

# WEED CONTROL AND ONION TOLERANCE WITH SOIL-ACTIVE AND POSTEMERGENCE HERBICIDES

Corey V. Ransom, Charles A. Rice, and Joey K. Ishida  
Malheur Experiment Station  
Oregon State University  
Ontario, OR, 2002

## Introduction

Weed control is essential for the production of marketable onions. Weed control in onion is difficult compared to many crops because of the lack of a complete crop canopy. Combinations of soil-active and postemergence herbicides are required to improve overall weed control. Weed control research is important in identifying potential herbicides and management strategies to improve weed control in onion production.

## Methods

### *General Procedures*

Trials were conducted at the Malheur Experiment Station to evaluate experimental and registered herbicides for weed control and onion tolerance. The effect of spray volume on weed control and onion tolerance was also evaluated. Trials were conducted under furrow irrigation. Blanket applications were applied with a four-wheeler-mounted sprayer calibrated to deliver 10 gal/acre at 30 psi. All other herbicide treatments were applied with a CO<sub>2</sub>-pressurized backpack sprayer calibrated to deliver 40 gal/acre at 30 psi.

On March 29, onions (cv. 'Vaquero', Sunseeds, Morgan Hill, CA) were planted at a 3.7-inch spacing in double rows on 22-inch beds. Plots were four rows wide and 27 ft long and treatments were arranged in a randomized complete block design with four replicates. Lorsban was applied in a 6-inch band over each row at 3.7 oz/1,000 ft of row. Onions were sidedressed with N at 75 lb/acre as urea on May 22 and a second time on June 5. Registered insecticides and fungicides were applied for thrip and downy mildew control. Weed control and onion injury were evaluated throughout the season. Onions were harvested September 16 and graded by size on September 25.

Data were analyzed using analysis of variance and means were separated using a protected least significant difference (LSD) at the 5 percent level (0.05).

### *Herbicide Application Timing for Pigweed Control in Onion*

Buctril and Goal were applied at different rates and application timings alone and in combinations to determine the most effective treatments for control of pigweed (Powell amaranth and redroot pigweed), common lambsquarters, and hairy nightshade. All treatments included a preemergence application of Roundup (0.375 lb ai/acre).

Postemergence treatments were applied to one-, two-, three-, and five-leaf onions. At the five-leaf timing all treatments received an application of Goal (0.25 lb ai/acre). Herbicides and rates differed for applications to one-, two-, and three-leaf onions.

### ***Prowl and Outlook for Weed Control in Onion***

The soil-active herbicides Prowl, Prowl H<sub>2</sub>O, and Outlook were evaluated for crop injury and weed control in onion. All plots received a preemergence application of Roundup at 0.375 lb ai/acre. Prowl and Prowl H<sub>2</sub>O were compared at rates of 0.62 and 1.0 lb ai/acre applied to flag-leaf onions and to two-leaf onions at 0.62 lb ai/acre with Buctril (0.25 lb ai/acre) plus Outlook (0.5 lb ai/acre). Postemergence applications of Outlook were applied either as a split application to two- and three-leaf onions or a single application at 0.66 or 0.84 lb ai/acre to two-leaf onions. Split applications of Outlook were applied twice at 0.5 lb ai/acre or at 0.66 and 0.33 lb ai/acre to two-leaf and three-leaf onions, respectively. Outlook was applied with Buctril (0.125 or 0.25 lb ai/acre), Goal (0.125 or 0.25 lb ai/acre), Prowl (0.5 or 0.62 lb ai/acre), or Prowl H<sub>2</sub>O (0.62 lb ai/acre). All treatments consisting of four applications received an application of Goal at 0.25 lb ai/acre applied at the four-leaf stage.

