

EVALUATION OF HERBICIDES FOR WEED CONTROL IN POTATO

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Introduction

A field study was conducted in 2009 at the Malheur Experiment Station near Ontario, Oregon to evaluate herbicides for weed control in potato. The field previously planted to wheat was moldboard plowed, disked, fumigated, and bedded on 36-inch spacing in the fall preceding the trial. The study followed a randomized complete block design with four replications. Potato seed pieces (2 oz) for variety 'Ranger Russet' were cut on April 8 and treated with Tops-MZ-Gaicho[®] as a preventive measure against insects and diseases and placed in storage to suberize. Potatoes were planted on April 29 using a 2-row assist feed planter with 9-inch spacing within the row on 36-inch spaced beds. On April 29, potato rows were side-dressed with a fertilizer blend to supply 155 lb/acre nitrogen, 78 lb/acre phosphate, and 24 lb/acre sulfur, 4 lb/acre manganese, and 1 lb/acre boron. The beds were later rehilled using a Lilliston rolling cultivator. Plots were sprayed with azoxystrobin + chlorothalonil at 1.1 lb ai/acre (Quadris Opti[®], 1.6 pt/acre) fungicide using an airplane on June 11 as a preventative measure against diseases. Herbicide treatments were applied pre-emergence (PRE) on May 18 and POST on June 25 using a CO₂-pressurized backpack sprayer with a boom equipped with 8002EVS nozzles. Potatoes were treated with mancozeb at 1.5 lb ai/acre (Dithane[®], DF 2 lb/acre) on June 23 through sprinkler irrigation.

Irrigation was scheduled based on six Watermark soil moisture sensors (Irrrometer Co., Riverside, CA) connected to an AM400 data logger (M.K. Hansen Co., Wenatchee, WA) that recorded soil water tension at seed-piece depth. Irrigations were managed to prevent the soil at the seed-piece depth from drying beyond 60 kPa soil water tension. Treatments were visually evaluated for crop damage and weed control using a 0-100 percent scale (0 = no crop injury/no weed control and 100 = complete crop damage/excellent weed control) at 8, 22, and 45, and 66 days after PRE treatment (DAT). Field and herbicide application information is presented in Table 1. Potato vines were flailed on August 22 and tubers harvested on August 30 using a single-row mechanical harvester. Potato tubers were harvested from a 20-ft length of a single row to determine yield. Tubers were stored in a barn until October 16 when they were graded using USDA standards. Data were subjected to analysis of variance and means were compared using Fisher's protected least significant difference (LSD) at P = 0.05.

Results

Visual evaluations at 8 days after treatment (DAT) indicated an average of 28 percent

injury for plants treated with KSU12800 herbicide and 0 percent for the other herbicides (Table 2). Potato injury was characterized by entire leaf chlorosis on newly emerged leaves. All herbicides provided 96 to 100 percent control for common lambsquarters and pigweed species. Control for hairy nightshade was 94 percent for plots treated with KIH-485 at 1.5 and 2.5 oz/acre.

Potato injury at 22 DAT averaged 19 percent for plants treated with KSU12800 and 0 percent for the other herbicides tested (Table 3). Potato injury symptoms were still evident on older leaves while new young leaves were green and normal. Control for common lambsquarters and pigweed species was still high and ranged from 95 to 100 percent. Saflufenacil and KSU12800 provided the least barnyardgrass control, averaging 75 and 85 percent, respectively.

Visual evaluations at 45 DAT indicated consistently high control for common lambsquarters and pigweed species (Table 4). Control for hairy nightshade was 100 percent for all tested herbicides. Potato injury from KSU12800 had subsided to an average of 4 percent. Control of barnyardgrass with KSU12800 and saflufenacil was relatively low compared to other treatments. Tank-mixing saflufenacil with dimethenamid-p (Outlook[®]) or another herbicide with activity on grasses would undoubtedly improve control of grass weeds.

