

PREEMERGENCE HERBICIDES FOR WEED CONTROL IN POTATOES

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Introduction

Effective weed control and crop tolerance are important herbicide traits for maximizing tuber yield and quality in potatoes. Trials were conducted to evaluate new herbicides for weed control efficacy and crop tolerance in Russet Burbank, Shepody, and Umatilla potatoes.

Methods

Three potato varieties (Russet Burbank, Shepody, Umatilla) were planted in a silt loam soil with pH 7.9 and 1.6 percent organic matter. Seed pieces were planted every 9 inches in 36-inch beds. Plots were 12 feet wide by 30 feet long and consisted of one row of each variety with border rows of Russet Burbank on each side. Potatoes were planted May 1 and 2, 1997. At planting, Admire insecticide at 19 oz/acre was applied in the planter furrow. Potatoes were sidedressed with 114 lbs N/acre, May 15 as urea. Also 85 lbs N/acre as solution 32 was applied through the sprinklers on June 25.

Preemergence herbicides were applied May 23 and postemergence applications of Matrix were made June 10. Treatments were applied with a CO₂-pressurized backpack sprayer delivering 20 gpa at 30 psi. The experiment was a split-plot design with herbicide treatment as the main plot and varieties as the split-plots. Treatments were replicated four times. Plots were irrigated with sprinklers according to crop requirements throughout the season. Crop injury was evaluated visually June 2, 17, and 24. Weed counts were taken June 17 and 24, and weed control was visually evaluated on June 17, June 24, and September 5. Potatoes were harvested September 17 to 19. Potatoes were graded October 9 to 16.

Results

Weed Control. Eptam applied alone provided the least redroot pigweed control of all treatments, but still controlled 83 percent (Table 1). Sonalan applied alone had the lowest control of common lambsquarters (91 percent) and barnyardgrass (76 percent). Sonalan and Sencor applied alone and tank mixed together provided less than 30 percent hairy nightshade control. Isoxaflutole alone at 0.05 lb ai/acre was a little weak on redroot pigweed and barnyardgrass. However, isoxaflutole at rates from 0.07 to

0.12 lb ai/acre provided excellent control of all weed species present. Unfortunately, the higher rates of isoxaflutole injured all three potato varieties, with the 0.12 lb ai/acre rate resulting in the greatest injury. The other treatments, including Sonalan alone and in tank mixtures, did not injure potatoes. Weed control was similar later in the season (Table 2).

Potato Yields. Undersize and US Number One 6 to 12 oz tuber yields were different depending on the herbicide treatment and the potato variety (Table 3). Russet Burbank produced more undersize tubers than Shepody or Umatilla. Herbicide treatments reduced the amount of undersize tubers in Russet Burbank but had no effect on undersize tuber production in the other two varieties. Number one tubers in the 6 to 12 oz range were also affected by herbicide treatment and potato variety. Some herbicide treatments increased 6 to 12 oz sized tubers in Russet Burbank and Umatilla when compared to the control. In Shepody, only isoxaflutole (0.12 lb ai/acre) increased 6 to 12 oz tubers compared to the control. In Russet Burbank and Umatilla, the same treatment, isoxaflutole (0.12 lb ai/acre), reduced the amount of 6 to 12 oz tubers, presumably in response to the observed injury.

For all other yield parameters, potato varieties responded similarly in response to the herbicide treatments. Both treatment means averaged over potato variety, and variety means averaged over herbicide treatment will be discussed. Total yield, total number ones, and total marketable yield were increased by all treatments compared to the untreated control (Table 4). The high rate of isoxaflutole (0.12 lb ai/acre) resulted in one of the lowest total and lowest marketable yield of the herbicide treatments. The tank mixture of Sonalan plus Eptam was among the highest yielding of any herbicide treatment.

Averaged over herbicide treatments, Shepody produced the highest total and marketable yield and the highest yield of US Number One tubers (Table 5). Umatilla yielded lower than Shepody. Russet Burbank had the lowest yields in this trial. Both Shepody and Umatilla produced a higher percentage of number one potatoes than Russet Burbank. The Umatilla plants grew slowest early in the season in this trial, which may have been due to relatively more dormant potato seed. The Umatilla plants were at a competitive disadvantage to the Shepody and Russet Burbank plants due to their small size, which may not represent their real comparative yield potential.

Table 1. Weed control and injury in potatoes treated with preemergence herbicides, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1997.

