WEED MANAGEMENT IN CARBON-SEEDED TALL FESCUE AND PERENNIAL RYEGRASS WITH PREEMERGENCE HERBICIDES

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Introduction

Evaluation of herbicides for potential use with carbon seeding in the establishment of fall-seeded perennial ryegrass and tall fescue remains a priority in grass seed weed management in Oregon. Pyroxasulfone premixed with flumioxazin (Fierce) is in the registration process for use on grasses grown for seed and has performed well for management of diuron-resistant populations of annual bluegrass (*Poa annua*) in both new plantings with carbon seeding and in established stands. Indaziflam (Alion) also has performed well in carbon-seeding studies in perennial ryegrass and tall fescue (Curtis et al., 2011, 2012). The manufacturer of indaziflam has shown interest in the use of this product in grasses grown for seed.

Two studies were conducted during the 2016–2017 growing season in tall fescue and perennial ryegrass grown for seed to further evaluate crop safety and control of diuron-resistant annual bluegrass and roughstalk bluegrass (*Poa trivialis*) following applications of preemergent herbicides.

Materials and Methods

'Falcon IV' tall fescue was planted in 18-inch rows on September 27, 2016, and 'APR 2190' perennial ryegrass was planted in 12-inch rows on October 3, 2016, at Hyslop Research Farm near Corvallis, OR. Seeds for both species were planted approximately 0.25 inch deep with a 1-inch-wide band of activated carbon (300 lb/acre) sprayed over the seed rows. Experimental design in both studies was a randomized complete block with four replications. Plots were 8 feet x 35 feet, with 15 rows of tall fescue or 24 rows of perennial ryegrass, both carbon seeded. Each plot had two rows of diuron-resistant *P. annua* grower screenings, two rows of *P. annua* grower screenings of unknown susceptibility, and two rows of grower screenings of *P. trivialis* planted without carbon in a fallow area in the front of each plot. Seedbed preparation included use of a roller to compact the surface to help obtain shallow, uniform seed placement. A small-plot, single-wheeled sprayer with output of 20 gpa at 20 psi was used to apply the herbicide treatments on September 29 and November 17 on the tall fescue and on October 4 and November 29 on the perennial ryegrass (Tables 1 and 2).

The studies, each consisting of ten herbicide treatments, included a grower standard of diuron + pronamide followed by ethofumesate and an untreated check (Tables 3 and 4). Treatments with glufosinate +

Table 1. Application and soil data, tall fescue.

Planting date	Sep. 27, 2016	—
Application date	Sep. 29, 2016	Nov. 17, 2016
Crop growth stage	Preemergence	4 leaf + 1 tiller
Poa annua growth stage	Preemergence	1–2 tillers
Poa trivialis growth stage	Preemergence	1–2 tillers
Air temperature (°F)	69	46
Relative humidity (%)	55	86
Wind (mph, direction)	0–1, NE	2, E
Cloud cover (%)	40	80
First moisture (inches)	Oct.1 (0.12)	Nov. 18 (0.02)
Soil temperature at 2 inches (°F)	70	46
Soil pH	5.7	—
Soil OM (%)	4.0	—
Soil CEC (meq/100g)	8.1	—
Soil texture	Silt loam	—

Table 2. Application and soil data, perennial ryegrass.

Planting date	Oct. 3, 2016	—
Application date	Oct. 4, 2016	Nov. 29, 2016
Crop growth stage	Preemergence	5 leaf + 1 tiller
Poa annua growth stage	Preemergence	1–2 tillers
Poa trivialis growth stage	Preemergence	1–2 tillers
Air temperature (°F)	61	52
Relative humidity (%)	78	57
Wind (mph, direction)	0–4, S	2, E
Cloud cover (%)	90	70
First moisture (inches)	Oct. 4 (0.11)	Nov. 29 (0.12)
Soil temperature at 2 inches (°F)	60	50
Soil pH	5.7	—
Soil OM (%)	4.0	—
Soil CEC (meq/100g)	8.1	—
Soil texture	Silt loam	—

ethofumesate and glufosinate + oxyfluorfen were included to evaluate safety of treatments to remove weed species within the carbon-treated band. Plots were evaluated visually for crop injury and percent control of the *Poa* species. The tall fescue crop was swathed on June 27 and threshed with a small-plot combine on July 18. The perennial ryegrass was swathed on July 7 and threshed on July 19. Seed was cleaned with a Clipper Cleaner, and yields were quantified (Tables 3 and 4). Results were analyzed using ANOVA and means separated by LSD at 0.05.

Results and Discussion

The study site received 0.63 inch of rain between the herbicide application to the tall fescue and the planting of the perennial ryegrass. On the day of the herbicide application to the perennial ryegrass, the site received 0.11 inch of rain. During the following week, 1.46 inches of precipitation accumulated. During the week of grass seed emergence (tall fescue typically emerges in 10–14 days and perennial ryegrass in 7–10 days), rainfall was 5.7 inches. It takes approximately 4 inches of rainfall to dissipate a carbon band (Nortron SC label); thus, carbon protection was diminishing rapidly during seedling emergence. The heavy rainfall, combined with field preparation, led to standing water on the surface at plant emergence and for several days thereafter. October rainfall at the study site was 12.15 inches, which was the most ever recorded at Hyslop Research Farm. The 20-year October rainfall average for the site is 3.17 inches.

