WEED CONTROL AND POTATO VARIETY TOLERANCE TO HERBICIDES

Corey V. Ransom and Joey Ishida
Malheur Experiment Station
Oregon State University
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Summary

Trials conducted in 1998 determined that tank mixtures of Sonalan with registered herbicides continue to provide effective weed control and high tuber yields. Evaluations of sulfentrazone demonstrated that it did not injure Russet Burbank, Shepody, and Umatilla potato varieties and that sulfentrazone treatments provided exceptional control of redroot pigweed, common lambsquarters, and hairy nightshade. A tolerance trial demonstrated that BAS 656 07 H was safe on Shepody potatoes at the standard rate. Various combinations of registered herbicides and combinations of BAS 656 07 H with Sencor and Matrix were shown to provide effective weed control, which increased potato yields.

Introduction

Weed control in potatoes is critical to maximize yield and tuber quality. While effective weed control is important, herbicide injury can reduce potato yield and quality. Rotational crop restrictions and potato varieties that are sensitive to Sencor and Lexone limit the herbicide products available for weed control in potatoes. New herbicides may provide effective weed control in potatoes without injury to the crop. Trials were established at the Malheur Experiment Station to evaluate new and registered herbicides for weed control and potato tolerance.

Methods

Three trials were conducted at the Malheur Experiment Station, Ontario, OR to evaluate new herbicides for weed control efficacy and crop tolerance in potatoes. Potatoes were planted April 23 and 27 in a silt loam soil with a pH 7.6 and 2.4 percent O.M. Seed pieces were planted in 36-in wide rows every 9 in. Preemergence herbicides were applied May 7, and postemergence applications of rimsulfuron were made June 6. Preemergence treatments were incorporated with overhead irrigation immediately after they were applied. Treatments were applied with a CO_2-pressurized backpack sprayer delivering 20 gpa at 30 psi. Plots were irrigated with sprinklers according to crop requirements throughout the season.

Variety response and Weed Control with Sonalan and Sulfentrazone
For this trial, three potato varieties (Russet Burbank, Shepody, Umatilla) were planted in adjacent rows. Plots were 12-ft wide by 30-ft long and consisted of one row of each variety with border rows of Russet Burbank on each side. The experiment was a

split-plot design with herbicide treatments as the whole plot and varieties as the subplots. Treatments were replicated four times. Each plot was evaluated for weed control and all varieties (center 3 rows) were harvested and used to calculate potato yields.

Evaluation of Preemergence Herbicides for Weed Control in Shepody Potatoes
In this trial, only Shepody potatoes were planted in plots 4-rows wide and 30-ft long. Treatments were replicated three times. The center two rows of each plot were harvested and graded to determine yields.

Tolerance of Shepody Potatoes to BAS 656 07 H
This trial was conducted to evaluate BAS 656 07 H for crop injury at normal field-use rates and at twice the normal field-use rate, and to compare it to other standard herbicides applied at twice their labeled-use rates. BAS 656 07 H is an active isomer of the herbicide Frontier (dimethenamid), and a package has been submitted to EPA for its registration on potatoes. Plots were 4-rows wide and 30-ft long. Treatments were replicated four times, and the center two rows of each plot were harvested and graded to determine yields. Plots were maintained weed-free by hand weeding.

Results and Discussion

The Malheur Experiment Station was hit by a severe hail storm on July 4 that removed a lot of the potato foliage, damaged stems, and exposed the potato hills. The month following the hail storm, air temperatures were extremely high. The combination of the hail and heat caused a large percentage of potato tubers to be small in size or misshapen. Opening the crop canopy back up also allowed additional weeds to germinate and grow. Both potato yields and weed control were affected by these environmental occurrences.

Variety response and Weed Control with Sonalan and Sulfentrazone
In this study, control of redroot pigweed and common lambsquarters on June 22 was nearly complete with the exception of Eptam applied alone (Table 1). Eptam alone provided little broadleaf control. Also at the June evaluation, Sonalan, Eptam, and Sencor alone provided among the least control of hairy nightshade and barnyardgrass. All other treatments provided 88 percent or greater control of hairy nightshade and barnyardgrass.

