

DEVELOPMENT OF NEW HERBICIDE OPTIONS FOR WEED CONTROL IN POTATO PRODUCTION

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Introduction

Weed control in potatoes is essential for production of high yielding, marketable tubers. Herbicide options in potato production are limited. Outlook (dimethenamid-P), Spartan (sulfentrazone), and Chateau (flumioxazin) are new herbicides that have demonstrated great promise for use in potato. Spartan and Chateau (reported as Valor in previous reports) represent a mode of action that is not currently used in potatoes and offer excellent hairy nightshade control. In previous weed control trials at the Malheur Experiment Station, Outlook (dimethenamid-P) has controlled a larger spectrum of weeds than several other herbicides registered in potato. Trials were conducted to evaluate these new herbicides for weed control in potatoes. The results of our research have been provided to herbicide companies, the IR4 program, and state regulators in support of additional herbicide registrations in potatoes. Spartan has been registered for use in potato this year and a full label for Outlook is expected for 2005. The registration of these herbicides gives producers additional tools to use for controlling weeds and may increase economic returns through improved weed control.

Materials and Methods

A field trial was conducted at the Malheur Experiment Station to evaluate new herbicides for weed control efficacy and crop tolerance in potatoes. In the fall of 2002, 100 lbs P, 150 lbs K, 40 lbs elemental S, 6 lbs Mn, 2 lbs Zn, 2 lbs Cu, and 1 lb B/acre were applied to the trial area prior to bedding. Potatoes were planted April 24, 2003 in an Owyhee silt loam soil with pH 7.6, 2.1 percent organic matter content, and a cation exchange capacity of 20. 'Russet Burbank' seed pieces were planted every 9 inches in 36-inch-wide rows. Experimental plots were four rows wide and 30 ft long. Plots were sidedressed with 100 lb N/acre on May 13 and rehilled on May 19. Preemergence herbicide treatments were applied and immediately incorporated with 0.5 inch of sprinkler-applied irrigation water on May 19. Herbicides were applied with a CO₂-pressurized backpack sprayer delivering 20 gal/acre at 30 psi. On June 23, 20 lb N/acre was applied through the sprinkler. On August 8, 10 lb/acre of 'HighPhos PKS' (10-45-10) including 3 percent S, 0.02 percent B, 0.05 percent Cu, 0.1 percent Fe, 0.05 percent Mn, 0.0005 percent Mo, and 0.05 percent Zn was applied by airplane. Disease and insect management were accomplished by applying Ridomil Gold plus Bravo (2 lb/acre) on June 19, sulfur dust (40 lb/acre) on July 20, and Bravo (1.5 pt/acre) plus Sulpreme (1 gal/acre) on August 4. Potato injury and weed control were evaluated

throughout the growing season and tuber yields were determined by harvesting the center two rows of each plot on September 9-11. Potatoes were graded for yield and size on September 12-17.

Results and Discussion

Many herbicides provided excellent weed control in this trial (Table 1). Sencor (metribuzin) alone provided greater than 95 percent control of all weed species. Control of pigweed species was the lowest with Prowl (pendimethalin) and was less than 70 percent with Dual Magnum (s-metolachlor), Eptam (EPTC), and Chateau alone. Dual Magnum plus Prowl also had less pigweed control than other tank mixtures. On August 25, common lambsquarters control was lowest with Dual Magnum. Prowl and Chateau alone provided only 59 and 52 percent control of common lambsquarters while other treatments provided 68-100 percent control. Matrix (rimsulfuron) alone provided the least hairy nightshade control. Control with all other herbicides applied alone provided 90-100 percent hairy nightshade control. Chateau provided little barnyardgrass control unless tank mixed with another herbicide. Spartan gave greater than 94 percent control of all broadleaf weeds and 89 percent control of barnyardgrass. Chateau caused up to 21 percent injury 22 days after treatment, but no treatments had any injury 35 days after treatment (data not shown). In general, yields reflected weed control; treatments with poor weed control also had reduced potato yields (Table 2). There were cases where treatments providing similar weed control had significantly different yields. Spartan plus Prowl and Spartan plus Dual Magnum provided nearly identical levels of weed control, but Spartan plus Prowl had significantly higher tuber yields. These differences could not be explained by crop injury since no differences in potato injury between these treatments were observed during the season.

