ALS RESISTANT KOCHIA CONTROL IN SUGAR BEET

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ABSTRACT

ALS resistant kochia populations have increased markedly in the Big Horn Basin of Wyoming the last three years due to extensive use of sulfonylurea herbicides in barley and sugar beets. Studies were conducted under sprinkler and furrow irrigation at the Resource and Extension Centers at Torrington and Powell; respectively, in 2001 and 2002 to evaluate potential treatments for management of ALS resistant kochia in sugarbeets. Preplant applications of ethofumesate at full labeled rates in combination with postemergence applications of desmedipham/phenmedipham/ethofumesute provided the most consistence kochia control. Conventional rate treatments of desmedipham/phenmediphem/ ethofumesate were generally more effective than micro-rate treatments at both locations. Spiking desmedipham/phenmediphem/ethofumesate with additional ethofumesate increased kochia control at both sites; however the spiked treatments were less effective than the complementary preemerence/ postemergence treatment program.

INTRODUCTION

The repeated use of herbicides with similar modes of action on the same site over a period of years has resulted in weed biotypes that are resistant to such herbicides (LeBaron, H.M. and Gressel J., 1982). Since the first report of herbicide resistant weeds (Ryan, G.F., 1970) they have become widespread throughout the agricultural communities around the world. The first report of ALS resistant kochia came from a Kansas wheat field in 1987 (Primiani M.M. et al., 1990). Herbicides that inhibit the ALS enzyme have an increased risk of selecting for resistant weed populations because several mutations of the enzyme produce resistant biotypes (Saari, L.L. et al., 1994). ALS resistant kochia has since been identified in most western states and was first observed in Wyoming in 1996 (Heap I., 2003) and has increased markedly in sugar beets since that initial report. The objective of this research was to evaluate the effectiveness of complementary pre/post, post/layby or spiked post treatments for ALS resistant kochia control in sugarbeets.

MATERIALS AND METHODS

Plots were established under irrigation at the Research and Extension Centers at Torrington and Powell, WY in 2001 and 2002. Plots were 3 or 3.3 by 9 m at Torrington and Powell; respectively, and were replicated three times in a randomized complete block design. Sugar beets were planted to stand in mid to late April at both locations (See Table 1 for detailed information). Herbicide treatments were applied broadcast with a CO_2 pressurized knapsack sprayer delivering 187 L/ha at 276 kpa (see table 2 for application information and Table 3 for a detailed treatment description). Weed counts and visual crop injury ratings were made 10 to 14 days after the last treatment application in a given study and plots were harvested in early to mid-October with a single row mechanical lifter.

RESULTS AND DISCUSSION

ALS resistant kochia control differed between locations both years and was generally better at Torrington than Powell. However, ALS resistant kochia response to treatments was similar and the data was combined over locations and years. Micro-rate programs were 8 to 9% less effective than conventional rate programs on ALS resistant kochia when averaged over location and years (Table 4).

Complementary preplant incorporated (PPI) applications of ethofumesate at 0.5 and1.0X the labeled rate in combination with postemergence applications of desmediphan/phenmedipham/ethofumesate increased ALS resistant kochia control 18 to 29% depending on post program compared to the post program alone (Table 4). Full labeled rates of ethofumesate in combination with the post program tended to be more effective than the 0.5 x rate particularly when using the micro-rate program. Spiking desmedipham/phenmedipham/ethofumesate with additional ethofumesate increased ALS resistant kochia control 12 to 27% depending on post program compared to the non-spiked post treatments (Table 4). Spiking with 70 g/ha ethofumesate was more effective than spiking with 35 g/ha regardless of post program. Layby applications of dimethenamid-P increased ALS resistant kochia control in the post-programs 17 to 28%. Layby applications applied with the last post application tended to be more effective than delaying applications 7 to 14 days following the last post treatment (Table 4). Studies were also conducted using desmedipham/phenmedipham in the post program and in general treatments with desmedipham/phenmedipham were 5 to 10% less effective on ALS resistant kochia than post programs with desmedipham/phenmedipham/ethofumesate (data not shown).

No treatment reduced sugarbeet stands and; however, slight to moderate injury (3 to 19%) was observed with complementary preplant/post or post treatments spiked with the high rate of ethofumesate. Sugarbeet yields were 31 to 45 Mg/ha higher in herbicide treated compared to weedy check plots and were generally not different among herbicide treatments or the hand weeded check (data not shown).

Table 1. Agronomic information for trials conducted at Torrington and Powell in 2001 and 2002.