### ***Soil-active Herbicides for Weed Control in Onion***

The soil-active herbicides Dacthal, Prowl, and Valor were evaluated for crop injury and weed control in onion. Various rates of Prowl and Dacthal were applied alone and in combination with Roundup. All herbicide-treated plots received a preemergence application of Roundup (0.375 lb ai/acre) applied with Prowl (0.6, 0.75, or 0.8 lb ai/acre) and/or Dacthal (5.0, 7.5, or 10.0 lb ai/acre) on April 12. The two-leaf applications consisted of Buctril (0.125 or 0.25 lb ai/acre) plus Poast (0.1 lb ai/acre); Valor (0.063 or 0.094 lb ai/acre) with and without crop oil concentrate (COC) (1.0 percent v/v); or Buctril (0.25 lb ai/acre) plus Valor (0.094 lb ai/acre) applied on May 17. Buctril (0.25 lb ai/acre), Goal (0.25 lb ai/acre), and Poast (0.1 lb ai/acre) were applied to three-leaf onions on May 25 and Goal (0.25 lb ai/acre) plus Poast (0.1 lb ai/acre) were applied to four-leaf onions on May 30.

### ***Preemergence Nortron and Prowl for Weed Control in Onion***

Weed control with preemergence applications of Prowl and Nortron was evaluated at several rates alone and in combination. Treatments consisted of Prowl applied with Roundup (0.375 lb ai/acre) at 0.75 or 1.5 lb ai/acre; Nortron applied with Roundup at 1.0 or 2.0 lb ai/acre; and several combinations of Prowl at either 0.75 or 1.5 lb ai/acre plus Nortron applied at 1.0 or 2.0 lb ai/acre along with Roundup. Preemergence treatments were applied on April 12 followed by Buctril (0.125 lb ai/acre) plus Goal (0.125 lb ai/acre) and Poast (0.1 lb ai/acre) on May 17 to two-leaf onions; Buctril (0.25 lb ai/acre) plus Goal (0.125 lb ai/acre) and Poast (0.1 lb ai/acre) on May 25 to three-leaf onions; and Goal (0.25 lb ai/acre) plus Poast (0.1 lb ai/acre) on May 30 to four-leaf onions.

### ***Spray Volume Effects on Weed Control and Onion Injury***

Crop injury and weed control with spray volumes of 10, 30, and 60 gal/acre were evaluated for the herbicides Valor, Goal, and Buctril. Herbicide rates evaluated were

Valor applied at 0.094 lb ai/acre plus a non-ionic surfactant (NIS) at 0.25 percent v/v applied to two- and four-leaf onions; Goal at 0.12 lb ai/acre applied to two- and four-leaf onions; and Buctril at 0.125 applied to two-leaf onions and 0.25 lb ai/acre applied to four-leaf onions. Herbicides were applied to two-leaf onions on May 17 and to four-leaf onions on May 30.

## **Results and Discussion**

### ***Herbicide Application Timing for Pigweed Control in Onion***

In general, treatments with Goal (0.156 lb ai/acre) applied to one-leaf onions or those where Buctril plus Goal were applied to two- and three-leaf onions provided the best overall weed control (Table 1). Pigweed control was increased when Goal was applied with Buctril to one-leaf onions compared to Buctril alone. Treatments including Buctril at the two-leaf application timing provided significantly ( $P < 0.05$ ) greater control of hairy nightshade than those without Buctril. The treatment including Outlook plus Goal applied to two-leaf onions provided similar pigweed and hairy nightshade control compared to those treatments having Buctril plus Goal applied at the same application timing. However, common lambsquarters control was greater from treatments where Buctril plus Goal were applied to two-leaf onions compared with Goal plus Outlook. Hairy nightshade control on June 29 (30 days after treatment [DAT]) was similar among treatments having Buctril or Outlook applied at the two-leaf application timing. Due to deteriorating weed control over time, late season weed control evaluations and onion yields were not taken for this trial.