In September, Sonalan and Sonalan plus Eptam provided less redroot pigweed control than most other treatments. Eptam alone continued to provide the least control of any of the broadleaf weeds. Hairy nightshade control was poor for the majority of the treatments, with Matrix providing greater control than Sonalan, Eptam, and Sencor alone. Applications of sulfentrazone alone or in combinations provided complete control of redroot pigweed, common lambsquarters, and hairy nightshade. Sulfentrazone applied alone was weak on barnyardgrass but control was improved with

the addition of Sencor. Combining sulfentrazone with herbicides with grass activity could provide a very effective weed control program.
The hail storm and extreme heat affected potato yield and quality and resulted in variable yield data. Because of variability, yield data is presented as treatment averages within Russet Burbank (Table 2), Shepody (Table 3), and Umatilla (Table 4) varieties. Total yields and marketable potato yields in all three varieties were among the lowest with Sonalan, Eptam, and Sencor applied alone. Matrix alone and tank mixture treatments produced among the highest potato yields in all three varieties. Sulfentrazone alone also produced among the highest total and marketable yields in Shepody and Umatilla varieties but produced less total marketable tubers in Russet Burbank than Matrix applied alone. The percentage of number one tubers for the Shepody variety was the highest in plots with the poorest weed control, while the percentage of number one tubers in the Umatilla variety was lowest in plots with poor weed control. Reduced yields in some tuber sizes with sulfentrazone treatments may have been due to barnyardgrass competition, but sulfentrazone needs to be evaluated in weed-free conditions to ensure yield reductions are not associated with its use.

Evaluation of Preemergence Herbicides for Weed Control in Shepody Potatoes
Weed control with preemergence herbicides in general was good because of the high rainfall in May. Redroot pigweed control was greater than 95 percent for all treatments on June 20 (Table 5). By September 21, control of redroot pigweed was still nearly complete with all treatments with the exception of Prowl applied alone. Control of common lambsquarters was among the lowest for Dual II Magnum on June 6, while Matrix, Eptam plus Matrix, Dual II Magnum, and Dual were among the poorest on September 21. Nightshade evaluations were variable with few clear separations among the treatments. The addition of BAS 656 07 H to Sencor or Matrix significantly improved control of hairy nightshade on both evaluation dates. Prowl alone provided less control of barnyardgrass than all other treatments on September 21. All herbicide treatments increased potato yields in comparison to the untreated check for most tuber sizes with the exception of 4-6 oz tubers (Table 6).

Tolerance of Shepody Potatoes to BAS 656 07 H
Potato injury was evident June 5 in plots treated with twice the labeled rate of Frontier and two times the standard rate of BAS 656 07 H as compared to the untreated plots (Table 7). Dual applied at twice the labeled rate also caused some stunting early in the season. Injury was primarily stunting and disappeared as the crop developed. The standard rate of BAS 656 07 H and Prowl applied at twice the field rate did not injure potatoes. Large fluctuations in potato yields were not significant because of the high variability. However at the 10 percent significance level, Prowl applied at twice the labeled rate produced higher total yield and total marketable yields than all other treatments except for BAS 656 07 H applied at the standard rate (0.64 lb ai/acre). All treatments produced potato yields equal to or greater than the hand-weeded control.

Table 1. Weed control on June 22 and September 21 with Sonalan and sulfentrazone combinations, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

			Weed control							
			Redroot pigweed		Common lambsquarters		Barnyardgrass		Hairy nightshade	
Treatment	Rate	Timing	6-22	9-21	6-22	9-21	6-22	9-21	6-22	9-21
	lb ai/acre		----------				%----------			
Sonalan	0.94	PRE	92	86	96	94	72	84	24	16
Eptam	3.0	PRE	5	0	5	5	69	75	13	10
Matrix	0.016	PRE	98	99	98	84	93	90	85	56
Sencor	0.25	PRE	96	90	98	98	70	73	63	21
Sonalan + Eptam	0.94 + 3.0	PRE	95	84	98	93	97	91	71	41
Sonalan + Eptam + Matrix	0.94 + 3.0 + 0.016	PRE + POST	98	99	96	93	98	94	92	65
Sonalan + Matrix	0.94 + 0.016	PRE	98	100	98	93	98	88	85	48
Eptam + Sencor	3.0 + 0.25	PRE	98	100	98	100	90	75	81	44
Sencor + Matrix	0.25 + 0.016	PRE	98	99	98	100	95	90	85	70
Sulfentrazone	0.25	PRE	98	100	98	100	92	71	98	100
Sulfentrazone	0.31	PRE	98	100	98	100	88	68	98	100
Sulfentrazone + Sencor	0.25 + 0.25	PRE	98	100	98	100	97	91	98	100
Sulfentrazone + Matrix	0.25 + 0.016	PRE	98	100	98	100	95	85	98	100
Untreated	-	-	0	0	0	0	0	0	0	0
LSD (0.05)			6	11	3	8	12	15	15	29

Table 2. Russet Burbank tuber yield and grade in response to preemergence herbicide treatments, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

