

MANAGEMENT OF GLYPHOSATE-RESISTANT WATERHEMP WITH SOIL-APPLIED FOLLOWED BY POSTEMERGENCE HERBICIDES IN ROUNDUP READY® SUGARBEET

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The soil was tilled two or three times prior to seedbed preparation using a spring-tooth harrow. A seedbed was prepared using an 11-foot Kongskilde S-tine field cultivator equipped with rolling baskets. Glyphosate-resistant waterhemp from Richland County, ND was spread on May 11 to add to the variable local glyphosate-resistant population. Due to exceptionally dry conditions, sugarbeet was not seeded until May 25. ‘Hilleshog 4022 RR’ sugarbeet was seeded 1.25 inches deep in 22 inch rows at 60,825 seeds per acre. 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 25, June 8, 15, 28, and July 12. All treatments were applied with a bicycle sprayer in 17 gpa spray solution through 8002 XR flat fan nozzles pressurized with CO₂ at 40 psi to the center four rows of six row plots 30 feet in length. Preplant-incorporated treatments were incorporated 2 inches deep with an 8-foot John Deere ‘S-tine’ field cultivator equipped with a spring tooth harrow. Quadris was broadcast at 16 fl oz/A June 12, 26 to prevent Rhizoctonia root rot. Cercospora leaf spot was controlled with Headline at 9 fl oz/A and Inspire XT at 7 fl oz/A broadcast July 18 and August 7, respectively. Sugarbeet was harvested September 20 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 28, July 19, and September 20. Sugarbeet injury was evaluated on June 15, 21, 30, July 5, 13, 16, 25, and August 9. Waterhemp, common lambsquarters, and redroot pigweed control were evaluated on June 15, 30, July 13, 25, and August 9, 29 and volunteer RR canola evaluated on July 25. 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 8.4.2 software package.

Table 1. Application Information

Application code	A	B	X	C	D	E
Date	May 25	May 25	June 8	June 15	June 28	July 12
Time of Day	11:30 A	1:30 P	9:30 A	3:00 P	11:00 A	12:30 P
Air Temperature (F)	62	64	70	79	82	81
Relative Humidity (%)	41	40	55	44	29	59
Wind Velocity (mph)	4	4	10	2	9	8
Wind Direction	W	W	WNW	ENE	NW	SSE
Soil Temp. (F at 6")	50	50	70	70	70	81
Soil Moisture	Good	Good	Fair	Good	Fair	Dry
Cloud Cover	80	80	10	15	5	40
Sugarbeet stage (avg)	PPI	PRE	cot	2 lf	8 lf	11 lf
Wahe height [min./max.(avg)]	-	-	-	0.1/1"(0.37")	-	-
Wahe density (plants/m ²)	-	-	-	31	-	-
Colq height [min./max.(avg)]	-	-	-	0.1/1.2"(0.63")	-	-
Colq density (plants/m ²)	-	-	-	50	-	-

SUMMARY

This location has glyphosate-resistant waterhemp based upon the 55% control on August 29th following three glyphosate applications. On June 15 at the time of the first postemergence applications, Nortron provided the greatest waterhemp control, followed closely by Dual Magnum. Ro-Neet controlled significantly fewer waterhemp compared to the other two soil-applied herbicides and produced a greater difference between rates than the other soil-applied herbicides. The addition of Betamix to glyphosate did not improve control of waterhemp and can be explained by the presence of resistant biotypes according to greenhouse research. The addition of Outlook to the postemergence applications did not improve control substantially and caused more injury and the greatest yield loss. The use of a soil-applied herbicide is essential to controlling waterhemp.

Table 2. Weed control and sugarbeet injury and yield from the management of glyphosate-resistant waterhemp with soil-applied followed by postemergence herbicides in Roundup Ready® sugarbeet - Moorhead, MN – 2012 (Stachler).