Weed control at 66 DAT was 100 percent for common lambsquarters and hairy nightshade (Table 5). Control for pigweed species and barnyardgrass was reduced for KSU12800 at 20 oz/acre and saflufenacil (Sharpen) at 1.98 oz/acre. U.S. No. 1 potato yield varied among treatments (Table 6) with KSU12800 at 30 oz/acre resulting in the lowest yield compared to other herbicides. The reduction in yield for saflufenacil was due to weed competition and not a direct effect of herbicide injury. The tested herbicides have a potential to control weeds in potato in the future. The study will be repeated in the 2010 growing season.

Table 1. Soil and herbicide application information on Ranger Russet potato at the Malheur Experiment Station, Ontario, OR, 2009.

Crop	Potato		PRE	POST
Variety	Russet Ranger	Date	5/18/09	6/25/09
Planting date	April 24, 2009	Time	11AM	10AM
Soil type	Owyhee Silt Loam	Temp. (air) (°F)	86.5	81.2
pH	6.7	Temp. (soil) (°F)	70.7	65.9
Organic matter (%)	1.69	Rel. humidity (%)	20	34
CEC (meq/kg)	10	Wind speed (mph)	2.3	1.7
Irrigation		Wind direction	SW	SE
May 21	7 hrs	Nozzle type	Flat fan	Flat fan
June 23, 29	8, 10 hrs	Nozzle size	8002EVS	8002EVS
July 3, 7, 11, 17, 22, 28	10, 8, 10, 8, 10, 8hrs	Spray vol. (gpa)	20	20
August 3, 7, 18	Rain, 8, 6 hrs	Spray speed (mph)	3	3
September 3, 11	6, 5 hrs	Boom height (inches)	18	18

Table 2. Weed control in potato 8 days after pre-emergence herbicide application at the Malheur Experiment Station, Ontario, OR, 2009.

Treatment	Rate	Timing	Crop injury	Weed control ¹		
				Common lambsquarters	Hairy nightshade	Pigweed spp.
				----- % -----		
Untreated control			0 b	0 c	0 c	0 b
Dual Magnum	1.33 pt/a	PRE	0 b	100 a	100 a	100 a
Prowl H ₂ O	1.58 pt/a	PRE				
Eptam	4.5 pt/a					
Targa	5 oz/a	POST				
COC ²	1.6 pt/a	POST				
Dual Magnum	1.33 pt/a	PRE	0 b	99 ab	96 ab	99 a
Prowl H ₂ O	1.58 pt/a					
Eptam	4.5 pt/a					
Targa	7 oz/a	POST				
COC	1.6 pt/a	POST				
Dual Magnum	1.33 pt/a	PRE	0 b	100 a	98 ab	100 a
Prowl H ₂ O	1.58 pt/a					
Eptam	4.5 pt/a					
Select Max	6 oz/a	POST				
COC	1.6 pt/a	POST				
KIH-485 (Pyroxasulfone)	1.5 oz/a	PRE	0 b	100 a	94 b	100 a
KIH-485 (Pyroxasulfone)	2.5 oz/a	PRE	0 b	96 b	94 b	96 a
BAS 800 (Saflufenacil)	1.98 oz/a	PRE	0 b	100 a	100 a	98 a
KSU12800	20 oz/a	PRE	28 a	98 ab	99 a	99 a
KSU12800	30 oz/a	PRE	29 a	96 b	96 ab	98 a
KSU12800	20 oz/a	PRE	28 a	100 a	99 a	100 a
Dual Magnum	1.05 pt/a	PRE				

¹Means followed by same letter do not significantly differ (P = 0.05, LSD).

²COC = crop oil concentrate.

Table 3. Weed control in potato 22 days after pre-emergence herbicide application at the Malheur Experiment Station, Ontario, OR, 2009.

