MANAGEMENT OF WATERHEMP WITH SOIL-APPLIED FOLLOWED BY POSTEMERGENCE HERBICIDES IN ROUNDUP READY® SUGARBEET AT MOORHEAD, MN IN 2013

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The objective of this study was to determine the effectiveness of soil-applied followed by postemergence herbicides on control of glyphosate-resistant and -susceptible waterhemp populations and the impact on sugarbeet yield and extractable sucrose.

MATERIALS AND METHODS

Plot area was worked with a Kongskilde 's-tine' field cultivator equipped with rolling baskets on May 17, 2013. 'Hilleshog 4022RR' sugarbeet was seeded 1.25 inches deep in 22 inch rows at 60,825 seeds per acre on May 17. Sugarbeet was treated with Tachigaren and Poncho Beta at 45 grams and 5.07 fl oz of product, respectively, per 100,000 seeds. Counter 20G insecticide at 8.9 pounds product per acre was applied in a 5-inch band and drag chain incorporated at planting. Herbicide treatments were applied May 17, June 12, and July 2 & 17. All treatments were applied with a bicycle sprayer in 17 gpa spray solution through 8002 XR flat fan nozzles pressurized with CO_2 at 40 psi to the center four rows of six row plots 30 feet in length. Preplant-incorporated (PPI) treatments were incorporated 1.5 inches deep with a John Deere 8-foot 's-tine' field cultivator equipped with a spring-tooth harrow. Quadris was broadcast at 16 fl oz/A June 13 to prevent Rhizoctonia root rot. Cercospora leaf spot was controlled with Proline at 5.7 fl oz/A and Headline EC at 9 fl oz/A broadcast July 29 and August 19, respectively. Sugarbeet was harvested September 26 from the center two rows of each plot and weighed. Twenty to thirty pounds of sugarbeet was collected from each plot and analyzed for quality at American Crystal Sugar Quality Lab, East Grand Forks, MN.

Sugarbeet stand was counted in the center two rows of plots on June 18, July 11, and September 26. Sugarbeet injury was evaluated on June 12, July 30, and August 13. Waterhemp control was evaluated June 12, July 30, August 13, and September 4. All evaluations were a visual estimate of percent fresh weight reduction in the four treated rows compared to the adjacent untreated strip. Experimental design was randomized complete block with 4 replications. Data were analyzed with the ANOVA procedure of Agriculture Research Manager, version 8.5.0 software package.

Table 1. Application Information

Application code	A	B	C	D	E
Date	May 17	May 17	June 12	July 2	July 17
Time of Day	10:00 A	12:30 P	12:00 P	12:45 P	10:00 A
Air Temperature (F)	72	75	74	84	87
Relative Humidity (%)	39	32	65	32	63
Wind Velocity (mph)	2	3	3	4	2
Wind Direction	SE	SE	NE	NE	N
Soil Temp. (F at 6")	57	57	65	78	74
Soil Moisture	Good	Good	Good	Good	Good
Cloud Cover	60	80	98	40	15
Sugarbeet stage (avg)	PPI	PRE	2 lf	10 lf	15 lf
Waterhemp (untreated avg)	-	-	2 lf	18 inch	24 inch

SUMMARY

Three applications of Roundup PowerMax (glyphosate; 4.5 lbae/gal) gave 53% waterhemp control at the September 4 evaluation. This level of control indicates the presence of glyphosate-resistant waterhemp. The addition of Betamix (desmedipham + phenmedipham; 0.65 + 0.65 lbai/gal), Ethofumesate 4SC (ethofumesate; 4 lbai/gal), and Destiny HC (a high surfactant methylated seed oil concentrate) to glyphosate increased waterhemp control to 83%. The addition of Outlook (dimethanamid-p; 6 lbai/gal) to the PowerMax+Ethofumesate+Betamix tank-mix improved waterhemp control in some treatments but not in others. Outlook must be applied prior to waterhemp emergence to provide any control. Outlook may have been applied too late in this study to show a consistent benefit from the lay-by herbicide. When combined across all postemergence (POST) combinations, PRE Dual Magnum (s-metolachlor; 7.62 lbai/gal) gave the greatest waterhemp control of 92% at both 1.0 and 1.5 pt/a. When combined across all POST combinations, waterhemp control in the absence of a soil applied herbicide was 72%. Ro-Neet SB (cycloate; 6 lbai/gal) at 5.6 pt/a and Ethofumesate 4SC (ethofumesate; 4 lb ai/gal) at 7.5 pt/a each gave 82% waterhemp control when averaged across all POST combinations.

