 10 WAT. TNSC represents the sum of glucose, fructose, and sucrose within the roots. Means were separated using least significant difference (LSD) in PROC GLM (α=0.05).





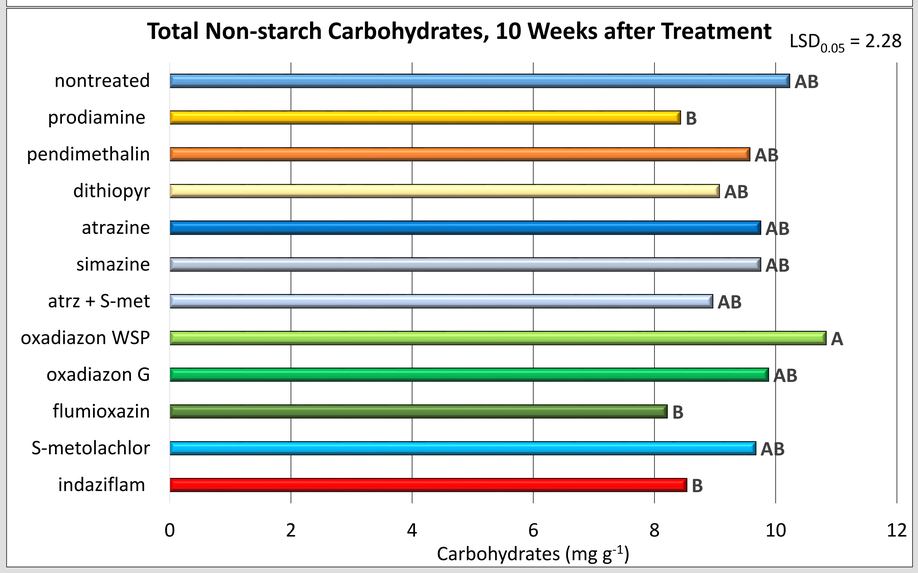
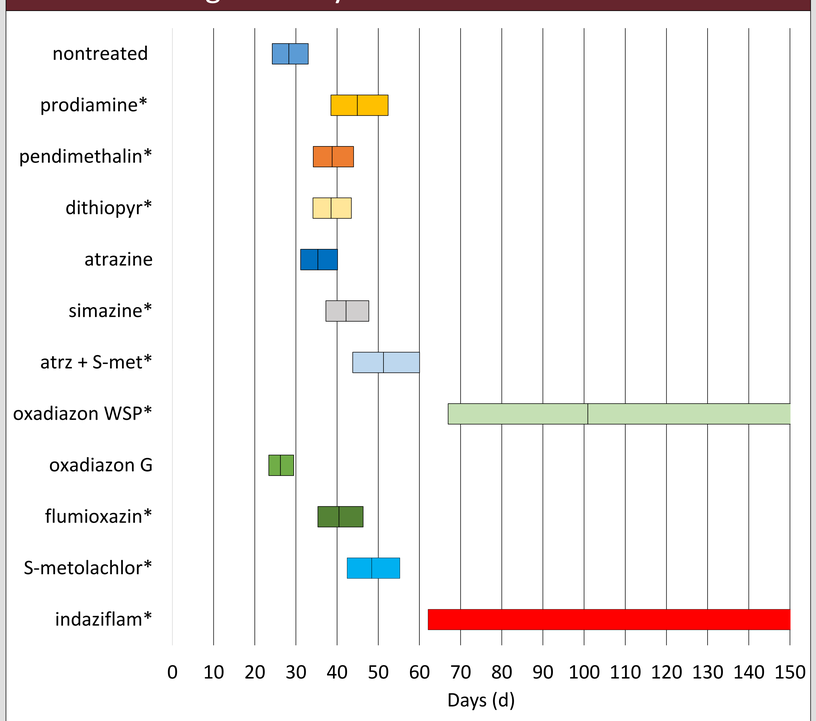


Figure 4. Non-linear sigmoidal variable slope regression estimates for days to reach 50% hybrid bermudagrass cover based on 95% confidence intervals. Overlapping bars are not significantly different.



*Increased days to reach 50% cover when compared to the nontreated.

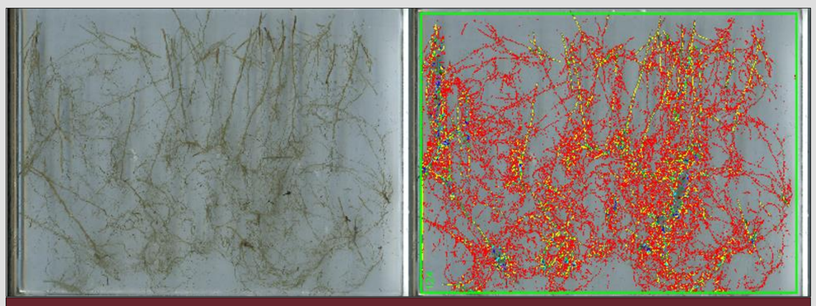


Photo 2: Root sample before and after analysis in WinRHIZO Pro to determine total root length.

Results

Time to 50% Hybrid Bermudagrass Cover

Prodiamine, pendimethalin, dithiopyr, simazine, atrazine + *S*-metolachlor, oxadiazon WSP, flumioxazin, *S*-metolachlor, and indaziflam increased time to reach 50% cover compared to the nontreated.

Root Parameters

All herbicide treatments reduced root mass compared to the nontreated. However, dithiopyr, *S*-metolachlor, and indaziflam reduced root length compared to the nontreated 10 WAT.

Root Carbohydrates

Herbicide treatments did not reduce root carbohydrates compared to the nontreated 10 WAT.

Conclusions

★ Dithiopyr, *S*-metolachlor, and indaziflam were consistently the most injurious to hybrid bermudagrass root architecture and establishment.

★ Despite reductions in root mass, no herbicide treatments reduced total non-starch root carbohydrates.

★ Granular applied oxadiazon and atrazine are viable options for preemergence weed control without reducing hybrid bermudagrass establishment.