ANNUAL BLUEGRASS MANAGEMENT WITH PYROXASULFONE AND FLUMIOXAZIN IN PERENNIAL RYEGRASS AND TALL FESCUE GROWN FOR SEED

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Introduction

Annual bluegrass (*Poa annua*) contamination in grass grown for seed continues to be a major production challenge with significant economic ramifications for growers. Cool season grasses grown for seed are swathed into windrows, allowed to dry and then threshed with a combine equipped with a pick-up header. Weed seeds present in the crop are inherently harvested along with the crop seed in this production system. Oregon seed certification allows contamination of only 0.3% annual bluegrass seed by weight in tall and fescue crops and 0.5% by weight in perennial ryegrass crops (2012 Oregon Certified Seed Handbook). Many seed companies have a zero tolerance. Thus, annual bluegrass seed contamination in cool season grass seed production is a major weed management consideration for growers. Research results from field experiments utilizing flumioxazin and pyroxasulfone herbicides for annual bluegrass control in established and spring planted perennial ryegrass and tall fescue are presented here. Cole et al. (2003) documented poor control of annual bluegrass with flumioxazin and diuron in carbon seeded perennial ryegrass, but good annual bluegrass control was documented by Curtis et al. (2011) with pyroxasulfone in carbon seeded perennial ryegrass. Neither flumioxazin nor pyroxasulfone are currently registered for use in grasses grown for seed.

Methods

Field experiments were conducted from 2009-2012 to examine weed control efficacy and crop tolerance of grasses grown for seed to pyroxasulfone and flumioxazin. These experiments were located at the Oregon State University Hyslop Research Farm near Corvallis, OR. All studies utilized a randomized complete block design with four replications. Visual evaluations of annual bluegrass control along with crop injury ratings were taken following herbicide applications. Seed was harvested, cleaned and yields were quantified. Data were analyzed using ANOVA and means separated by LSD.

Results

In early January, 2009, treatments of pyroxasulfone applied at 0.09 lb ai/A and flumioxazin applied at 0.1 lb ai/A to an established stand of perennial ryegrass infested with diuron resistant annual bluegrass resulted in control of 90% or greater with pyroxasulfone and 48% with flumioxazin (Table 1). Perennial ryegrass yields were not significantly different than the untreated control.

Table 1. Established Perennial Ryegrass Tolerance to Herbicides

Treatment	Rate	Annual bluegrass	Yield clean seed
	lb ai/A	% control	lb/A
check	0	0	1569
flufenacet	0.34	100	1327
pyroxasulfone	0.09	90	1207
oxyfluorfen	0.25	23	1403
flumioxazin	0.1	48	1440
LSD P = 0.05%		29	NS
CV		36	14

planted 9/25/2007
applied 1/13/2009
evaluated 4/24/2009

A study initiated in the fall of 2009 documented crop safety and diuron resistant annual bluegrass control with pyroxasulfone and flumioxazin in spring planted perennial ryegrass. Pyroxasulfone was applied at 0.053, 0.106 and 0.213 lb ai/A preemergence to annual bluegrass which had been overseeded across a bare ground area in each plot. The diuron resistant annual bluegrass was controlled 90% or greater with all three application rates (Table 2). In this same study, a flumioxazin treatment applied preemergence to the annual bluegrass at 0.063 lb ai/A controlled 83% of the diuron resistant annual bluegrass. Perennial ryegrass yields were not significantly affected by these treatments.

Table 2. Spring Planted Perennial Ryegrass Tolerance to Herbicides

Treatment	Rate	Annual bluegrass	Yield clean seed
	lb ai/A	% control	lb/A
check	0	0	628
pyroxasulfone	0.53	98	856
pyroxasulfone	0.106	100	1034
pyroxasulfone	0.213	100	625
flumioxazin	0.063	90	734
flufenacet-metribuzin	0.425	100	734
LSD P = 0.05%		3	NS
CV		3	29

planted 4/7/2009
applied 10/1/2009
evaluated 6/14/2010

Two additional studies were conducted during the 2010-2011 growing season, one in established perennial ryegrass and one in established tall fescue, with four rates of a pre-mix combination of flumioxazin plus pyroxasulfone. The objectives of these studies were to evaluate tolerance and annual bluegrass control efficacy in perennial ryegrass and tall fescue seed crops to the pre-mix formulation of flumioxazin plus pyroxasulfone. Flumioxazin plus pyroxasulfone was applied preemergence to diuron resistant annual bluegrass at 0.095, 0.143, 0.19 and 0.285 lb ai/A.

Table 3. Control of Diuron Resistant Annual Bluegrass in Established Perennial Ryegrass

Treatment	Rate	Annual bluegrass	Yield clean seed
	lb ai/A	% control	lb/A
check	0	0	552
flumioxazin-pyroxasulfone	106	75	693
flumioxazin-pyroxasulfone	160	90	583
flumioxazin-pyroxasulfone	212	90	674
flumioxazin-pyroxasulfone	319	100	731
flufenacet-metribuzin	476	88	748
LSD P = 0.05%		7	NS
CV		6	31

planted 9/06/2009
applied 9/16/2010
evaluated 4/22/2011

Table 4. Control of Diuron Resistant Annual Bluegrass in Established Tall Fescue

Treatment	Rate	Annual bluegrass	Crop injury	Yield clean seed
	lb ai/A	% control	% injury	lb/A
check	0	0	0	1110
flumioxazin-pyroxasulfone	0.095	90	5	1292
flumioxazin-pyroxasulfone	0.143	100	18	1227
flumioxazin-pyroxasulfone	0.19	100	25	1364
flumioxazin-pyroxasulfone	0.285	100	45	1180
flufenacet-metribuzin	0.425	100	8	1419
LSD P = 0.05%		0	7	NS
CV		0	28	14

planted 4/23/2010
applied 10/8/2010
evaluated 4/22/2011

In the perennial ryegrass study, diuron resistant annual bluegrass was controlled 90% or greater with the three higher rates of flumioxazin plus pyroxasulfone (Table 3). In the tall fescue study, flumioxazin plus pyroxasulfone controlled the diuron resistant annual bluegrass 90% at the lowest rate and 100% at the highest three rates (Table 4). There was considerable visible injury in the tall fescue study which initially showed up as slight tissue necrosis and later as stunting. This injury increased with increasing rate. Tall fescue yield was not affected despite the injury.

Discussion

This series of studies indicates that pyroxasulfone and combinations of pyroxasulfone and flumioxazin control diuron resistant biotypes of annual bluegrass with adequate crop safety in perennial ryegrass and tall fescue seed production. These data were used to initiate an IR-4 project in 2012-13 in an effort to seek registration of Fierce™ herbicide (a combination of pyroxasulfone plus flumioxazin marketed by Valent U.S.A.) since this product is not currently registered for use in grasses grown for seed in Oregon. Additional research is underway to evaluate applications rates which minimize potential for crop injury, improve annual bluegrass control, and to determine if these herbicides can be utilized in carbon-seeding systems to improve weed management in seedling grasses.

References

C.M. Cole, R.P. Affeldt, B.D. Brewster, J.B. Colquhoun and C.A. Mallory-Smith. 2003. Annual Bluegrass Control in Carbon-Seeded Perennial Ryegrass. *In* W.C. Young III (ed.), Seed Production Research, Oregon State Univ., Ext/CrS 123, 3/04.

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