### ***Prowl and Outlook for Weed Control in Onion***

Crop injury ranged from 4 to 17 percent on June 12 (18 DAT) (Table 3). Treatments including a four-leaf application of Goal caused similar injury on June 12. Weed control with treatments including comparisons between Prowl and Prowl H<sub>2</sub>O were not different (Table 2). Common lambsquarters control was not different ( $P < 0.05$ ) among herbicide treatments on either evaluation date. Prowl (1.0 lb ai/acre) followed by applications of Buctril plus Outlook to two-leaf onions, Goal plus Outlook to three-leaf onions, and Goal applied to four-leaf onions were the only herbicide treatments that provided less than 60 percent hairy nightshade control on August 6. In general, the highest marketable and total onion yields came from those treatments where Goal was applied to two- and three-leaf onions or Outlook was applied at 0.66 lb ai/acre to two-leaf onions (Table 3).

### ***Soil-active Herbicides for Weed Control in Onion***

Onion injury ranged from 12 to 30 percent on May 23 (6 days after the two-leaf application) and was greatest in plots receiving a two-leaf application of Buctril at 0.25 lb ai/acre plus Valor at 0.094 lb ai/acre (Table 5). However, by June 12 (13 DAT) crop injury associated with this treatment was similar to or less than all other herbicide treatments. Pigweed control was 100 percent on both June 29 (30 DAT) and August 6 (68 DAT) with the treatment including Dacthal (7.5 lb ai/acre) plus Prowl (0.6 lb ai/acre) preemergence followed by Buctril (0.25 lb ai/acre) plus Valor (0.094 lb ai/acre) applied to two-leaf onions (Table 4). In general, greater common lambsquarters control was achieved when Buctril was applied to two-leaf onions compared to Valor alone with or

without COC. However, the greatest common lambsquarters control was observed with Buctril at 0.25 lb ai/acre plus Valor at 0.094 lb ai/acre applied to two-leaf onions following a preemergence application of Roundup (0.375 lb ai/acre) plus Dacthal (7.5 lb ai/acre) and Prowl (0.6 lb ai/acre). Hairy nightshade control was greatest on August 6 when Valor at 0.094 lb ai/acre was included in the herbicide program. Treatments with Valor at 0.094 lb ai/acre provided 93 and 98 percent hairy nightshade control on August 6. All herbicide-treated plots provided marketable and total onion yields greater than the untreated control (Table 5). The herbicide program including the combination of Buctril (0.25 lb ai/acre) plus Valor (0.094 lb ai/acre) applied to two-leaf onions provided greater colossal, super colossal, marketable, and total onion yields than all other treatments. The high onion yield associated with this treatment is directly related to season-long weed control that was 98 percent or greater for all species.

#### ***Preemergence Nortron and Prowl for Weed Control in Onion***

On June 13 (14 DAT) onion injury from herbicide treatments ranged from 14 to 16 percent and was significantly ( $P < 0.05$ ) greater than the untreated control (Table 7). Pigweed control was greater with Prowl applied at 1.5 lb ai/acre than at 0.75 lb ai/acre on both June 13 and August 6 (68 DAT) (Table 6). The addition of preemergence Nortron at both 1.0 and 2.0 lb ai/acre increased pigweed control over Prowl applied preemergence at 0.75 lb ai/acre and the Roundup-only preemergence treatment on August 6. Common lambsquarters control was greater on August 6 with preemergence applications of Prowl at 1.5 lb ai/acre, Nortron at 2.0 lb ai/acre, and all Prowl plus Nortron combinations compared to Roundup alone preemergence. The treatment including preemergence Nortron at 2.0 lb ai/acre and Prowl at 0.75 lb ai/acre was the only treatment that provided greater than 90 percent control of hairy nightshade on August 6.