Sugarbeet injury was observed from PRE Dual Magnum at both 1.0 and 1.5 pt/a rates. The greatest injury, 16%, was observed for the 1.5 pt/a rate when combinded across all POST combinations. Sugarbeet stand was also reduced from Dual Magnum at 1.5 pt/a compared to any other soil applied herbicide when combined across all POST combinations. Dual Magnum, when applied PRE at 1.0 pt/a, did not affect sugarbeet stand. No significant sugarbeet injury or stand reduction was observed from Ro-Neet SB or Ethofumesate 4SC at any rate tested. The addition of Betamix POST resulted in significant sugarbeet injury at the July 30 evaluation. However, this injury did not appear to affect sugarbeet yield or quality. Sugarbeet extractable sucrose yield was greater when the highest rate tested of each of Dual Magnum, Ro-Neet SB, and Ethofumesate 4SC was followed by three PowerMax applications, compared to three PowerMax applications alone. The addition of Ethofumesate at 4 fl oz/a to each PowerMax application also increased extractable sucrose compared to PowerMax alone.

Table 2. Management of Waterhemp with Soil-Applied Followed by Postemergence Herbicides in Roundup Ready® Sugarbeet – Moorhead, MN – 2013 (Carlson)

					June 12		July 30		Aug 13		Sept 4	Jun 18	Jul 11	September 26			
Trt No	Treatment Name	Rate	Rate Unit	Appl Code	sgbt inj	wahe cntl	sgbt inj	wahe cntl	sgbt inj	wahe cntl	wahe cntl	sgbt stand	sgbt stand	sgbt stand	sgbt yield	sgbt sucr	sgbt ext sucr
					---%---							---no. / 100 ft---			ton/a	%	lb/a
1	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E	0	0	0	52	0	51	53	173	163	155	22.5	13.8	5164
	N Pak AMS	2.5	% v/v	CDE													
	NIS	0.25	% v/v	CDE													
2	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E	0	0	0	70	0	74	70	183	179	155	29.1	13.7	6595
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
3	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E	0	0	7	87	1	87	83	185	179	181	27.9	13.9	6554
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
4	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E	0	0	7	87	0	83	81	183	187	176	29.2	14.0	6906
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Outlook	21	fl oz/a	D													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
5	Ro-Neet SB	3.6	pt/a	A	1	68	0	69	0	69	66	186	178	160	23.9	13.9	5675
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	N Pak AMS	2.5	% v/v	CDE													
	NIS	0.25	% v/v	CDE													
6	Ro-Neet SB	3.6	pt/a	A	0	54	0	84	0	83	82	181	175	166	31.1	13.7	7110
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
7	Ro-Neet SB	3.6	pt/a	A	3	56	7	89	1	86	83	169	165	150	28.0	13.6	6323
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
8	Ro-Neet SB	3.6	pt/a	A	0	59	7	93	0	94	91	182	178	159	29.9	13.7	6833
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Outlook	21	fl oz/a	D													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
9	Ro-Neet SB	5.3	pt/a	A	1	75	0	72	0	69	70	174	183	163	28.0	13.8	6443
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	N Pak AMS	2.5	% v/v	CDE													
	NIS	0.25	% v/v	CDE													