Trt No.	Herbicide Name	Rate	Appl Unit	Appl Code	15-Jun				30-Jun				25-Jul				29-Aug			20-Sep		
					Sgbt Inj	Wahe Cntl	Colq Cntl	Rrpw Cntl	Sgbt Inj	Sgbt Inj	Wahe Cntl	Colq Cntl	Rrpw Cntl	Cano Cntl	Wahe Cntl	Colq Cntl	Sgbt Stnd	Sgbt Yield	Sgbt Sucr	Ext. Sucr		
9	Dual Mag	1 pt/a	B	8	84	41	78	17	11	91	99	99	44	86	99	90	23.4	15.7	267			
	Betamix	12 fl oz/a	C	-----%-----																		
	Betamix	16 fl oz/a	D	#/100'																		
	Betamix	24 fl oz/a	E	ton/A																		
	Nortron	4 fl oz/a	CDE	% lb/ton																		
	RU P.Max	1.13 lb ae/a	C																			
	RU P.Max	0.84 lb ae/a	D																			
	RU P.Max	0.75 lb ae/a	E																			
	Destiny HC	1.5 pt/a	CDE																			
	N-Pak AMS	2.5 % v/v	CDE																			
10	Dual Mag	1 pt/a	B	6	87	38	77	18	10	95	99	99	47	91	99	109	25.2	15.9	272			
	Betamix	12 fl oz/a	C																			
	Betamix	16 fl oz/a	D																			
	Betamix	24 fl oz/a	E																			
	Nortron	4 fl oz/a	CDE																			
	Outlook	14 fl oz/a	C																			
	Outlook	10 fl oz/a	D																			
	RU P.Max	1.13 lb ae/a	C																			
	RU P.Max	0.84 lb ae/a	D																			
	RU P.Max	0.75 lb ae/a	E																			
	Destiny HC	1.5 pt/a	CDE																			
	N-Pak AMS	2.5 % v/v	CDE																			
11	Dual Mag	1.5 pt/a	B	8	88	48	87	7	4	94	99	99	18	90	99	101	25.2	16.4	281			
	RU P.Max	1.13 lb ae/a	C																			
	RU P.Max	0.84 lb ae/a	D																			
	RU P.Max	0.75 lb ae/a	E																			
	Destiny HC	1.5 pt/a	CDE																			
	N-Pak AMS	2.5 % v/v	CDE																			
12	Dual Mag	1.5 pt/a	B	8	91	60	85	7	2	97	99	99	35	95	99	109	25.4	16.8	292			
	RU P.Max	1.13 lb ae/a	C																			
	RU P.Max	0.84 lb ae/a	D																			
	RU P.Max	0.75 lb ae/a	E																			
	Nortron	4 fl oz/a	CDE																			
	Destiny HC	1.5 pt/a	CDE																			
	N-Pak AMS	2.5 % v/v	CDE																			
13	Dual Mag	1.5 pt/a	B	10	90	60	82	13	11	94	99	99	45	94	99	101	25.1	16.8	293			
	Betamix	12 fl oz/a	C																			
	Betamix	16 fl oz/a	D																			
	Betamix	24 fl oz/a	E																			
	Nortron	4 fl oz/a	CDE																			
	RU P.Max	1.13 lb ae/a	C																			
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14	Dual Mag	1.5	pt/a	B	8	94	65	84	17	15	97	99	99	50	96	99	97	23.9	16	274
	Betamix	12	fl oz/a	C	-----%-----															
	Betamix	16	fl oz/a	D																
	Betamix	24	fl oz/a	E																
	Nortron	4	fl oz/a	CDE																
	Outlook	14	fl oz/a	C																
	Outlook	10	fl oz/a	D																
	RU P.Max	1.13	lb ae/a	C																
	RU P.Max	0.84	lb ae/a	D																
	RU P.Max	0.75	lb ae/a	E																
	Destiny HC	1.5	pt/a	CDE																
	N-Pak AMS	2.5	% v/v	CDE																
15	Ro-Neet SB	4	pt/a	A	6	64	60	58	5	2	81	99	99	16	73	99	96	25.1	16.3	283
	RU P.Max	1.13	lb ae/a	C																
	RU P.Max	0.84	lb ae/a	D																
	RU P.Max	0.75	lb ae/a	E																
	Destiny HC	1.5	pt/a	CDE																
	N-Pak AMS	2.5	% v/v	CDE																
16	Ro-Neet SB	4	pt/a	A	11	75	71	65	10	6	89	99	99	35	84	99	105	24.7	15.9	271
	RU P.Max	1.13	lb ae/a	C																