#### ***Spray Volume Effects on Weed Control and Onion Injury***

Increasing onion injury with Valor plus NIS from increasing spray volume was observed on all three evaluation dates (Table 8). This increase in injury may be attributed to the spray volume effects or to the increasing surfactant load as the NIS rate was applied at 0.25 percent of the spray gallonage for all three spray volumes. Crop injury from Goal applications was not affected by spray volume. Crop injury from Buctril decreased with increasing spray volume as observed on June 13 (14 DAT). By June 29 (30 DAT), only Valor plus NIS applied at 30 and 60 gal/acre displayed injury greater than the untreated control. Common lambsquarters control 30 DAT with Valor plus NIS increased from 69 percent applied at 10 gal/acre to 92 percent applied at 60 gal/acre spray volume (Table 8). The opposite was true for Buctril; common lambsquarters control significantly decreased from 97 percent at 10 gal/acre down to 60 percent at 60 gal/acre spray volume. Due to deteriorating weed control over time, late-season weed control evaluations and onion yields were not taken for this trial.

Table 1. Timing and rate of Buctril and Goal for weed control in onions, Malheur Experiment Station, Oregon State University, Ontario, OR, 2002.

Treatment*	Rate	Timing†	Weed control					
			Pigweed species‡		Common lambsquarters		Hairy nightshade	
			6-12	6-29	6-12	6-29	6-12	6-29
	lb ai/acre	Crop stage	----- % -----					
Untreated control	--	--	0	0	0	0	0	0
Buctril	0.05	1-leaf	84	69	94	88	96	92
Buctril	0.125	2-leaf						
Buctril	0.25	3-leaf						
Goal	0.25	5-leaf						
Buctril + Goal	0.05 + 0.063	1-leaf	92	79	93	86	94	91
Buctril	0.125	2-leaf						
Buctril	0.25	3-leaf						
Goal	0.25	5-leaf						
Goal	0.156	1-leaf	96	91	98	95	97	96
Buctril	0.25	2-leaf						
Buctril	0.25	3-leaf						
Goal	0.25	5-leaf						
Buctril	0.05	1-leaf	91	83	90	76	89	79
Goal	0.31	2-leaf						
Buctril	0.25	3-leaf						
Goal	0.25	5-leaf						
Buctril	0.05	1-leaf	92	81	91	82	96	97
Buctril + Goal	0.125 + 0.156	2-leaf						
Buctril	0.25	3-leaf						
Goal	0.25	5-leaf						
Buctril	0.05	1-leaf	96	89	95	83	97	96
Buctril + Goal	0.125 + 0.31	2-leaf						
Buctril	0.25	3-leaf						
Goal	0.25	5-leaf						
Buctril	0.05	1-leaf	97	92	97	90	98	100
Buctril + Goal	0.25 + 0.156	2-leaf						
Buctril + Goal	0.125 + 0.156	3-leaf						
Goal	0.25	5-leaf						
Buctril	0.05	1-leaf	96	88	93	75	95	95
Goal + Outlook	0.156 + 0.656	2-leaf						
Buctril + Goal	0.25 + 0.156	3-leaf						
Goal	0.25	5-leaf						
Buctril	0.05	1-leaf	91	77	88	71	89	74
Goal	0.156	2-leaf						
Buctril + Goal	0.125 + 0.156	3-leaf						
Goal	0.25	5-leaf						
LSD (0.05)			5	8	4	7	6	15

\*All treatments received a preemergence application of Roundup (0.375 lb ai/acre).

†The application dates were: preemergence (April 12), 1-leaf (May 9), 2-leaf (May 17), 3-leaf (May 25), and 5-leaf (May 30).

‡Pigweed species at this location are predominantly Powell amaranth mixed with some redroot pigweed.

Table 2. Weed control in onions with Prowl and Outlook, Malheur Experiment Station, Oregon State University, Ontario, OR, 2002.

