

EXPLORING ALTERNATIVE HERBICIDES FOR ROW SPRAYING AT PLANTING IN NEW ANNUAL RYEGRASS SEED PRODUCTION FIELDS

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Introduction

In Oregon’s Willamette Valley, annual ryegrass (ARG) seed production typically occurs in fields with a history of ARG seed production, and volunteer ARG populations can be problematic when growers are establishing new ARG fields. Row spraying ARG at planting is a useful management tool for growers to manage volunteer ARG. However, effective herbicide options are limited. Axiom DF (flufenacet + metribuzin) is a preemergent herbicide commonly used for row spraying ARG seed production fields; approximately 48,000 acres (40%) of the ARG grown in the Willamette Valley are treated with Axiom DF annually (Hulting, 2013). In fields with a long history of ARG production, the most common practice is to apply Axiom DF preemergence between the rows when planting new ARG stands to suppress volunteer ARG emergence. This “Axiom-planting” practice also enables growers to plant fields earlier since they do not need to wait for rainfall to germinate the first flush of volunteer ARG in order to control emerged seedlings with a nonselective broadcast herbicide application prior to planting.

Since Axiom DF herbicide is used for weed management in ARG, perennial ryegrass, tall fescue, and wheat production, there is concern by OSU researchers and the grass seed industry that the continuous and widespread use of Axiom DF will lead to the development of resistant ARG. Such resistance is now suspected in Willamette Valley ARG and wheat production fields. To maintain Axiom as an effective herbicide in a variety of field crop production scenarios, a need exists to identify herbicides with different modes of action for row spraying purposes in order to build a resistance management strategy. The objective of this study was to evaluate several alternative herbicide products to determine row-spraying utility based on crop safety, row persistence, and seed yield.

Materials and Methods

Four field trials were conducted over two growing seasons to evaluate row spraying at planting in ARG seed production fields. Two trials were established during the fall of 2015 and harvested in 2016; the details are outlined in Sullivan et al., 2017. A second group of trials was established during the fall of 2016. A trial in Lebanon was planted to ‘Winterhawk’ on September 15, and a trial at Irish Bend was planted to ‘Big Boss’ on September 16. Seeding rate was 22 lb/acre for all trials.

All field experiments were arranged as randomized complete block designs with four replications. Plot size was 5 feet x 30 feet. At planting, a spray boom was mounted on the front of a plot-sized drill to spray while seeding. Both the drill and nozzles (4003) were at 10-inch spacing, and a 7.7-inch band of herbicide was sprayed between the drill rows. Herbicide treatments included in the trial are presented by product name, active ingredient, and application rate (Table 1).

Results and Discussion

The trial sites used in the 2016–2017 growing season had a long history of ARG and very heavy volunteer pressure. There was a large range in percentage control of volunteer ARG across the treatments (Table 2), which was very different than the consistently high annual bluegrass control rates observed in the 2015–2016 growing season (Sullivan et al., 2017).

Table 1. Herbicide treatments used for row spraying at planting in new annual ryegrass seed fields planted in fall 2015 and fall 2016.

Product	Active ingredient	Rate	Product rate
		(lb ai/a)	(oz/a)
Control	—	—	—
Axiom DF ¹	Flufenacet + metribuzin	0.425	10
Diuron ¹	Diuron	1.0	32
Metribuzin	Metribuzin	0.25	9.7
Kerb	Pronamide	0.375	8
Fierce	Pyroxasulfone + flumioxazin	0.095	2
Alion	Indaziflam	0.013	1
Matrix	Rimsulfuron	0.047	3
Everest	Flucarbazone	0.0273	1
Eptam	EPTC	3.5	64

¹Product is registered for row spraying in ARG seed fields in Oregon.

Based on evaluations conducted at the end of March 2017, Fierce and Eptam provided the greatest (about 90%) and most consistent ARG control during the 2016–2017 growing season (Table 2). The metribuzin, Matrix, and Everest treatments all provided less than 25% control of volunteer ARG across both trial sites. The efficacy of diuron, Axiom DF, and Kerb varied by site. Diuron provided 69% control at the Lebanon site but only 5% control at the Irish Bend site, suggesting that the volunteer ARG populations at Irish Bend were tolerant to the rate of diuron used. Axiom DF resulted in only 67% volunteer ARG control at Lebanon but 91% at Irish Bend, while Kerb provided 85% control at Lebanon and only 58% control at Irish Bend.

