

PREEMERGENCE AND POSTEMERGENCE COMBINATIONS FOR WEED CONTROL IN ONION

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

Introduction

Because postemergence herbicides cannot be applied until onions have two true leaves, preemergence herbicide applications can be critical for limiting weed growth prior to when postemergence herbicides can be applied. Preemergence herbicides can control weeds as they germinate and reduce the size and number of weeds that are present until onions are large enough to tolerate postemergence herbicide applications. This research evaluated preemergence and postemergence herbicide combinations for weed control in onion.

Materials and Methods

A trial was conducted at the Malheur Experiment Station under furrow irrigation. On March 31, onions (cv. 'Vaquero', Nunhems, Parma, ID) were planted at 3.7-inch spacing in double rows on 22-inch beds. Plots were 4 rows wide and 27 ft long and arranged in a split-plot design with 4 replicates. Lorsban[®] was applied in a 6-inch band over each double row at 3.7 oz/1,000 ft of row. Onions were sidedressed with 150 lb nitrogen, 50 lb phosphorus, 30 lb potassium, 30 lb sulfate, 8 lb zinc, 5 lb manganese, 1 lb copper, and 2 lb boron/acre on June 7. Registered insecticides and fungicides were applied for thrips and downy mildew control.

Combinations of preemergence and postemergence herbicide applications were evaluated for weed control. Preemergence (PRE) treatments included no herbicide, Roundup[®] (glyphosate), and Roundup plus Prowl[®] (pendimethalin). Another treatment applied prior to the sequential postemergence treatments was Roundup applied preemergence followed by Prowl and Outlook[®] (dimethenamid-P) applied postemergence to one-leaf onions. Sequential postemergence treatments included Buctril[®] (bromoxynil) plus Goal[®] (oxyfluorfen) or Buctril plus Chateau[®] (flumioxazin) applied to two- or four-leaf onions. All plots were treated with Goal when onions had six leaves. Herbicide treatments were applied with a CO₂-pressurized backpack sprayer. Preemergence and one-leaf applications were applied at 20 gal/acre at 30 psi. All other postemergence applications were applied at 40 gal/acre at 30 psi. Preemergence treatments were applied on April 12. One-, two-, four-, and six-leaf applications were made on May 10, May 21, June 4, and June 16, respectively. All plots received Poast[®] (sethoxydim) at 0.29 lbs ai/acre plus crop oil concentrate (COC) (1 qt/acre) on May 24 to control grasses. Weed control and onion injury were evaluated throughout the

season. Onions were harvested September 13-14 and graded by size on September 14-15.

Treatments were arranged in a factorial design to allow the analysis of preemergence and postemergence treatment effects and interactions. Data were analyzed to determine significant effects and means were separated using a protected least significant difference (LSD) at the 5 percent level (0.05). Significance levels of main effects and interactions are included in Table 1.

Results and Discussion

Rainfall activated preemergence treatments and postemergence treatments were effective because weeds were actively growing at the time herbicides were applied. Preemergence treatments did not cause onion injury (data not shown). On May 28, injury was similar among postemergence treatments (data not shown). On June 13, the treatment that included Buctril plus Chateau applied to four-leaf onions caused more injury (31 percent) than treatments where Buctril plus Chateau was applied to two-leaf onions (20 percent) or where Buctril plus Goal was applied sequentially (19 percent).

On May 21, weed control was greatest with Roundup plus Prowl applied preemergence compared to the other preemergence treatments (Table 2). Roundup preemergence followed by Prowl plus Outlook applied to one-leaf onions had greater pigweed, common lambsquarters, hairy nightshade, and barnyardgrass control than Roundup alone, but the two treatments provided similar kochia control. Significant preemergence herbicide by postemergence herbicide interactions were present for pigweed, hairy nightshade, and kochia control ratings taken September 8 (Table 3). Depending on what preemergence treatments were applied, postemergence treatments responded differently in the control of these species. When no preemergence herbicides were applied, treatments containing Buctril plus Chateau provided greater control of pigweed, nightshade, and kochia compared to Buctril plus Goal. When Roundup alone was applied preemergence, Buctril plus Chateau combinations provided greater pigweed control compared to Buctril plus Goal. Also when Roundup alone was applied preemergence, Chateau plus Buctril applied to four-leaf onions controlled hairy nightshade and kochia better than Chateau plus Buctril applied to two-leaf onions and the Buctril plus Goal treatment. When Roundup plus Prowl were applied preemergence or Roundup was applied preemergence followed by an application of Prowl plus Outlook to one-leaf onions, all postemergence herbicide combinations provided similar control of pigweed, nightshade, and kochia. Only preemergence herbicide treatments significantly affected common lambsquarters and barnyardgrass control on September 8 (Table 4). All preemergence treatments increased control of both species compared to no preemergence herbicide. Roundup alone had less control than Roundup plus Prowl preemergence or Roundup preemergence followed by Prowl plus Outlook applied to one-leaf onions. Treatments containing Prowl had the highest common lambsquarters and barnyardgrass control.