Treatment*	Rate	Timing†	Weed control					
			Pigweed species‡		Common lambsquarters		Hairy nightshade	
			6-12	8-6	6-12	8-6	6-12	8-6
	lb ai/acre	Crop stage	-----%-----					
Untreated control	--	--	0	0	0	0	0	0
Prowl	0.62	flag	92	65	98	100	97	96
Buctril + Prowl + Outlook	0.25 + 0.62 + 0.5	2-leaf						
Buctril + Outlook	0.25 + 0.5	3-leaf						
Goal	0.25	4-leaf						
Prowl H <sub>2</sub> O	0.62	flag	89	53	98	100	98	88
Buctril + Prowl H <sub>2</sub> O + Outlook	0.25 + 0.62 + 0.5	2-leaf						
Buctril + Outlook	0.25 + 0.5	3-leaf						
Goal	0.25	4-leaf						
Prowl	1.0	flag	96	70	98	99	96	84
Buctril + Outlook	0.25 + 0.66	2-leaf						
Goal	0.25	3-leaf						
Goal	0.25	4-leaf						
Prowl H <sub>2</sub> O	1.0	flag	95	78	98	100	93	66
Buctril + Outlook	0.25 + 0.66	2-leaf						
Goal	0.25	3-leaf						
Goal	0.25	4-leaf						
Prowl	1.0	flag	96	64	98	95	97	80
Buctril	0.25	2-leaf						
Goal	0.25	3-leaf						
Goal	0.25	4-leaf						
Prowl	1.0	flag	94	76	98	98	98	99
Buctril + Goal + Outlook	0.125 + 0.125 + 0.5	2-leaf						
Buctril + Goal + Outlook	0.25 + 0.125 + 0.5	3-leaf						
Goal	0.25	4-leaf						
Prowl	1.0	flag	96	73	98	98	93	58
Buctril + Outlook	0.25 + 0.5	2-leaf						
Goal + Outlook	0.25 + 0.5	3-leaf						
Goal	0.25	4-leaf						
Prowl	1.0	flag	92	70	98	96	94	83
Buctril + Outlook	0.25 + 0.84	2-leaf						
Goal	0.25	3-leaf						
Goal	0.25	4-leaf						
Prowl	1.0	flag	96	76	98	96	97	88
Buctril + Goal + Outlook	0.25 + 0.25 + 0.66	2-leaf						
Goal + Prowl + Outlook	0.25 + 0.5 + 0.33	3-leaf						
LSD (0.05)			5	15	NS	6	4	21

\*All treatments received a preemergence application of Roundup (0.375 lb ai/acre).

†The application dates were: Preemergence (April 12), flag (April 22), 2-leaf (May 17), 3-leaf (May 25), and 4-leaf (May 30).

‡Pigweed species at this location are predominantly Powell amaranth mixed with some redroot pigweed.

Table 3. Onion injury and yield with Prowl and Outlook, Malheur Experiment Station, Oregon State University, Ontario, OR, 2002.

