

ABSTRACT

Imidazolinone-resistant (Clearfield) sunflower response and weed management with herbicides were investigated in field trials conducted at Carrington, ND in 2001 and 2002. In 2001, preemergence (PRE) –applied sulfentrazone (Spartan) provided 70 to 99% control of common lambsquarters, pigweed, wild buckwheat, and eastern black nightshade and pendimethalin (Prowl) + Spartan provided 87 to 99% control. Weed control in 2002 was poor with PRE treatments due to the extended delay in rainfall after herbicide application. Weed control generally was good to excellent (81 to 99%) with PRE treatments followed by post emergence (POST) imazamox (Beyond) at 0.031 lb ai/A (4 fl oz/A) + nonionic surfactant (NIS) + 28% N. Without a PRE treatment, Beyond at 4 fl oz/A provided 84 to 91% control of foxtail and 92 to 99% control of pigweed, marshelder, wild mustard, and eastern black nightshade. Beyond + methylated seed oil (MSO) generally did not improve weed control compared to Beyond + NIS. In 2001, Clearfield sunflower growth generally was reduced with Beyond, but the effect lessened as plants developed. In 2002, sunflower tolerance to Beyond was excellent, but variable with six POST sulfonylurea herbicides and injury ranged from 0 to 90%.

OBJECTIVE

The trial was conducted to identify Clearfield sunflower response and weed management strategies with selected soil- and POST-applied herbicides, with emphasis on use of Beyond herbicide.

MATERIALS AND METHODS

Trial experimental design was a randomized complete block with three replicates. The trial was conducted on loam soil with 8.0 pH and 2.5% organic matter in 2001, and 6.2 pH and 3.9% organic matter in 2002 at Carrington, ND. Clearfield sunflower lines were planted in 30-inch rows on June 1, 2001 and May 22, 2002. Herbicide treatments were applied to 10 by 30 ft plots with a CO₂ pressurized hand-held plot sprayer.

In 2001, PRE treatments were applied on a dry soil surface at 14 gal/A and 30 psi through 8002 flat fan nozzles on June 2 with 55 F, 81% RH, clear sky, and 6 mph wind. A total of 2.15 inches of rainfall occurred during the 10-day period following PRE treatment application. POST treatments were applied at 14 gal/A and 30 psi through 80015 flat fan nozzles on June 28 with 79 F, 84% RH, clear sky, and 5 mph wind to V4-stage sunflower, 3- to 5-leaf green and yellow foxtail, 0.5- to 1-inch tall common lambsquarters, 0.5- to 2-inch tall redroot and prostrate pigweed, 1- to 4-inch tall wild mustard, 1- to 2-inch tall wild buckwheat, and 0.5-inch tall eastern black nightshade. The late-POST (LPOST) treatments were applied on July 5 with 55 F, 84% RH, clear sky, and 5 mph wind to V8-stage sunflower, 1- to 6-inch tall foxtail, 2- to 3-inch tall common lambsquarters, 0.5- to 2-inch tall pigweed, 3- to 4-inch tall wild mustard, 1- to 2-inch tall wild buckwheat, and 0.5- to 1-inch tall eastern black nightshade.

In 2002, PRE treatments were applied on a dry soil surface at 17 gal/A and 30 psi through 8002 flat fan nozzles on May 23 with 44 F, 53% RH, 65% clear sky, and 11 mph wind. Rainfall did not occur until 16 days following application of PRE treatments (1.15 inches). POST treatments were applied at 11.5 gal/A and 30 psi through 8001 flat fan nozzles on June 29 with 81 F, 61% RH, 80% clear sky, and 6 mph wind to V10-stage sunflower, 1- to 10-inch tall foxtail, and 1- to 2-inch tall marshelder.

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RESULTS AND DISCUSSION

In 2001, weed control was generally good to excellent (81 to 99%) with PRE treatments followed by POST Beyond or Beyond + imazapyr (Arsenal) (Table 1). Without a PRE treatment, Beyond generally provided excellent control (84-99%) of foxtail, pigweed, wild mustard and eastern black nightshade. Common lambsquarters and wild buckwheat control improved with Beyond + Arsenal compared to Beyond alone. The low rate of sequentially-applied Beyond + Arsenal + Quad7 provided 84 to 99% weed control. Sunflower growth was generally reduced in the Clearfield lines with Beyond or Beyond + Arsenal, ranging from 0 to 31%.

In 2002, weed control was poor with PRE treatments due to the extended delay in rainfall after herbicide application (Table 2). Foxtail and marshelder control generally was good to excellent (83 to 92%) with Beyond. Use of MSO as an adjuvant or addition of Arsenal did not improve weed control compared to Beyond + NIS + 28% N. Sunflower tolerance to Beyond and Beyond + Arsenal was excellent. Sunflower tolerance to tribenuron (Express) and nicosulfuron (Accent) was excellent while response was high with thifensulfuron (Harmony GT), thifensulfuron&tribenuron (Harmony Extra), foramsulfuron (Option), and chloransulam (FirstRate).

Table 1. Clearfield sunflower weed control and response with herbicides, Carrington, 2001 (Endres and Zollinger).