Treatment	Rate	Timing	US number one					Total no.2	Total marketable	Total yield
			4-6 oz	6-12 oz	> 12 oz	Total	%			
	lb ai/acre		cwt/acre				%	cwt/acre		
Sonalan	0.94	PRE	113	81	2	196	51	64	260	388
Eptam	3.0	PRE	86	46	1	134	45	35	169	304
Matrix	0.016	PRE	91	99	12	202	41	175	377	492
Sencor	0.25	PRE	103	87	2	192	48	71	263	401
Sonalan + Eptam	0.94 + 3.0	PRE	100	128	10	238	52	113	350	465
Sonalan + Eptam + Matrix	0.94 + 3.0 + 0.016	PRE + POST	94	130	12	236	47	154	390	504
Sonalan + Matrix	0.94 + 0.016	PRE	96	88	12	196	41	164	360	479
Eptam + Sencor	3.0 + 0.25	PRE	102	102	12	215	46	137	353	479
Sencor + Matrix	0.25 + 0.016	PRE	106	99	13	218	46	130	348	479
Sulfentrazone	0.25	PRE	64	68	5	137	31	171	309	452
Sulfentrazone	0.31	PRE	87	80	6	173	40	143	316	440
Sulfentrazone + Sencor	0.25 + 0.25	PRE	76	73	13	161	33	212	373	486
Sulfentrazone + Matrix	0.25 + 0.016	PRE	72	76	2	150	32	194	344	477
Untreated	-	-	73	42	1	116	44	20	136	264
LSD (0.05)			21	33	NS	42	9	48	48	58

Table 3. Shepody tuber yield and grade in response to preemergence herbicide treatments, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

Treatment	Rate	Timing	US number one					Total no.2	Total marketable	Total yield
			4-6 oz	6-12 oz	> 12 oz	Total	%			
	lb ai/acre		cwt/acre				%	cwt/acre		
Sonalan	0.94	PRE	67	154	24	244	68	53	298	359
Eptam	3.0	PRE	73	112	12	197	74	17	213	268
Matrix	0.016	PRE	81	126	21	228	50	162	390	454
Sencor	0.25	PRE	67	123	17	207	62	82	289	340
Sonalan + Eptam	0.94 + 3.0	PRE	77	121	14	212	53	130	342	404
Sonalan + Eptam + Matrix	0.94 + 3.0 + 0.016	PRE + POST	60	161	17	238	53	143	381	447
Sonalan + Matrix	0.94 + 0.016	PRE	67	130	15	211	50	140	351	422
Eptam + Sencor	3.0 + 0.25	PRE	65	154	27	246	58	121	367	428
Sencor + Matrix	0.25 + 0.016	PRE	62	125	27	214	47	173	387	456
Sulfentrazone	0.25	PRE	63	110	25	198	50	144	342	395
Sulfentrazone	0.31	PRE	77	101	13	191	49	143	334	397
Sulfentrazone + Sencor	0.25 + 0.25	PRE	82	126	22	230	53	134	363	437
Sulfentrazone + Matrix	0.25 + 0.016	PRE	51	124	29	204	47	163	367	434
Untreated	-	-	68	70	6	144	66	22	166	225
LSD (0.05)			NS	37	NS	47	11	50	55	62

Table 4. Umatilla tuber yield and grade in response to preemergence herbicide treatments, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

Treatment	Rate	Timing	US number one					Total no.2	Total marketable	Total yield
			4-6 oz	6-12 oz	> 12 oz	Total	%			
	lb ai/acre		cwt/acre				%	cwt/acre		
Sonalan	0.94	PRE	128	69	1	199	58	16	215	340
Eptam	3.0	PRE	84	31	2	117	48	9	126	245
Matrix	0.016	PRE	147	154	11	312	66	53	365	474
Sencor	0.25	PRE	128	95	8	232	64	21	253	362
Sonalan + Eptam	0.94 + 3.0	PRE	150	128	4	283	65	29	311	432
Sonalan + Eptam + matrix	0.94 + 3.0 + 0.016	PRE + POST	128	164	14	306	64	71	377	479
Sonalan + Matrix	0.94 + 0.016	PRE	141	101	17	259	55	89	348	473
Eptam + Sencor	3.0 + 0.25	PRE	132	123	4	259	61	47	306	424
Sencor + Matrix	0.25 + 0.016	PRE	141	154	8	303	61	53	355	494
Sulfentrazone	0.25	PRE	140	128	6	274	61	50	324	447
Sulfentrazone	0.31	PRE	147	94	5	246	57	56	302	429
Sulfentrazone + Sencor	0.25 + 0.25	PRE	130	136	6	273	58	87	360	469
Sulfentrazone + Matrix	0.25 + 0.016	PRE	130	95	3	227	51	79	306	446
Untreated	-	-	61	22	0	83	37	2	85	213
LSD (0.05)			38	40	NS	57	10	41	55	55

Table 5. Weed control with Prowl, Dual, and BAS 656 07 H, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