Treatment	Rate	Timing*	Onion injury†	Onion yield‡					
				Medium	Jumbo	Colossal	Super colossal	Total	Marketable
				cwt/acre					
lb ai/acre	Crop stage	%	-----						
Untreated control	--	--	0	4	1	0	0	14	4
Prowl	0.62	flag	14	40	507	142	26	737	716
Buctril + Prowl + Outlook	0.25 + 0.62 + 0.5	2-leaf							
Buctril + Outlook	0.25 + 0.5	3-leaf							
Goal	0.25	4-leaf							
Prowl H <sub>2</sub> O	0.62	flag	16	41	329	92	37	514	499
Buctril + Prowl H <sub>2</sub> O + Outlook	0.25 + 0.62 + 0.5	2-leaf							
Buctril + Outlook	0.25 + 0.5	3-leaf							
Goal	0.25	4-leaf							
Prowl	1.0	flag	16	34	443	117	20	621	614
Buctril + Outlook	0.25 + 0.66	2-leaf							
Goal	0.25	3-leaf							
Goal	0.25	4-leaf							
Prowl H <sub>2</sub> O	1.0	flag	15	21	569	149	30	776	769
Buctril + Outlook	0.25 + 0.66	2-leaf							
Goal	0.25	3-leaf							
Goal	0.25	4-leaf							
Prowl	1.0	flag	13	24	470	123	16	643	633
Buctril	0.25	2-leaf							
Goal	0.25	3-leaf							
Goal	0.25	4-leaf							
Prowl	1.0	flag	17	38	611	168	24	860	842
Buctril + Goal + Outlook	0.125 + 0.125 + 0.5	2-leaf							
Buctril + Goal + Outlook	0.25 + 0.125 + 0.5	3-leaf							
Goal	0.25	4-leaf							
Prowl	1.0	flag	17	26	434	164	38	676	661
Buctril + Outlook	0.25 + 0.5	2-leaf							
Goal + Outlook	0.25 + 0.5	3-leaf							
Goal	0.25	4-leaf							
Prowl	1.0	flag	17	23	451	153	38	677	664
Buctril + Outlook	0.25 + 0.84	2-leaf							
Goal	0.25	3-leaf							
Goal	0.25	4-leaf							
Prowl	1.0	flag	4	23	541	169	51	796	783
Buctril + Goal + Outlook	0.25 + 0.25 + 0.66	2-leaf							
Goal + Prowl + Outlook	0.25 + 0.5 + 0.33	3-leaf							
LSD (0.05)			3	NS	221	83	NS	246	244

\*The application dates were: Preemergence (April 12), flag (April 22), 2-leaf (May 17), 3-leaf (May 25), and 4-leaf (May 30).

†Crop injury evaluations were taken on June 12, 18 days after the 4-leaf application.

‡Plots were harvested on September 16 and onions were graded on September 24-25.

Table 4. Weed control in onions with soil-active herbicides, Malheur Experiment Station, Oregon State University, Ontario, OR, 2002.

Treatment	Rate	Timing*	Weed control					
			Pigweed species†		Common lambsquarters		Hairy nightshade	
			6-29	8-06	6-29	8-06	6-29	8-06
	lb ai/acre	Crop stage	----- % -----					
Untreated control	--	--	0 d	0 d	0	0	0	0
Roundup + Prowl	0.375 + 0.75	PRE	89 bc	67 c	95	81	86	38
Buctril + Poast	0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Roundup + Dacthal	0.375 + 10.0	PRE	87 c	67 c	87	68	87	53
Buctril + Poast	0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Roundup + Dacthal + Prowl	0.375 + 5.0 + 0.6	PRE	92 bc	81 bc	94	79	84	30
Buctril + Poast	0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Roundup + Dacthal + Prowl	0.375 + 5.0 + 0.8	PRE	89 bc	77 bc	93	82	84	15
Buctril + Poast	0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Roundup + Dacthal + Prowl	0.375 + 7.5 + 0.6	PRE	94 b	86 b	93	77	84	16
Buctril + Poast	0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Roundup + Dacthal + Prowl	0.375 + 7.5 + 0.6	PRE	85 c	64 c	84	51	91	72
Valor	0.063	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Roundup + Dacthal + Prowl	0.375 + 7.5 + 0.6	PRE	89 bc	75 bc	89	58	99	93
Valor	0.094	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Roundup + Dacthal + Prowl	0.375 + 7.5 + 0.6	PRE	93 b	84 b	83	58	94	73
Valor + COC	0.063 + 1.0% v/v	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Roundup + Dacthal + Prowl	0.375 + 7.5 + 0.6	PRE	100 a	100 a	100	98	100	98
Buctril + Valor	0.25 + 0.094	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
LSD (0.05)			--	--	8	18	7	32

\*The application dates were: (PRE) preemergence (April 12), 2-leaf (May 17), 3-leaf (May 25), and 4-leaf (May 30).