	RU P.Max	0.84	lb ae/a	D																
	RU P.Max	0.75	lb ae/a	E																
	Nortron	4	fl oz/a	CDE																
	Destiny HC	1.5	pt/a	CDE																
	N-Pak AMS	2.5	% v/v	CDE																
17	Ro-Neet SB	4	pt/a	A	8	76	68	66	15	12	87	99	99	42	83	99	109	25.9	16.8	293
	Betamix	12	fl oz/a	C																
	Betamix	16	fl oz/a	D																
	Betamix	24	fl oz/a	E																
	Nortron	4	fl oz/a	CDE																
	RU P.Max	1.13	lb ae/a	C																
	RU P.Max	0.84	lb ae/a	D																
	RU P.Max	0.75	lb ae/a	E																
	Destiny HC	1.5	pt/a	CDE																
	N-Pak AMS	2.5	% v/v	CDE																
18	Ro-Neet SB	4	pt/a	A	9	72	71	63	17	16	91	99	99	56	85	99	102	22.9	16.3	282
	Betamix	12	fl oz/a	C																
	Betamix	16	fl oz/a	D																
	Betamix	24	fl oz/a	E																
	Nortron	4	fl oz/a	CDE																
	Outlook	14	fl oz/a	C																
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	RU P.Max	1.13	lb ae/a	C																
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19	Ro-Neet SB	5.3	pt/a	A	8	82	77	71	6	3	93	99	99	25	90	99	107	25.6	16.5	286		
	RU P.Max	1.13	lb ae/a	C	-----%-----																	
	RU P.Max	0.84	lb ae/a	D	#/100'																	
	RU P.Max	0.75	lb ae/a	E	ton/A																	
	Destiny HC	1.5	pt/a	CDE	% lb/ton																	
	N-Pak AMS	2.5	% v/v	CDE																		
20	Ro-Neet SB	5.3	pt/a	A	11	81	76	74	11	8	95	99	99	38	86	99	94	23.2	16.1	276		
	RU P.Max	1.13	lb ae/a	C																		
	RU P.Max	0.84	lb ae/a	D																		
	RU P.Max	0.75	lb ae/a	E																		
	Nortron	4	fl oz/a	CDE																		
	Destiny HC	1.5	pt/a	CDE																		
	N-Pak AMS	2.5	% v/v	CDE																		
21	Ro-Neet SB	5.3	pt/a	A	11	77	73	69	16	13	89	99	99	44	81	99	87	24.4	16.1	278		
	Betamix	12	fl oz/a	C																		
	Betamix	16	fl oz/a	D																		
	Betamix	24	fl oz/a	E																		
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	Destiny HC	1.5	pt/a	CDE																		
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22	Ro-Neet SB	5.3	pt/a	A	11	84	77	71	20	14	96	99	99	62	97	99	109	23.1	16.1	275		
	Betamix	12	fl oz/a	C																		
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23	Nortron	6	pt/a	A	7	95	58	94	8	2	99	99	99	31	99	99	104	25.9	16.5	287		
	RU P.Max	1.13	lb ae/a	C																		
	RU P.Max	0.84	lb ae/a	D																		
	RU P.Max	0.75	lb ae/a	E																		
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	N-Pak AMS	2.5	% v/v	CDE																		
24	Nortron	6	pt/a	A	9	94	59	92	9	3	99	99	99	36	99	99	112	28.4	16	276		
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															-----%-----			#/100'	ton/A	%	lb/ton
30	Nortron	7.5	pt/a	A	6	95	58	91	17	13	99	99	99	77	99	99	116	24.1	16.3	280	
	Betamix	12	fl oz/a	C																	
	Betamix	16	fl oz/a	D																	
	Betamix	24	fl oz/a	E																	
	Nortron	4	fl oz/a	CDE																	
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	Destiny HC	1.5	pt/a	CDE																	
	N-Pak AMS	2.5	% v/v	CDE																	
LSD 5%					3.4	9.0	11.3	11.8	3.1	5.6	7.0	0.4	0.1	11.4	11.2	0.1	18.6	4.3	NS	NS	
CV %					38	9	16	12	20	53	6	0	0	20	10	0	13	13	4	5	