Treatment	Rate	Timing	Crop injury	Weed control ¹			
				Common lambsquarters	Hairy nightshade	Pigweed spp.	Barnyard grass
Untreated control			0 b	0 b	0 c	0 c	0 d
Dual Magnum	1.33 pt/a	PRE	0 b	100 a	100 a	100 a	100 a
Prowl H ₂ O	1.58 pt/a	PRE					
Eptam	4.5 pt/a						
Targa	5 oz/a	POST					
COC ²	1.6 pt/a	POST					
Dual Magnum	1.33 pt/a	PRE	0 b	100 a	100 a	100 a	100 a
Prowl H ₂ O	1.58 pt/a						
Eptam	4.5 pt/a						
Targa	7 oz/a	POST					
COC	1.6 pt/a	POST					
Dual Magnum	1.33 pt/a	PRE	0 b	100 a	100 a	100 a	100 a
Prowl H ₂ O	1.58 pt/a						
Eptam	4.5 pt/a						
Select Max	6 oz/a	POST					
COC	1.6 pt/a	POST					
KIH-485 (Pyroxasulfone)	1.5 oz/a	PRE	0 b	100 a	100 a	100 a	100 a
KIH-485 (Pyroxasulfone)	2.5 oz/a	PRE	0 b	100 a	100 a	100 a	100 a
BAS 800 (Safinphos)	1.98 oz/a	PRE	0 b	100 a	100 a	95 b	75 c
KSU12800	20 oz/a	PRE	18 a	100 a	100 a	100 a	84 bc
KSU12800	30 oz/a	PRE	19 a	100 a	99 a	99 a	89 b
KSU12800	20 oz/a	PRE	19 a	100 a	100 a	100 a	81 bc
Dual Magnum	1.05 pt/a	PRE					

¹Means followed by same letter do not significantly differ (P = 0.05, LSD).

²COC = crop oil concentrate.

Table 4. Weed control in potato 45 days after pre-emergence herbicide application at the Malheur Experiment Station, Ontario, OR, 2009.

Treatment	Rate	Timing	Crop injury	Weed control ¹			
				Common lambsquarters	Hairy nightshade	Pigweed spp	Barnyard grass
Untreated control			0 c	0 b	0 b	0 c	0 c
Dual Magnum	1.33 pt/a	PRE	0 c	100 a	100 a	100 a	100 a
Prowl H ₂ O	1.58 pt/a	PRE					
Eptam	4.5 pt/a						
Targa	5 oz/a	POST					
COC ²	1.6 pt/a	POST					
Dual Magnum	1.33 pt/a	PRE	0 c	100 a	100 a	100 a	100 a
Prowl H ₂ O	1.58 pt/a						
Eptam	4.5 pt/a						
Targa	7 oz/a	POST					
COC	1.6 pt/a	POST					
Dual Magnum	1.33 pt/a	PRE	0 c	100 a	100 a	100 a	100 a
Prowl H ₂ O	1.58 pt/a						
Eptam	4.5 pt/a						
Select Max	6 oz/a	POST					
COC	1.6 pt/a	POST					
KIH-485 (Pyroxasulfone)	1.5 oz/a	PRE	0 c	100 a	100 a	100 a	100 a
KIH-485 (Pyroxasulfone)	2.5 oz/a	PRE	0 c	100 a	100 a	100 a	100 a
BAS 800 (Safinpyracil)	1.98 oz/a	PRE	0 c	100 a	100 a	98 a	90 b
KSU12800	20 oz/a	PRE	2 b	100 a	100 a	93 b	98 a
KSU12800	30 oz/a	PRE	5 a	100 a	100 a	93 b	89 b
KSU12800	20 oz/a	PRE	5 a	100 a	100 a	100 a	100 a
Dual Magnum	1.05 pt/a	PRE					

¹Means followed by same letter do not significantly differ (P = 0.05, LSD).

²COC = crop oil concentrate.

Table 5. Weed control in potato 66 days after pre-emergence herbicide application at the Malheur Experiment Station, Ontario, OR, 2009.