†Pigweed species at this location are predominantly Powell amaranth mixed with some redroot pigweed. ANOVA was conducted on arcsine percent transformed data. Transformed mean separation applied to non-transformed data.



Table 5. Onion injury and yield response to soil-active herbicides, Malheur Experiment Station, Oregon State University, Ontario, OR, 2002.

Treatment*	Rate lb ai/acre	Timing† Crop stage	Onion injury		Onion yield‡					Total
			5-23	6-12	Medium	Jumbo	Colossal	Super colossal	Marketable	
			----- % -----		----- cwt/acre -----					
Untreated	--	--	0	0	1	0	0	0	1	8
Prowl	0.75	PRE	12	14	53	414	67	22	556	567
Buctril + Poast	0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Dacthal	10.0	PRE	12	15	77	361	69	11	517	532
Buctril + Poast	0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Dacthal + Prowl	5.0 + 0.6	PRE	15	13	35	353	79	25	492	500
Buctril + Poast	0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Dacthal + Prowl	5.0 + 0.8	PRE	16	14	44	340	53	0	438	447
Buctril + Poast	0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Dacthal + Prowl	7.5 + 0.6	PRE	15	14	56	433	57	8	554	566
Buctril + Poast	0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Dacthal + Prowl	7.5 + 0.6	PRE	16	13	80	250	61	7	397	416
Valor	0.063	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Dacthal + Prowl	7.5 + 0.6	PRE	16	14	38	293	91	31	452	470
Valor	0.094	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Dacthal + Prowl	7.5 + 0.6	PRE	18	15	60	350	101	21	533	543
Valor + COC	0.063 + 1.0% v/v	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Dacthal + Prowl	7.5 + 0.6	PRE	30	13	15	408	288	97	808	822
Buctril + Valor	0.25 + 0.094	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
LSD (0.05)			5	2	44	164	76	39	195	192

\*All preemergence applications included Roundup at 0.375 lb ai/acre.

†The application dates were: (PRE) preemergence (April 12), 2-leaf (May 17), 3-leaf (May 25), and 4-leaf (May 30).

‡Plots were harvested on September 16 and onions were graded on September 24-25.

Table 6. Preemergence Nortron and Prowl for weed control in onions, Malheur Experiment Station, Oregon State University, Ontario, OR, 2002.

Treatment	Rate	Timing*	Weed control†					
			Pigweed species‡		Common lambsquarters		Hairy nightshade	
			6-13	8-06	6-13	8-06	6-13	8-06
	lb ai/acre	Crop stage	----- % -----					
Untreated control	--	--	0	0	0	0	0 c	0
Prowl	0.75	PRE	94	68 d	91	65	93 ab	67
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Prowl	1.5	PRE	97	89 bc	97	83	94 ab	49
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Nortron	1.0	PRE	97	94 ab	95	68	94 ab	35
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Nortron	2.0	PRE	97	95 ab	96	79	93 ab	51
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf	95	81 cd	93	56	91 b	40
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Nortron + Prowl	1.0 + 0.75	PRE	97	93 ab	94	82	92 b	48
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Nortron + Prowl	1.0 + 1.5	PRE	97	95 ab	97	95	96 ab	72
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Nortron + Prowl	2.0 + 0.75	PRE	97	98 a	95	89	98 a	92
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.25 + 0.1	4-leaf						
Nortron + Prowl	2.0 + 1.5	PRE	98	97 ab	98	95	96 ab	73
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf						
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf						
Goal + Poast	0.125 + 0.1	4-leaf						
LSD (0.05)			3	--	5	21	--	42

\*The application dates were: (PRE) preemergence (April 12), 2-leaf (May 17), 3-leaf (May 25), and 4-leaf (May 30).

†In data columns with letter designations the ANOVA was conducted on arcsine percent transformed data. Transformed mean separation applied to non-transformed data.

‡Pigweed species at this location are predominantly Powell amaranth mixed with some redroot pigweed.