Treatment ^a	Rate (lb/A)	4 w k after treatment						Sunflower response ^b						
		Fota	Colq	Pwe	Wimu	Wibw	Ebns	Con	Im1	Im2	Con	Im1	Im2	
		----- (% control) -----						----- (% growth reduction) -----						
Untreated	---	0	0	0	0	0	0	0	0	0	0	0	0	0
PRE														
Pendimethalin	1.24	62	63	58	70	91	61	0	0	0	0	0	0	0
Sulfentrazone	0.14	63	99	75	35	75	78	0	0	0	0	0	0	0
Sulfentrazone	0.16	59	99	97	58	70	99	0	0	0	0	0	0	0
Pend+suen	1.24+0.14	76	99	97	70	87	99	5	9	7	0	3	0	0
Pend+suen	1.24+0.16	75	99	98	78	99	99	0	9	7	0	0	0	0
PRE/POST														
Pend+suen/Imzamax+NIS+28%N	1.24+0.14/0.031+0.25%+2.5%	95	99	99	99	96	99	95	14	10	98	7	8	
Pend+suen/Immx+NIS+28%N	1.24+0.14/0.039+0.25%+2.5%	96	99	99	99	92	99	95	17	13	98	6	7	
Pend+suen/Immx+ imazapyr+NIS+28%N	1.24+0.14/0.039+0.016+0.25%+2.5%	90	99	99	99	99	99	96	17	13	99	4	6	
Pend/Immx+NIS+28%N	1.24/0.031+0.25%+2.5%	93	95	98	99	81	91	96	15	12	99	16	8	
Pend/Immx+MSO+28%N	1.24/0.031+1.25%+2.5%	94	96	96	99	93	99	96	15	17	98	3	0	
POST														
Pend+Immx+NIS+28%N	1.24+0.031+0.25%+2.5%	91	98	98	99	72	99	95	21	21	98	12	7	
Pend+Immx+MSO+28%N	1.24+0.031+1.25%+2.5%	94	97	97	99	79	99	96	19	19	97	13	8	
Immx+MSO+28%N	0.031+1.25%+2.5%	91	87	98	99	71	96	95	17	12	99	11	5	
Immx+NIS+28%N	0.031+0.25%+2.5%	84	86	98	99	69	96	95	11	5	99	9	2	
Immx+MSO+28%N	0.039+1.25%+2.5%	91	86	97	99	70	90	96	13	7	95	7	5	
Immx+NIS+28%N	0.039+0.25%+2.5%	93	78	96	99	72	94	95	14	12	98	5	3	
Immx+impr+NIS+28%N	0.031+0.016+0.25%+2.5%	94	94	99	99	91	98	98	13	11	99	7	3	
Immx+impr+MSO+28%N	0.031+0.016+1.25%+2.5%	91	93	98	99	94	98	96	11	14	98	4	5	
Immx+impr+Quad7	0.031+0.016+1%	90	97	99	99	96	98	97	10	9	99	9	0	
Immx+impr+Quad7	0.063+0.031+1%	98	99	99	99	98	99	99	31	23	99	16	11	
POST/LPOST														
Immx+impr+Quad7/Immx+ impr+Quad7	0.016+0.008+1%/0.016+0.008+1%	97	99	99	99	93	99	97	7	9	97	0	3	
Immx+impr+Quad7/Immx+ impr+Quad7	0.012+0.006+1%/0.012+0.006+1%	95	98	99	99	84	99	93	13	3	96	3	3	
LSD (0.05)		10	8	12	18	20	14	4	9	9	3	9	NS	

^aNIS=Induce, a nonionic surfactant from Helena Chemical Co., Memphis, TN; MSO=Destiny, a methylated seed oil from Agrilliance, St. Paul, MN; Quad7=a surfactant blend from AGSCO, Grand Forks, ND.

^bSunflower response=height or biomass reduction 2 and 4 weeks after treatment; Con=Cargill 'SF290', Im1=USDA 'CMSH425 xRHA426', Im2=Mycogen 'x81350'.

Table 2. Clearfield sunflower weed control and response with herbicides, Carrington, 2002 (Endres and Zollinger).

Treatment ^a	Rate (lb ai/A)	4 w k after trt		Sunflower response	
		Fota	Mael	2 w k after trt	4 w k after trt
		-- (% control) --		----- (% growth reduction) -----	
Untreated	x	0	0	0	0
PRE					
Pendimethalin+sulfentrazone	1.24+0.164	25	36	x	0
Pendimethalin H ₂ O+suen	1.24+0.164	44	40	x	0
PRE/POST					
Pend/Imzamax+NIS+28%N	1.0/0.031+0.25%+1%	83	86	0	0
Pend/Immx+imazapyr+NIS+28%N	1.0/0.031+0.014+0.25%+1%	90	88	0	0
Pend/Immx+impr+NIS+28%N	1.0/0.022+0.010+0.25%+1%	81	85	0	0
Pend+suen/Immx+NIS+28%N	1.0+0.125/0.031+0.25%+1%	87	88	0	0
Pend+suen/Immx+impr+NIS+28%N	1.0+0.125/0.022+0.010+0.25%+1%	91	83	0	0
POST					
Immx+NIS+28%N	0.031+0.25%+1%	76	92	0	0
Immx+MSO+28%N	0.031+1%+1%	80	92	1	0
Immx+impr+NIS+28%N	0.031+0.014+0.25%+1%	90	92	0	0
Immx+impr+NIS+28%N	0.031+0.010+0.25%+1%	77	88	0	0
Tribenuron+NIS	0.014+0.25%	0	38	0	0
Thifensulfuron+NIS	0.014+0.25%	0	95	90	90
Thif&trib+NIS	0.014+0.25%	0	96	89	77
Nicosulfuron+NIS	0.031+0.25%	57	45	0	0
Foramsulfuron+MSO+28%N	0.033+1.6%+3.3%	73	93	70	38
Chloransulam+NIS	0.016+0.25%	0	95	71	47
LSD (0.05)		24	22	4	6

^aNIS=Preference, a nonionic surfactant from agrilliance, St. Paul, MN; MSO=Destiny, a methylated seed oil from Agrilliance, St. Paul, MN.



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