Treatment	Rate	Timing	Weed control							
			Redroot pigweed		Common lambsquarters		Barnyardgrass		Hairy nightshade	
			6-20	9-21	6-20	9-21	6-20	9-21	6-20	9-21
	lb ai/acre		----------				%----------			
Frontier + Sencor	1.17 + 0.5	PRE	98	100	98	99	98	99	95	87
BAS 656 07 H + Sencor	0.64 + 0.5	PRE	98	99	98	98	98	100	98	97
BAS 656 07 H + Matrix	0.016	PRE	98	99	98	99	98	100	97	93
Eptam + Sencor	3.0 + 0.5	PRE	98	97	98	100	98	100	92	90
Prowl + Sencor	1.0 + 0.5	PRE	98	100	98	100	97	100	93	89
Eptam + Matrix	3.0 + 0.016	PRE	98	100	95	78	98	100	83	67
Matrix	0.016	PRE	98	100	93	75	98	98	78	58
Sencor	0.5	PRE	98	100	98	100	98	98	79	62
Prowl + Matrix	1.0 + 0.016	PRE	98	100	98	100	98	100	96	83
Prowl + Eptam	1.0 + 3.0	PRE	98	97	98	98	98	98	96	93
Prowl + Eptam + Sencor	1.0 + 3.0 + 0.5	PRE	98	100	98	100	98	100	92	94
Prowl + Matrix	1.0 + 0.016	PRE + POST	98	100	98	100	98	100	98	96
Prowl	1.0	PRE	95	88	98	97	94	92	96	81
Dual Magnum	1.9	PRE	98	100	90	86	98	100	95	85
Dual II Magnum	1.9	PRE	98	98	73	83	98	100	75	60
Dual	2.0	PRE	98	97	85	80	89	100	84	67
BAS 65607 + Matrix	0.64 + 0.016	PRE + POST	98	100	89	87	98	100	90	83
Untreated	-	-	0	0	0	0	0	0	0	0
LSD (0.05)			2	4	13	12	7	5	15	24

Table 6. Tuber yield and quality with Prowl, Dual, and BAS 656 07 H, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

Treatment	Rate	Timing	US number one					Total no.2	Total marketable	Total yield
			4-6 oz	6-12 oz	> 12 oz	Total	%			
	lb ai/acre		cwt/acre				%	cwt/acre		
Frontier + Sencor	1.17 + 0.5	PRE	62	134	41	237	49	190	426	487
BAS 656 07 H + Sencor	0.64 + 0.5	PRE	57	143	40	240	54	142	382	444
BAS 656 07 H + Matrix	0.016	PRE	70	161	43	274	56	156	430	489
Eptam + Sencor	3.0 + 0.5	PRE	56	164	39	259	56	141	401	462
Prowl + Sencor	1.0 + 0.5	PRE	60	158	45	263	56	156	418	471
Eptam + Matrix	3.0 + 0.016	PRE	61	136	37	234	49	166	400	473
Matrix	0.016	PRE	67	153	32	252	56	131	383	445
Sencor	0.5	PRE	59	159	37	254	56	143	397	451
Prowl + Matrix	1.0 + 0.016	PRE	61	162	27	250	49	187	437	512
Prowl + Eptam	1.0 + 3.0	PRE	71	151	30	252	52	168	419	490
Prowl + Eptam + Sencor	1.0 + 3.0 + 0.5	PRE	46	164	58	267	57	149	416	469
Prowl + Matrix	1.0 + 0.016	PRE + POST	59	155	49	263	52	172	435	503
Prowl	1.0	PRE	62	161	41	264	55	157	421	484
Dual Magnum	1.9	PRE	53	137	39	229	52	137	366	441
Dual II Magnum	1.9	PRE	69	162	38	268	56	141	409	476
Dual	2.0	PRE	59	170	31	259	60	113	372	436
BAS 656 07 H + Matrix	0.64 + 0.016	PRE + POST	54	148	59	261	56	153	413	462
Untreated	-	-	66	92	4	162	64	24	186	252
LSD (0.05)			NS	33	23	45	7	37	57	62

Table 7. Potato injury and yield in response to BAS 656 07 H applications, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

Treatment	Rate	Field rate	Injury		US number ones					Two's	Total	
			6-5	6-20	4-6 oz	6-12 oz	>12 oz	Total	%		Market-able	Yield
	lb ai/acre				cwt/acre				%	cwt/acre		
Frontier 6.0	2.34	2×	23	0	58	134	29	220	48	177	397	461
BAS 656 07 H	0.64	1×	9	0	57	138	25	219	46	191	410	482
BAS 656 07 H	1.28	2×	24	0	61	139	20	220	47	178	398	469
Dual	4.0	2×	11	0	62	121	23	206	45	192	398	460
Prowl	3.0	2×	1	0	60	155	39	253	49	197	450	522
Untreated	-	-	0	0	58	131	30	218	46	182	400	475
LSD (0.05) Injury LSD (0.10) Yields			9	NS	NS	NS	NS	NS	NS	NS	42	44