The majority of the herbicide treatments resulted in about 10 to 20% crop injury at both sites (Table 2). However, the observed crop injury in March 2017 did not correspond to seed yield differences between treatments. Yields were very low at the Lebanon site due to a very significant amount of seed shatter at swathing and high winds disturbing the swaths. The results were very low yields and no separation between treatments (Table 2).

At the Irish Bend site, there was a trend toward higher seed yield in the Axiom DF treatment (2,331 lb/acre) as compared to the check and a trend showing lower yields with Kerb (1,153 lb/acre) and Alion (1,007 lb/acre) as compared to the check (Table 2).

Conclusions

We were able to collect reliable crop injury data from 2 years of trials, and results consistently showed no correlation between crop injury and seed yield. While weed pressure was too low in 2015–2016 for reliable control data, the 2016–2017 trials provided very realistic results from the use of these herbicide treatments for row spraying at planting in fields with heavy volunteer ARG pressure. Consistently over the 2 years of trials, Fierce provided the greatest and most consistent weed control between rows (*Poa* spp. and volunteer ARG).

The excellent control (greater than 90%) of *Poa* spp. observed in the metribuzin and Matrix treatments in 2015–2016 had some growers and fieldmen very interested, but these same products provided less than 30% control of volunteer ARG in 2016–2017. This

Table 2. Volunteer annual ryegrass control, crop injury, and clean seed yield results at two sites harvested in 2017.

Product	-- Volunteer control --		---- Crop injury ----		----- Seed yield ^{1,2} -----	
	Lebanon	Irish Bend	Lebanon	Irish Bend	Lebanon	Irish Bend
	----- (%) ³ -----				----- (lb/a) -----	
Control	0	0	0	0	37 a	1,438 ab
Axiom	67	91	12	16	173 a	2,331 a
Diuron	69	5	10	3	236 a	1,524 ab
Kerb	85	58	4	8	198 a	1,153 b
Metribuzin	23	11	8	4	296 a	1,512 ab
Fierce	96	94	20	11	166 a	1,685 ab
Alion	59	56	11	13	297 a	1,007 b
Matrix	19	15	10	11	285 a	1,476 ab
Everest	15	23	10	19	217 a	1,441 ab
Eptam	89	88	16	16	273 a	1,775 ab
LSD ($P = 0.05$)					184	618
CV					58	28

¹Lebanon was swathed June 28, 2017 and harvested July 12. Irish Bend was swathed June 28, 2017 and harvested July 17.

²Means followed by the same letter within the same column are not significantly different at LSD ($P = 0.05$).

³Control and crop injury evaluated March 31, 2017 at Lebanon and March 25, 2017 at Irish Bend.

was a very important observation, as the 2016–2017 trials tested these products under high volunteer ARG pressure, and they performed much differently than in the low-pressure fields of the first year of trials. The weed control performance of Kerb, Alion, and Everest also decreased with the heavy volunteer ARG pressure in the second year of trials. Axiom DF, the product currently used for row spraying at planting, varied in its weed control performance across all 4 site years from 67 to 92% control.

Axiom-planting is a common practice for ARG growers that is likely to continue, especially since it allows growers to plant their fields earlier in the fall. Whether the practice is advantageous in terms of input costs per pound of seed is yet to be determined. Based on these 2 years of data, there was no difference in yield between any of the treatments, including the untreated control. These preliminary studies show no advantage to row spraying at planting over conventional seeding, and none of the herbicide products tested in this experiment stand out as viable alternatives for Axiom DF. Fierce is the only product with potential; however, using Fierce would not be helpful for resistance management, as flufenacet and pyroxasulfone are the same mode of action. The injury potential and variability in efficacy from year to year with Kerb, Eptam, and Alion are too great to pursue registration for this use of these products.

In this study there was no measurement of other benefits that may be associated with row spraying, such as ease of straw management and harvest. Decreased biomass may allow for faster travel speeds at swathing and combining, resulting in increased harvest efficiency. Growers have reported that the reduction in overall straw load can be beneficial for slug management and future seedbed preparation.

References

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