Table 1. Outlook, Spartan, and Chateau combinations for weed control in potato, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Treatment*	Rate lb ai/acre	Weed control								
		Pigweed spp. [†]		Common lambsquarters		Hairy nightshade		Kochia		Barnyard- grass
		6-23	8-25	6-23	8-25	6-23	8-25	6-23	8-25	8-25
Untreated control	--	-	-	-	-	-	-	-	-	-
Handweeded	--	-	-	-	-	-	-	-	-	-
Sencor	0.5	99	98	100	100	100	95	100	100	96
Prowl	1.0	69	40	84	59	100	90	100	93	74
Dual Magnum	1.34	84	66	73	21	97	96	83	59	95
Eptam	3.0	89	68	86	84	98	94	96	79	98
Spartan	0.141	100	95	98	94	100	100	100	100	89
Chateau	0.094	94	68	97	52	100	93	100	94	31
Outlook	0.656	96	90	94	73	99	90	99	95	98
Matrix	0.023	97	88	92	68	94	76	98	93	69
Spartan + Sencor	0.141 + 0.5	100	100	97	100	100	100	100	100	100
Spartan + Prowl	0.141 + 1.0	100	98	100	100	100	100	100	100	100
Spartan + Dual Magnum	0.141 + 1.34	100	98	100	100	100	100	100	100	98
Spartan + Eptam	0.141 + 3.0	100	98	100	99	100	100	100	100	100
Spartan + Matrix	0.141 + 0.023	100	98	100	97	100	100	100	100	91
Chateau + Sencor	0.094 + 0.5	100	100	100	100	100	100	100	100	97
Chateau + Prowl	0.094 + 1.0	100	88	99	79	100	100	100	97	61
Chateau + Dual Magnum	0.094 + 1.34	100	100	98	93	100	100	100	99	76
Chateau + Eptam	0.094 + 3.0	100	100	100	97	100	100	100	100	100
Chateau + Matrix	0.094 + 0.023	100	98	100	90	100	98	100	100	98
Outlook + Sencor	0.656 + 0.5	100	98	100	98	100	100	100	100	100
Outlook + Matrix	0.656 + 0.023	100	99	99	95	100	100	100	100	100
Spartan + Outlook	0.141 + 0.656	100	100	100	98	100	100	100	100	100
Chateau + Outlook	0.094 + 0.656	100	96	100	97	100	100	100	100	93
Prowl + Matrix	1.0 + 0.023	100	92	100	92	98	81	100	100	92
Outlook + Prowl	0.656 + 1.0	96	95	100	97	100	100	100	98	98
Dual Magnum + Prowl	1.34 + 1.0	92	76	99	86	100	94	100	98	97
Dual Magnum + Sencor	1.34 + 0.5	100	100	100	98	100	100	100	100	99
Dual Magnum + Matrix	1.34 + 0.023	100	98	97	83	98	100	100	100	100
Prowl + Eptam	1.0 + 3.0	100	91	100	100	100	100	98	98	98
LSD (0.05)		7	17	7	17	3	13	5	13	24

*Herbicide treatments were applied preemergence on May 19. Chateau was reported as Valor in previous reports.

[†]Pigweed species were a combination of Powell amaranth and redroot pigweed.

Table 2. Outlook, Spartan, and Chateau combinations for weed control in potato, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Treatment*	Rate lb ai/acre	Potato yield†					Total No. 2	Total marketable cwt/acre	Total yield
		U.S. No. 1			Total	Percent			
		4-6 oz	6-12 oz	>12 oz					
		cwt/acre				%	cwt/acre		
Untreated control	--	36	19	0	55	64	4	59	151
Handweeded	--	87	125	19	231	33	26	257	342
Sencor	0.5	89	163	29	282	31	40	322	406
Prowl	1.0	82	87	7	176	42	19	195	293
Dual Magnum	1.34	75	88	9	171	41	18	189	291
Eptam	3.0	89	117	8	214	37	40	255	338
Spartan	0.141	79	156	23	257	35	44	301	388
Chateau	0.094	70	127	22	220	32	22	242	315
Outlook	0.656	84	148	34	265	32	36	302	388
Matrix	0.023	84	114	17	215	38	31	246	342
Spartan + Sencor	0.141 + 0.5	92	173	26	291	32	43	334	428
Spartan + Prowl	0.141 + 1.0	95	188	38	322	28	50	372	448
Spartan + Dual Magnum	0.141 + 1.34	92	138	24	254	33	41	295	382
Spartan + Eptam	0.141 + 3.0	84	162	39	285	30	38	323	406
Spartan + Matrix	0.141 + 0.023	95	158	34	286	32	49	336	418
Chateau + Sencor	0.094 + 0.5	82	155	31	267	29	27	294	373
Chateau + Prowl	0.094 + 1.0	89	136	19	244	33	28	273	364
Chateau + Dual Magnum	0.094 + 1.34	79	160	42	282	28	31	312	391
Chateau + Eptam	0.094 + 3.0	91	161	25	287	29	31	318	402
Chateau + Matrix	0.094 + 0.023	85	176	31	292	28	42	334	403
Outlook + Sencor	0.656 + 0.5	101	183	35	319	28	38	357	443
Outlook + Matrix	0.656 + 0.023	97	165	31	294	31	33	327	422
Spartan + Outlook	0.141 + 0.656	87	169	33	289	31	50	339	420
Chateau + Outlook	0.094 + 0.656	89	160	30	280	28	25	305	389
Prowl + Matrix	1.0 + 0.023	90	180	36	306	29	42	348	429
Outlook + Prowl	0.656 + 1.0	91	176	40	307	29	30	337	431
Dual Magnum + Prowl	1.34 + 1.0	100	138	26	264	32	24	288	385
Dual Magnum + Sencor	1.34 + 0.5	92	167	28	287	29	35	322	405
Dual Magnum + Matrix	1.34 + 0.023	103	182	35	320	27	30	350	439
Prowl + Eptam	1.0 + 3.0	105	167	29	301	30	28	329	429
LSD (0.05)		18	36	16	54	7	13	53	52

*Herbicide treatments were applied preemergence on May 19. Chateau was reported as Valor in previous reports.

†Potatoes were harvested September 9 to 11.