Onion yields were significantly different among preemergence treatments (Table 5). Roundup preemergence increased medium, jumbo, total, and marketable yields compared to no preemergence treatment, but yields were significantly less than with Roundup plus Prowl preemergence or Roundup preemergence followed by Prowl plus Outlook at one-leaf onions. Roundup plus Prowl preemergence had fewer medium onions and greater jumbo, colossal, total, and marketable yields compared to Roundup preemergence followed by Prowl plus Outlook applied to one-leaf onions. It is possible that this yield increase resulted from the prevention of early weed competition.

This research demonstrates that the effectiveness of postemergence herbicide programs is strongly related to early season weed control. Although in several instances weed control was similar between different treatments at the conclusion of the season, yields were reduced in treatments where weeds were allowed to compete early. The use of an effective preemergence herbicide may provide the best opportunity for effectively controlling weeds with postemergence herbicides and for maximizing onion yield. An effective preemergence herbicide could also potentially allow a producer to use lower rates of postemergence herbicides to achieve acceptable weed control. This research also demonstrated that Buctril plus Chateau applied to four-leaf onions can provide increased weed control under certain conditions, but application of Buctril plus Chateau at that timing also caused greater injury than the other treatments. The level of injury observed would likely not be acceptable in commercial onion production.

Table 1. Significance of preemergence and postemergence treatment main effects and the preemergence by postemergence interactions for onion injury and yield and weed control evaluation data, Malheur Experiment Station, Oregon State University, Ontario, OR, 2005.

Effects	Onion			Weed control				
	Injury 5-28	Injury 6-13	Total yield	Pigweed	Common lambsquarters	Hairy nightshade	Kochia	Barnyard-grass
Preemergence	0.3416	0.0834	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Postemergence	0.5878	0.0001	0.0616	0.0001	0.5035	0.0008	0.0007	0.5170
PRE X POST	0.2756	0.4218	0.1386	0.0005	0.3958	0.0108	0.0073	0.9529

*Main effects or interactions with probabilities equal to or less than 0.05 are considered significant.

Table 2. Weed control in onion provided by preemergence and early postemergence herbicide applications prior to spraying sequential postemergence treatments, Malheur Experiment Station, Oregon State University, Ontario, OR, 2005.

Treatment	Rate [*] lb ai or ae/acre	Timing [†]	Weed control [§]				
			Pigweed [‡]	Common lambsquarters	Hairy nightshade	Kochia	Barnyard- grass
None	--	--	0	0	0	0	0
Roundup	0.75	PRE	44	63	46	89	0
Roundup + Prowl	0.75 + 1.0	PRE	94	94	77	96	76
Roundup Prowl + Outlook	0.75 1.0 + 0.84	PRE 1-leaf	66	71	66	85	48
LSD (0.05)	--	--	2	5	10	10	3

*Roundup rates are in lb ae/acre and all other herbicides are lb ai/acre.

†Preemergence (PRE) treatments were applied on April 12 and one-leaf (1-leaf) on May 10.

‡Pigweed is a combination of redroot pigweed and Powell amaranth.

§Weed control was evaluated on May 21, prior to the beginning of sequential postemergence herbicide applications.

Table 3. Weed control in onion with preemergence and postemergence herbicides, Malheur Experiment Station, Oregon State University, Ontario, OR, 2005.