	Location	
Parameter	Torrington	Powell
Soil type	Sandy loam	Clay loam
Soil series	Mitchell	Garland
Soil pH	7.7-7.9	7.5-7.7
Soil OM (%)	1.1-1.3	1.3-1.5
Fertilizer (NPK kg/ha)	168-56-0	235-75-0
Seed rate (1000/ha)	168	138
Row width (cm)	76	56
Cultivar 01	Monohikari	Ranger
02	Beta 4657	Geyser
Irrigation	Overhead sprinkler	Furrow

Table 2. Application and climatic information for trials conducted at Torrington and Powell in 2001 and 2002.

Application timing	Torrington[1]						Powell					
	PPI	CO	2L	4L	6L	Lay	PPI	CO	2L	4L	6L	Lay
01-Date	4/17	5/07	5/16	5/22	5/29	6/06	4/19	5/14	5/21	5/28	6/4	6/13
Air temp. (C)	18	19	18	18	20	21	18	22	26	26	21	24
Rel. Hum. (%)	30	35	40	30	45	28	40	46	30	46	25	30
Wind (kph)	12	-	8	30	--	5	--	5	8	5	12	8
Weeds (cm)	-	<1.0	2.5	3.0	3.0	<1.0	-	1.0	2.0	2.0	3.0	2.0
02-Date	4/16	5/24	5/31	6/7	6/14	6/20	4/18	5/17	5/24	5/30	6/4	6/13
Air temp.(C)	20	10	18	18	22	22	19	12	12	22	18	15
Rel. Hum. (%)	30	53	20	35	30	30	43	60	45	58	38	38
Wind (kph)	12	-	5	5	8		8	5		-	8	5
Weed (cm)	-	1.0	2.0	3.0	3.0	<1.0	--	1.0	3.0	3.0	3.0	3.0

Table 3. Treatment definitions for trials conducted at Torrington and Powell in 2001 and 2002.

Treat	Definitions and rate
PPI	Ethofumesate preplant incorporated. Herbicide applied in front of planter and 7 inch band rotary incorporated directly over sugar beet row. X rate =1.68 kg/ha at Torrington and 2.24 kg/ha at Powell.
Micro-rate	Desmediphan/phenmedipham or desmedipham/ phenmedipham/ethofumesate+ clopyralid+triflusulfuron+methylated seed oil applied 3 or 4 times. Rate 90 g/ha + 26g/ha + 4.5g/ha + 1.5% V/V with applications starting at the cotyledon stage.
Conventional-rate	Desmediphan/phenmedipham or desmedipham/ phenmedipham/ethofumesate applied 2 to 3 times. The first appliction contains triflusulfuron and the second application clopyralid. The third application may or may not contain a grass herbicide. Rate 280g/ ha+18g/ha triflusulfuron; 370g/ha+105g/ha clopyralid; 370g/ha±grass herbicide.
Spiked treatment	Additional ethofumeate added to each application of either the micro-rate or conventional-rate program. Rate 35 or 70g/ha ethofumesate.
Layby	Dimethenamid-P applied with last post application or 7 days later. Rate 0.84 kg/ha at Torrington or 0.9 kg/ha Powell.

Table 4. ALS resistant kochia control with complementary PPI/Post treatments, ethofumesate spiked post treatments and complementary post/layby treatments.

Post treatment[1]	PPI ethofumesate rate		
	0	0.5 X	1 X
		%	
None	- -	69	84
Micro-rate (3X)	62	86	93
Micro-rate (4X)	70	90	94
Conventional-rate (2X)	71	93	98
Conventional-rate (3X)	78	95	98
		Spiked ethofumesate rate (g/ha)	
		35	70
Micro-rate (3X)		75	89
Micro-rate (4X)		86	94
Conventional-rate (2X)		84	93
Conventional-rate (4X)		90	96
		layby applications of dimethenamid-P	
		With last Post application	7 to 14 day following last Post application
Micro-rate (3X)		87	84
Micro-rate (4X)		92	90
Conventional-rate (2X)		90	86
Conventional-rate (3X)		96	92

[1]*Foundation herbicide in post program was desmedipham/phenmedipham/ethofumesate. See Table 3 for treatment definitions.*

CONCLUSIONS

Preplant applications of ethofumesate at full labeled rates in combination with postemergence applications of desmedipham/phenmedipham/ethofumesate provided the most consistent ALS resistant kochia control. Conventional rate treatments were more effective than micro-rate treatments

and desmedipham/phenmedipham/ethofumesate more effective than desmedipham/phenmedipham in all studies.

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