Treatment	Rate	Timing	Weed control ¹				Potato injury ^a
			Pigweed	Lambsquarters	Barnyardgrass	H. nightshade	
	lb ai/acre		-----%				
Sonalan HFP	0.94	PRE	95	91	76	29	0
Eptam	3	PRE	83	100	100	74	3
Matrix	0.02	PRE	100	98	98	75	0
Sencor	0.25	PRE	100	100	96	21	0
Isoxaflutole	0.05	PRE	91	100	88	78	5
Isoxaflutole	0.07	PRE	96	100	100	98	18
Isoxaflutole	0.09	PRE	100	100	100	93	23
Isoxaflutole	0.12	PRE	100	100	100	99	41
Isoxaflutole + Sencor	0.071 + 0.25	PRE	100	100	100	99	26
Isoxaflutole + Eptam	0.071 + 3.0	PRE	100	100	100	100	24
Sonalan HFP + Eptam	0.94 + 3.0	PRE	100	100	98	84	2
Sonalan HFP + Sencor	0.94 + 0.25	PRE	100	100	100	16	0
Sonalan HFP + Matrix	0.94 + 0.016	PRE	100	100	100	77	0
Isoxaflutole + Matrix	0.071 + 0.016	PRE	100	100	100	93	3
Eptam + Sencor	3.0 + 0.25	PRE	100	100	100	78	0
Eptam + Matrix	3.0 + 0.016	PRE	100	100	100	90	0
Sencor + Matrix	0.25 + 0.016	PRE	100	100	95	55	0
Sonalan HFP + Eptam + Sencor	0.94 + 3.0 + 0.25	PRE	100	100	100	83	1
Sonalan HFP + Matrix	0.94 + 0.016	PRE + POST	100	100	98	88	5
Isoxaflutole + Matrix	0.071 + 0.016	PRE + POST	100	100	100	99	12
Eptam + Sencor + Matrix	3.0 + 0.25 + 0.016	PRE + POST	100	100	100	100	4
Untreated			0	0	0	0	0
LSD (0.05)			7.7	5.5	10	22	14

¹Weed control and potato injury were evaluated June 24, 1997. Injury ratings: 0 = no visible injury, 100 = death of the plant.

Table 2. Weed control evaluations in potatoes, September 5, 1997, Malheur Experiment Station, Oregon State University, Ontario, Oregon.

Treatment	Rate	Timing	Weed control			
			Pigweed	Lambsquarters	Barnyardgrass	H. nightshade
	lb ai/acre		-----%-----			
Sonalan HFP	0.94	PRE	65	85	64	36
Eptam	3	PRE	70	90	96	82
Matrix	0.02	PRE	91	85	96	70
Sencor	0.25	PRE	98	99	90	13
Isoxaflutole	0.05	PRE	73	98	78	78
Isoxaflutole	0.07	PRE	93	96	96	92
Isoxaflutole	0.09	PRE	91	100	98	90
Isoxaflutole	0.12	PRE	100	100	100	98
Isoxaflutole + Sencor	0.071 + 0.25	PRE	99	100	100	95
Isoxaflutole + Eptam	0.071 + 3.0	PRE	99	100	99	99
Sonalan HFP + Eptam	0.94 + 3.0	PRE	95	98	100	92
Sonalan HFP + Sencor	0.94 + 0.25	PRE	100	100	99	29
Sonalan HFP + Matrix	0.94 + 0.016	PRE	100	98	100	68
Isoxaflutole + Matrix	0.071 + 0.016	PRE	100	100	99	88
Eptam + Sencor	3.0 + 0.25	PRE	98	100	100	85
Eptam + Matrix	3.0 + 0.016	PRE	100	100	100	88
Sencor + Matrix	0.25 + 0.016	PRE	100	100	100	53
Sonalan HFP + Eptam + Sencor	0.94 + 3.0 + 0.25	PRE	100	100	100	88
Sonalan HFP + Matrix	0.94 + 0.016	PRE + POST	98	100	100	74
Isoxaflutole + Matrix	0.071 + 0.016	PRE + POST	100	100	100	99
Eptam + Sencor + Matrix	3.0 + 0.25 + 0.016	PRE + POST	100	100	100	96
Untreated			0	0	0	0
LSD (0.05)			6	8	10	14

Table 3. Yield of undersize and US Number One 6 to 12 oz tubers as influenced by potato variety and herbicide treatment, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1997.