Treatment	Rate*	Timing†	Weed control‡		
			Pigweed‡	Hairy nightshade	Kochia
	lb ai or ae/acre	Leaf	-----%		
None		PRE	97	85	76
Buctril+ Chateau	0.125 + 0.094	2-leaf			
Buctril + Goal	0.25 + 0.125	4-leaf			
Goal	0.25	6-leaf			
None		PRE	95	88	89
Buctril + Goal	0.125 + 0.125	2-leaf			
Buctril + Chateau	0.25 + 0.094	4-leaf			
Goal	0.25	6-leaf			
None		PRE	82	75	66
Buctril + Goal	0.125 + 0.125	2-leaf			
Buctril + Goal	0.25 + 0.125	4-leaf			
Goal	0.25	6-leaf			
Roundup	0.75	PRE	88	55	85
Buctril + Chateau	0.125 + 0.094	2-leaf			
Buctril + Goal	0.25 + 0.125	4-leaf			
Goal	0.25	6-leaf			
Roundup	0.75	PRE	86	70	95
Buctril + Goal	0.125 + 0.125	2-leaf			
Buctril + Chateau	0.25 + 0.094	4-leaf			
Goal	0.25	6-leaf			
Roundup	0.75	PRE	72	49	85
Buctril + Goal	0.125 + 0.125	2-leaf			
Buctril + Goal	0.25 + 0.125	4-leaf			
Goal	0.25	6-leaf			
Roundup + Prowl	0.75 + 1.0	PRE	99	100	100
Buctril + Chateau	0.125 + 0.094	2-leaf			
Buctril + Goal	0.25 + 0.125	4-leaf			
Goal	0.25	6-leaf			
Roundup + Prowl	0.75 + 1.0	PRE	100	100	100
Buctril + Goal	0.125 + 0.125	2-leaf			
Buctril + Chateau	0.25 + 0.094	4-leaf			
Goal	0.25	6-leaf			
Roundup + Prowl	0.75 + 1.0	PRE	100	100	100
Buctril + Goal	0.125 + 0.125	2-leaf			
Buctril + Goal	0.25 + 0.125	4-leaf			
Goal	0.25	6-leaf			
Roundup	0.75	PRE	95	99	97
Prowl + Outlook	1.0 + 0.84	1-leaf			
Buctril + Chateau	0.125 + 0.094	2-leaf			
Buctril + Goal	0.25 + 0.125	4-leaf			
Goal	0.25	6-leaf			
Roundup	0.75	PRE	97	100	99
Prowl + Outlook	1.0 + 0.84	1-leaf			
Buctril + Goal	0.125 + 0.125	2-leaf			
Buctril + Chateau	0.25 + 0.094	4-leaf			
Goal	0.25	6-leaf			
Roundup	0.75	PRE	95	100	98
Prowl + Outlook	1.0 + 0.84	1-leaf			
Buctril + Goal	0.125 + 0.125	2-leaf			
Buctril + Goal	0.25 + 0.125	4-leaf			
Goal	0.25	6-leaf			
LSD (0.05)	--	--	6	9	9

*Roundup rates are in lb ae/acre and all other herbicides are in lb ai/acre.

†Preemergence (PRE) treatments were applied on April 12, one-leaf (1-leaf) on May 10, two-leaf (2-leaf) on May 21, four-leaf (4-leaf) on June 4, and six-leaf (6-leaf) on June 16.

‡Pigweed is a combination of redroot pigweed and Powell amaranth.

§Weed control was evaluated on September 8.

Table 4. Weed control in onion provided by preemergence herbicide applications averaged over postemergence treatments, Malheur Experiment Station, Oregon State University, Ontario, OR, 2005.

Treatment	Rate* lb ai or ae/acre	Timing†	Weed control‡	
			Common lambsquarters %	Barnyardgrass
None	--	--	67	75
Roundup	0.75	PRE	85	88
Roundup + Prowl	0.75 + 1.0	PRE	99	96
Roundup Prowl + Outlook	0.75 1.0 + 0.84	PRE 1-leaf	98	97
LSD (0.05)	--	--	6	8

*Roundup rates are in lb ae/acre and all other herbicides are in lb ai/acre.

†Preemergence (PRE) treatments were applied on April 12 and one-leaf (1-leaf) on May 10.

‡Weed control was evaluated on September 8 and are averaged over postemergence herbicide treatments.

Table 5. Onion yield as influenced by preemergence herbicide treatments, Malheur Experiment Station, Oregon State University, Ontario, OR, 2005.

Treatment	Rate* lb ai or ae/acre	Timing†	Onion yield‡					Super- Colossal	Total	Market- able
			Small	Medium	Jumbo	Colossal	cwt/acre			
None	--	--	98	208	89	0	0	394	297	
Roundup	0.75	PRE	26	284	339	0	0	659	624	
Roundup + Prowl	0.75 + 1.0	PRE	6	87	838	14	0	945	939	
Roundup Prowl + Outlook	0.75 1.0 + 0.84	PRE 1-leaf	12	155	686	5	0	859	847	
LSD (0.05)	--	--	12	27	66	6	NS	52	63	

*Roundup rates are in lb ae/acre all other herbicides are in lb ai/acre.

†Preemergence (PRE) treatments were applied on April 12 and one-leaf (1-leaf) on May 10.

‡Onions were harvested September 13 and 14.