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					June 12		July 30		Aug 13		Sept 4	Jun 18	Jul 11	September 26			
Trt No	Treatment Name	Rate	Rate Unit	Appl Code	sgbt inj	wahe cntl	sgbt inj	wahe cntl	sgbt inj	wahe cntl	wahe cntl	sgbt stand	sgbt stand	sgbt stand	sgbt yield	sgbt sucr	sgbt ext sucr
					----------------------------%----------------------------							------no. / 100 ft------			ton/a	%	lb/a
10	Ro-Neet SB	5.3	pt/a	A	0	60	0	82	0	84	80	180	176	166	31.6	13.5	7081
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
11	Ro-Neet SB	5.3	pt/a	A	5	76	6	96	0	93	87	154	160	144	29.9	13.4	6644
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
12	Ro-Neet SB	5.3	pt/a	A	1	71	7	97	0	97	91	179	167	162	29.5	13.2	6445
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Outlook	21	fl oz/a	D													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
13	Dual Magnum	1	pt/a	B	3	78	0	87	0	81	80	163	161	168	31.9	13.5	7084
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	N Pak AMS	2.5	% v/v	CDE													
	NIS	0.25	% v/v	CDE													
14	Dual Magnum	1	pt/a	B	4	79	0	97	0	96	96	170	163	158	32.6	14.0	7795
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
15	Dual Magnum	1	pt/a	B	7	71	7	97	1	97	95	162	152	151	28.9	13.3	6330
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
16	Dual Magnum	1	pt/a	B	6	86	8	98	1	97	97	154	145	144	30.5	14.0	7228
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Outlook	21	fl oz/a	D													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
17	Dual Magnum	1.5	pt/a	B	14	79	0	84	0	85	82	150	160	142	30.1	13.8	6929
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	N Pak AMS	2.5	% v/v	CDE													
	NIS	0.25	% v/v	CDE													
18	Dual Magnum	1.5	pt/a	B	18	86	0	94	0	95	92	143	124	122	30.7	13.4	6749
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
19	Dual Magnum	1.5	pt/a	B	16	81	8	95	0	97	95	147	152	143	28.7	13.6	6424
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													

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					----------%----------							------no. / 100 ft------			ton/a	%	lb/a
20	Dual Magnum	1.5	pt/a	B	16	84	8	98	0	99	98	139	138	135	29.0	13.3	6361
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Outlook	21	fl oz/a	D													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
21	Ethofumesate	5	pt/a	A	0	63	0	79	0	80	78	158	166	135	27.6	13.1	5910
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	N Pak AMS	2.5	% v/v	CDE													
	NIS	0.25	% v/v	CDE													
22	Ethofumesate	5	pt/a	A	0	63	0	82	0	83	82	163	167	161	30.7	13.0	6517
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
23	Ethofumesate	5	pt/a	A	0	59	7	87	0	86	82	173	183	163	30.2	13.6	6743
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
24	Ethofumesate	5	pt/a	A	2	64	7	94	1	93	89	180	173	166	28.1	13.8	6410
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Outlook	21	fl oz/a	D													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
25	Ethofumesate	7.5	pt/a	A	1	70	0	79	0	71	73	176	182	163	31.1	13.6	6985
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	N Pak AMS	2.5	% v/v	CDE													
	NIS	0.25	% v/v	CDE													
26	Ethofumesate	7.5	pt/a	A	0	80	0	92	0	90	85	185	169	165	32.1	13.7	7284
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
27	Ethofumesate	7.5	pt/a	A	0	76	9	89	0	87	84	185	176	166	28.9	14.0	6868
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
28	Ethofumesate	7.5	pt/a	A	1	65	8	93	0	95	88	173	159	160	29.2	13.6	6597
	RU PowerMax	32 / 24 / 22	fl oz/a	C/D/E													
	Betamix	10 / 16 / 24	fl oz/a	C/D/E													
	Outlook	21	fl oz/a	D													
	Ethofumesate	4	fl oz/a	CDE													
	N Pak AMS	2.5	% v/v	CDE													
	Destiny HC	1.5	pt/a	CDE													
29	Untreated Check				0	0	0	0	0	0	0	174	-	21	0.0	0.0	0
	LSD 5%				**6.8**	**12.7**	**3.1**	**9.6**	**NS**	**10.0**	**10.8**	**24.1**	**26.3**	**26.6**	**3.72**	**0.76**	**935**
	CV %				**143**	**15**	**64**	**8**	**491**	**9**	**10**	**10**	**11**	**12**	**9**	**4**	**10**