Table 7. Onion injury and yield with preemergence Nortron and Prowl, Malheur Experiment Station, Oregon State University, Ontario, OR, 2002.

Treatment	Rate	Timing*	Onion injury <sup>†</sup>	Onion yield						
				Small	Medium	Jumbo	Colossal	Super colossal	Marketable	Total
				cwt/acre						
	lb ai/acre	Crop stage	%							
Untreated control	--	--	0	19	1	0	0	0	1	20
Prowl	0.75	PRE	14	9	71	426	88	15	600	612
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Prowl	1.5	PRE	14	6	60	491	114	21	685	695
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Nortron	1.0	PRE	14	7	52	446	77	23	598	616
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Nortron	2.0	PRE	15	9	42	408	140	23	613	626
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf	15	8	70	375	53	6	503	517
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Nortron + Prowl	1.0 + 0.75	PRE	15	6	40	283	127	63	513	528
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Nortron + Prowl	1.0 + 1.5	PRE	15	4	25	435	175	66	700	716
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Nortron + Prowl	2.0 + 0.75	PRE	16	3	32	374	191	68	665	680
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.25 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.25 + 0.1	4-leaf								
Nortron + Prowl	2.0 + 1.5	PRE	15	6	25	415	176	84	700	716
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	2-leaf								
Buctril + Goal + Poast	0.125 + 0.125 + 0.1	3-leaf								
Goal + Poast	0.125 + 0.125 + 0.1	4-leaf								
LSD (0.05)			2	7	41	220	116	56	209	207

\*The application dates were: (PRE) preemergence (April 12), 2-leaf (May 17), 3-leaf (May 25), and 4-leaf (May 30).

<sup>†</sup>Onion injury was evaluated on June 13, 14 days after the 4-leaf application.

Table 8. Effect of spray volume on onion injury and weed control with Buctril, Goal, and Valor, Malheur Experiment Station, Oregon State University, Ontario, OR, 2002.

Treatment*	Rate	Spray volume	Timing†	Onion injury			Weed control‡		
				5-23	6-13	6-29	Pigweed species §	Common lambsquarters	Hairy nightshade
	lb ai/acre	gpa	Crop stage	----- % -----			----- % -----		
Untreated	--	--	--	0	0	0	0	0	0
Valor + NIS	0.094 + 0.25% v/v	10	2-leaf	26	34	0	86	69	86
Valor + NIS	0.094 + 0.25% v/v	10	4-leaf						
Valor + NIS	0.094 + 0.25% v/v	30	2-leaf	39	41	5	92	76	92
Valor + NIS	0.094 + 0.25% v/v	30	4-leaf						
Valor + NIS	0.094 + 0.25% v/v	60	2-leaf	45	48	10	100	92	100
Valor + NIS	0.094 + 0.25% v/v	60	4-leaf						
Goal	0.12	10	2-leaf	12	16	0	64	82	13
Goal	0.12	10	4-leaf						
Goal	0.12	30	2-leaf	12	10	0	66	79	34
Goal	0.12	30	4-leaf						
Goal	0.12	60	2-leaf	16	15	0	74	72	42
Goal	0.12	60	4-leaf						
Buctril	0.125	10	2-leaf	14	21	0	28	97	68
Buctril	0.25	10	4-leaf						
Buctril	0.125	30	2-leaf	15	11	0	34	76	46
Buctril	0.25	30	4-leaf						
Buctril	0.125	60	2-leaf	13	3	0	24	60	73
Buctril	0.25	60	4-leaf						
LSD (0.05)				5	8	3	25	17	38

\*All treatments received a preemergence application of Roundup (0.375 lb ai/acre) on April 12.

†Treatments were applied on May 17 and May 30 to 2-leaf and 4-leaf onions, respectively.

‡Weed control evaluations were taken on June 29 (30 DAT).

§Pigweed species at this location are predominantly Powell amaranth mixed with some redroot pigweed.