Seed yields for the tall fescue were very low, as planting was not early enough for adequate vernalization (Table 3).

In perennial ryegrass, clean seed yields with the lower rate of pyroxasulfone/flumioxazin, including treatments followed by glufosinate + ethofumesate, were equivalent to the untreated check and the grower standard treatment (Table 4). Severe crop injury (60% or greater) was observed in all of the indaziflam treatments and with the high rate of pyroxasulfone/flumioxazin (Table 4). This injury resulted in clean seed yield decreases. Extreme rainfall amounts during seed germination allowed the herbicide to move into the

Table 3. Control of two populations of *Poa annua* and *Poa trivialis*, crop injury, and seed yield with herbicide treatments in carbon-seeded tall fescue.

		Control[1]				
Treatment[2]	Rate	*Poa annua*	DR *Poa annua*[3]	*Poa trivialis*	Crop injury[1]	Clean seed yield
	(lb ai/a)	---------- (%) ----------			(%)	(lb/a)
Untreated check	0	0	0	0	0	181
Pyroxasulfone/flumioxazin	0.07	96	92	94	4	160
Pyroxasulfone/flumioxazin	0.14	100	100	99	23	91
Indaziflam	0.01	100	100	100	50	83
Indaziflam	0.03	100	100	100	65	52
Pyroxasulfone/flumioxazin fb glufosinate + ethofumesate	0.07 fb 0.18 + 1.0	100	98	100	11	167
Pyroxasulfone/flumioxazin fb glufosinate + oxyfluorfen	0.07 fb 0.18 + 0.02	100	98	99	9	152
Indaziflam fb glufosinate + ethofumesate	0.01 fb 0.18 + 1.0	100	100	100	21	144
Indaziflam fb glufosinate + oxyfluorfen	0.01 fb 0.18 + 0.02	100	100	100	29	99
diuron + pronamide fb ethofumesate	1.6 + 0.25 fb 1.0	98	83	99	0	253
LSD ($P = 0.05$)		3	4	2	13	106
CV		2	4	1	43	53

[1]Control and crop injury evaluated May 15, 2017.
[2]fb = followed by
[3]DR = diuron-resistant

seed row and inhibit root growth, thus preventing plant establishment. There is a risk of severe crop injury with the practice of carbon planting in wetter than normal years, especially in areas with poor drainage.

Control of the *Poa* species with all herbicide treatments was 89–100%, with the exception of the diuron + pronamide treatment with the diuron-resistant *P. annua* in the tall fescue trial (Tables 3 and 4). The application to tall fescue was made to dry soil, and more herbicide may have been tied to soil particles than in the perennial ryegrass, where the application was to moist soil.

References

Curtis, D.W., K.C. Roerig, A.G. Hulting, and C.A. Mallory-Smith. 2011. Alternative herbicides to diuron in carbon seeded perennial ryegrass (*Lolium perenne*) grown for seed. In W.C. Young III (ed.). *2011 Seed Production Research Report*. Oregon State University, Ext/CrS 136.

Curtis, D.W., K.C. Roerig, A.G. Hulting, and C.A. Mallory-Smith. 2012. Annual bluegrass management with pyroxasulfone and flumioxazin in perennial ryegrass and tall fescue grown for seed. In A. Hulting, N. Anderson, D. Walenta, and M. Flowers (eds.). *2012 Seed Production Research Report*. Oregon State University, Ext/CrS 143.

Table 4. Control of two populations of *Poa annua* and *Poa trivialis*, crop injury, and seed yield with herbicide treatments in carbon-seeded perennial ryegrass.

		Control[1]				
Treatment[2]	Rate	*Poa annua*	DR *Poa annua*[3]	*Poa trivialis*	Crop injury[1]	Clean seed yield
	(lb ai/a)	---------- (%) ----------			(%)	(lb/a)
Untreated check	0	0	0	0	0	1,091
Pyroxasulfone/flumioxazin	0.07	96	99	98	26	1,296
Pyroxasulfone/flumioxazin	0.14	100	100	100	78	472
Indaziflam	0.01	99	100	100	60	533
Indaziflam	0.03	100	100	100	93	26
Pyroxasulfone/flumioxazin fb glufosinate + ethofumesate	0.07 0.18 + 1	100	100	98	41	1,126
Pyroxasulfone/flumioxazin fb glufosinate + oxyfluorfen	0.07 0.18 + 0.02	100	100	100	40	1,209
Indaziflam fb glufosinate + ethofumesate	0.01 0.18 + 1.0	100	100	100	63	516
Indaziflam fb glufosinate + oxyfluorfen	0.01 0.18 + 0.02	99	100	100	75	451
Diuron + pronamide fb ethofumesate	1.6 + 0.25 1.0	89	90	95	5	1,244
LSD ($P = 0.05$)		4	4	3	24	228
CV		3	3	3	175	20

[1]Control and crop injury evaluated May 15, 2017.
[2]fb = followed by
[3]DR = diuron-resistant