Treatment	Rate	Timing	Potato yield					
			Less than 4 oz			6 to 12 oz		
			Russet Burbank	Shepody	Umatilla	Russet Burbank	Shepody	Umatilla
	lb ai/acre		cwt/acre					
Sonalan HFP	0.94	PRE	116	53	55	148	192	222
Eptam	3	PRE	121	58	63	124	182	183
Matrix	0.02	PRE	105	55	52	174	169	187
Sencor	0.25	PRE	124	53	68	136	198	175
Isoxaflutole	0.05	PRE	103	56	57	170	174	173
Isoxaflutole	0.07	PRE	86	56	50	136	200	162
Isoxaflutole	0.09	PRE	96	53	58	116	187	134
Isoxaflutole	0.12	PRE	86	59	53	92	208	123
Isoxaflutole + Sencor	0.071 + 0.25	PRE	90	54	46	111	176	192
Isoxaflutole + Eptam	0.071 + 3.0	PRE	81	48	47	133	173	142
Sonalan HFP + Eptam	0.94 + 3.0	PRE	118	53	55	154	178	225
Sonalan HFP + Sencor	0.94 + 0.25	PRE	137	62	55	131	184	202
Sonalan HFP + Matrix	0.94 + 0.016	PRE	110	66	50	151	163	177
Isoxaflutole + Matrix	0.071 + 0.016	PRE	110	68	57	120	173	178
Eptam + Sencor	3.0 + 0.25	PRE	114	63	61	152	192	171
Eptam + Matrix	3.0 + 0.016	PRE	107	62	66	160	169	197
Sencor + Matrix	0.25 + 0.016	PRE	118	59	56	173	173	205
Sonalan HFP + Eptam + Sencor	0.94 + 3.0 + 0.25	PRE	124	58	62	159	182	190
Sonalan HFP + Matrix	0.94 + 0.016	PRE + POST	112	69	55	160	198	198
Isoxaflutole + Matrix	0.071 + 0.016	PRE + POST	98	62	52	109	173	157
Eptam + Sencor + Matrix	3.0 + 0.25 + 0.016	PRE + POST	115	56	53	141	183	196
Untreated			146	68	61	82	155	122
LSD (0.05) Herbicide x Variety				20			45	

Table 4. Potato yields in response to herbicide treatments averaged across varieties, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1997.

Treatment	Potato yield and grade												
	Rate lb ai/acre	Timing	Unmarketable			US number one			Total No. 2	Total marketable	Total yield		
			Röt	Culls	Undersize	4-6 oz	6-12 oz	> 12 oz					
			cwt/acre									Total	%
										%	cwt/acre		
Sonalan HFP	0.94	PRE	5	18	74	74	187	61	322	71	30	352	450
Eptam	3	PRE	6	26	81	74	163	66	303	65	47	350	461
Matrix	0.02	PRE	8	28	70	69	177	56	301	66	46	347	453
Sencor	0.25	PRE	5	19	82	77	170	56	303	68	34	338	443
Isoxaflutole	0.05	PRE	10	21	72	69	172	68	309	68	42	351	453
Isoxaflutole	0.07	PRE	10	25	64	66	166	63	294	66	52	346	445
Isoxaflutole	0.09	PRE	8	31	69	63	146	56	265	62	48	313	421
Isoxaflutole	0.12	PRE	6	31	66	57	141	52	249	60	52	301	403
Isoxaflutole + Sencor	0.071 + 0.25	PRE	7	27	64	64	160	62	286	65	50	336	433
Isoxaflutole + Eptam	0.071 + 3.0	PRE	7	37	59	57	149	72	279	64	55	334	437
Sonalan HFP + Eptam	0.94 + 3.0	PRE	7	23	76	73	186	77	336	68	45	381	486
Sonalan HFP + Sencor	0.94 + 0.25	PRE	8	19	84	73	172	53	298	67	32	330	443
Sonalan HFP + Matrix	0.94 + 0.016	PRE	12	29	75	74	164	71	308	66	44	353	469
Isoxaflutole + Matrix	0.071 + 0.016	PRE	6	25	78	70	157	65	291	63	60	352	462
Eptam + Sencor	3.0 + 0.25	PRE	12	17	79	76	172	62	309	66	46	355	463
Eptam + Matrix	3.0 + 0.016	PRE	11	29	79	69	175	67	311	65	46	357	476
Sencor + Matrix	0.25 + 0.016	PRE	9	29	78	74	184	56	314	65	50	364	479
Sonalan HFP + Eptam + Sencor	0.94 + 3.0 + 0.25	PRE	9	25	81	71	177	76	325	67	43	368	482
Sonalan HFP + Matrix	0.94 + 0.016	PRE + POST	8	28	79	69	186	64	318	66	45	363	477
Isoxaflutole + Matrix	0.071 + 0.016	PRE + POST	8	31	71	62	146	72	280	63	53	334	443
Eptam + Sencor + Matrix	3.0 + 0.25 + 0.016	PRE + POST	11	20	74	81	173	74	329	68	46	374	480
Untreated			5	12	92	75	119	26	221	63	18	239	348
LSD (0.05)			NS	12	NS	12	NS	21	27	4	13	28	25

Table 5. Potato variety yields averaged over herbicide treatments, Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1997.

Variety	Potato yield and grade								Total No.2	Total marketable	Total yield
	Unmarketable			US number one			Total	%			
	Rot	Culls	Undersize	4-6 oz	6-12 oz	> 12 oz					
				-----cwt/acre-----				%	-----cwt/acre-----		
Russet Burbank	5	16	110	88	138	20	245	58	41	286	418
Shepody	6	34	59	62	181	95	338	69	53	390	489
Umatilla	13	25	56	60	178	73	310	70	40	351	445
LSD (0.05)	3	5	NS	4	NS	7	14	2	5	14	12