

POST-EMERGENCE HERBICIDE COMBINATIONS FOR WEED CONTROL IN DIRECT-SEEDED ONION

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Introduction

Weed control in direct-seeded onion is essential in order to realize acceptable bulb size and minimize yield losses from weed competition. Onions are vulnerable to weed competition because of the slow early development and lack of a complete canopy cover to shade weeds. Information is needed on the response of onions to tank mixes that include recently registered herbicides (e.g., Starane[®] Ultra) and nonregistered products (e.g., Reflex[®]) with the local onion production grower standard of GoalTender[®] and Buctril[®]. The weed control research program at the Malheur Experiment Station endeavors to evaluate new herbicides that come on the market and determine their usefulness for weed control in direct-seeded onions grown under local production practices. The objective of this study was to evaluate treatment combinations for weed control efficacy and direct-seeded onion tolerance under furrow-irrigation conditions.

Materials and Methods

A field study was established at the Malheur Experiment Station, Ontario, Oregon in 2012 to evaluate onion response to various herbicide combinations applied prior to or after onion emergence. The herbicide Sharpen[®] (saflufenacil) was applied prior to onion emergence at 0.71 lb ai/acre, while Dual II Magnum[®] (S-metolachlor) was applied at 15.3 or 20.3 oz ai/acre. Nortron[®] was applied prior to onion emergence at 10 oz ai/acre, while Reflex was applied at 4 oz ai/acre. The complete list of treatments is contained in Tables 1-3.

The wheat stubble was flailed and the field was plowed during fall 2011. Urea fertilizer was applied during fall 2011 to provide 100, 200, and 1 lb/acre of phosphate, sulfur, and boron, respectively. The field was then plowed, disked, and 22-inch-wide beds were formed. The beds were harrowed and reshaped on March 19, 2012. Onion variety 'Vaquero' was planted on March 27 in double rows spaced 3 inches apart and 4-inch seed spacing within each row on beds spaced 22 inches apart.

The study was a randomized complete block design with four replications. Individual plots measured 7.33 ft (4 rows wide) and 27 ft long. Lorsban 15G[®] (chlorpyrifos at 0.101 lb ai/acre) was banded at 3.7 oz/1,000 ft of row over the top of the onion rows on April 5 and the soil surface was rolled. Preemergence herbicide treatments were applied on April 3 using a small plot backpack sprayer. Treatment rates for the evaluated herbicides are contained in Table 1. All postemergence treatments were applied May 15, 2012 when onion plants were at the two-leaf stage. All plots (except the untreated control) were sprayed again with GoalTender[®] and Buctril[®] at the rate of 0.5 pt/acre, equivalent to oxyfluorfen at 2 oz ai/acre and bromoxynil at 2 oz ai/acre, respectively on June 4, 2012. Plants were also sprayed (except the untreated control) with Poast[®]

(sethoxydim) at 0.287 lb ai/acre on June 4 to control grassy weeds.

The first furrow irrigation was applied on May 12 and lasted 24 hours to supply about 4 inches of water (including runoff). All subsequent irrigations (16 times from May 21 to August 30, 2012) lasted the same duration and delivered the same amount of water.

Plants were sidedressed with urea fertilizer on June 1 to supply nitrogen at 200 lb/acre. Onion plants were sprayed with Movento[®] (spirotetramat) at 0.078 lb ai/acre tank-mixed with Prime Oil (crop oil concentrate) at 1.57 lb ai/acre on June 11 and 18 to control thrips. Plants were aerially sprayed for thrips control on June 25 using Radiant[®] (spinetoram) at 0.078 lb ai/acre tank-mixed with a crop oil concentrate. Subsequent aerial sprays for thrips control were on July 14, 21, and August 3 and 11 using Lannate[®] at 0.9 lb ai/acre. Plants were visually evaluated for weed control and crop injury on May 12 and June 12 based on 0 to 100 percent; where 0 percent = no weed control or crop injury and 100 percent = complete weed control or complete crop kill.

Plant tops were flailed on September 7 and bulbs lifted on September 10, 2012. Bulbs were hand-harvested from the two center rows on September 12 and graded on September 19, 2012. Bulbs were graded for quality and yield on September 23 based on USDA standards. The data were subjected to analysis of variance and the treatment means were compared using LSD at 0.05 percent level of confidence.

Results and Discussion

Preemergence application of Sharpen at 0.71 lb ai/acre injured onion 59 percent compared to the hand-weeded control and more than any other herbicide (Table 1). Onion injury was 10 and 8 percent when Dual II Magnum was applied at 15.2 and 20.3 oz ai/acre, respectively. Injury from Nortron at 10 oz ai/acre applied prior to onion planting caused only 3 percent injury. Reflex applied at 4 oz ai/acre when onions were at the two-leaf stage caused only 8 percent injury. GoalTender alone applied at the two-leaf stage did not cause any visible injury. Injury from GoalTender tank-mixed with Buctril caused injury ranging from 3 to 8 percent.

Mid-season control for common lambsquarters varied by the herbicide treatment and ranged from 70 to 96 percent. Control was generally reduced when herbicides other than Prowl[®] H₂O were used prior to onion emergence. Preemergence application of Sharpen at 0.71 oz ai/acre, Nortron at 10 oz ai/acre, and Dual II Magnum at 15.3 and 20.3 oz ai/acre provided 19, 10, 20, and 25 percent less common lambsquarters control than the grower standard of Prowl H₂O (Table 1). All herbicide treatments provided complete control for hairy nightshade and barnyardgrass. Redroot pigweed control was over 96 percent except when Sharpen was used preemergence. Reduced early season control of common lambsquarters control with the experimental products resulted in bigger weeds that were hard to control with GoalTender and Buctril applied when onions were at the two-leaf stage.