Treatment	Rate	Timing	Crop injury	Weed control ¹			
				Common lambsquarters	Hairy nightshade	Pigweed spp.	Barnyard grass
Untreated control			0 a	0 b	0 b	0 d	0 c
Dual Magnum	1.33 pt/a	PRE	0 a	100 a	100 a	100 a	100 a
Prowl H ₂ O	1.58 pt/a	PRE					
Eptam	4.5 pt/a						
Targa	5 oz/a	POST					
COC ²	1.6 pt/a	POST					
Dual Magnum	1.33 pt/a	PRE	0 a	100 a	100 a	100 a	100 a
Prowl H ₂ O	1.58 pt/a						
Eptam	4.5 pt/a						
Targa	7 oz/a	POST					
COC	1.6 pt/a	POST					
Dual Magnum	1.33 pt/a	PRE	0 a	100 a	100 a	100 a	100 a
Prowl H ₂ O	1.58 pt/a						
Eptam	4.5 pt/a						
Select Max	6 oz/a	POST					
COC	1.6 pt/a	POST					
KIH-485 (Pyroxasulfone)	1.5 oz/a	PRE	0 a	100 a	100 a	100 a	100 a
KIH-485 (Pyroxasulfone)	2.5 oz/a	PRE	0 a	100 a	100 a	100 a	100 a
BAS 800 (Safinpyracil)	1.98 oz/a	PRE	0 a	100 a	100 a	98 b	93 b
KSU12800	20 oz/a	PRE	0 a	100 a	100 a	99 ab	99 a
KSU12800	30 oz/a	PRE	0 a	100 a	100 a	95 c	93 b
KSU12800	20 oz/a	PRE	0 a	100 a	100 a	100 a	100 a
Dual Magnum	1.05 pt/a	PRE					

¹Means followed by same letter do not significantly differ (P = 0.05, LSD).

²COC = crop oil concentrate.

Table 6. Potato tuber yield in response to different herbicide application at the Malheur Experiment Station, Ontario, OR, 2009.

Treatment	Rate	Timing	Potato yield ¹					U.S. No.1
			U.S. No.2	<4oz	4-6oz	6-12oz	>12oz	
Untreated control			3 b	53 a	88 ab	214 bc	84 c	385 d
Dual Magnum	1.33 pt/a	PRE	3 ab	56 a	77 ab	253 ab	147 ab	491 ab
Prowl H ₂ O	1.58 pt/a	PRE						
Eptam	4.5 pt/a							
Targa	5 oz/a	POST						
COC	1.6 pt/a	POST						
Dual Magnum	1.33 pt/a	PRE	12 ab	59 a	100 a	206 bc	116 bc	408 cd
Prowl H ₂ O	1.58 pt/a							
Eptam	4.5 pt/a							
Targa	7 oz/a	POST						
COC	1.6 pt/a	POST						
Dual Magnum	1.33 pt/a	PRE	21 ab	52 a	80 ab	216 bc	179 a	475 abc
Prowl H ₂ O	1.58 pt/a							
Eptam	4.5 pt/a							
Select Max	6 oz/a	POST						
COC ²	1.6 pt/a	POST						
KIH-485 (Pyroxasulfone)	1.5 oz/a	PRE	17 ab	44 a	79 ab	246 abc	140 abc	465 abc
KIH-485 (Pyroxasulfone)	2.5 oz/a	PRE	16 ab	45 a	81 ab	200 c	163 ab	462 abc
BAS 800 (Saflufenacil)	1.98 oz/a	PRE	14 ab	45 a	77 ab	233 abc	181 a	491 ab
KSU12800	20 oz/a	PRE	26 a	65 a	71 b	254 ab	166 ab	490 ab
KSU12800	30 oz/a	PRE	15 ab	48 a	71 b	220 bc	126 abc	435 bcd
KSU12800	20 oz/a	PRE	5 ab	48 a	92 ab	273 a	146 ab	510 a
Dual Magnum	1.05 pt/a	PRE						

¹Means followed by same letter do not significantly differ (P = 0.05, LSD).

²COC = crop oil concentrate.