The number of onion bulbs varied across herbicide treatments (Table 2). The number of small bulbs ranged from 593 to 8,012/acre across herbicide treatments. Medium-size bulbs ranged from 3,265 to 12,759 bulbs/acre, while jumbo bulbs varied from 54,302 to 78,930/acre. The number of jumbo and colossal bulbs was reduced when Sharpen at 0.71 lb ai/acre was applied prior to onion emergence compared to the rest of herbicide treatments. Sharpen also reduced the number of U.S. No. 1 bulbs compared to the other herbicides.

Yield for the small bulb category was similar across herbicide treatments and highest for the untreated control (Table 3). Medium bulb category ranged from 11.5 to 47.3 cwt/acre across herbicide treatments. Yield for colossal bulbs ranged from 175.7 cwt/acre to 541 cwt/acre. The U.S. No.1 onion yield was reduced when Sharpen was applied prior to onion emergence. Application of Nortron prior to onion emergence did not reduce onion yield. Yield was low when Dual II Magnum was applied prior to onion emergence, but statistically similar to the grower standard.

These results indicated that application of Starane Ultra at 1.95 oz ai/acre tank-mixed with Buctril at 2 oz ai/acre did not adversely affect onion yield. More studies are needed to evaluate Reflex and Dual II Magnum for weed control in direct-seeded onion. Therefore, this study will be repeated in 2013 to further evaluate these herbicide combinations further.

Table 1. Weed control on June 12 in direct-seeded dry bulb onion treated with various herbicides at the Malheur Experiment Station at Ontario, OR, 2012.

Treatment	Rate oz ai/acre	Timing ^a	Crop injury	Weed control			
				Common lambsquarters	Hairy nightshade	Redroot pigweed	Barnyardgrass
			----- % -----				
Untreated			0	0	0	0	0
Prowl H2O (Grower std)	15.2	Pre-emerg	0	95	99	99	99
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Prowl H2O	15.20	Pre-emerg	3	86	100	99	100
Starane Ultra	1.95	2-leaf					
Prowl H2O	15.20	Pre-emerg	8	96	100	99	100
Starane Ultra	1.95	2-leaf					
Buctril	2.00	2-leaf					
Prowl H2O	15.2	Pre-emerg	0	90	100	99	100
GoalTender	2.00	2-leaf					
Prowl H2O	15.20	Pre-emerg	3	98	100	100	100
Starane Ultra	1.95	2-leaf					
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Prowl H2O	15.20	Pre-emerg	8	83	100	96	100
Reflex	4.00	2-leaf					
Sharpen	0.71	Pre-emerg	59	76	100	93	100
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Nortron	10.00	Pre-emerg	3	85	100	96	100
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Dual II Magnum	15.3	Pre-emerg	10	75	100	96	100
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Dual II Magnum	20.3	Pre-emerg	8	70	100	98	100
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Handweeded			0	100	100	100	100
LSD (<i>P</i> = 0.05)			8	13	1	5	1

^a Herbicide application timing; A = preplant incorporated; B = preemergence; C = onion at 1 leaf; D = onion at 2 leaf stage.

Table 2. Number of onion bulbs in response to various herbicides applied on direct-seeded onion at the Malheur Experiment Station at Ontario, OR, 2012.

Treatment	Rate oz ai/acre	Application timing	Number of onion bulbs ^a						
			Small	Medium	Jumbo	Colossal	Supercolossal	U.S. No. 1	Total number
Untreated			38,872	7,418	297	0	0	7,715	46,587
Prowl H2O (Grower std)	15.2	Pre-emergence	593	3,561	57,566	32,937	5,935	99,998	100,592
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H2O	15.20	Pre-emergence	2,077	6,825	63,500	34,717	2,967	108,010	110,087
Starane Ultra	1.95	2-leaf							
Prowl H2O	15.20	Pre-emergence	1,780	6,231	54,302	36,201	5,935	102,669	104,449
Starane Ultra	1.95	2-leaf							
Buctril	2.00	2-leaf							
Prowl H2O	15.2	Pre-emergence	2,671	7,122	77,447	26,112	3,561	114,241	116,912
GoalTender	2.00	2-leaf							
Prowl H2O	15.20	Pre-emergence	1,780	3,264	65,281	42,136	5,935	116,615	118,395
Starane Ultra	1.95	2-leaf							
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H2O	15.20	Pre-emergence	2,697	5,638	68,545	22,255	1,780	98,218	101,185
Reflex	4.00	2-leaf							
Sharpen	0.71	Pre-emergence	8,012	9,792	38,872	14,243	1,780	64,687	72,699
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Nortron	10.00	Pre-emergence	2,967	5,638	59,346	29,376	5,935	100,295	103,262
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Dual II Magnum	15.3	Pre-emergence	3,561	10,089	78,930	18,397	2,077	109,493	113,054
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Dual II Magnum	20.3	Pre-emergence	5,044	12,759	62,313	21,667	2,967	99,701	104,746
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Handweeded			890	4,451	62,017	41,839	9,495	117,802	118,692
LSD (<i>P</i> = 0.05)			7,456	7,039	18,008	13,286	5,571	18503	19,964

^a Onion were graded to size as follows: small (<2¼ inches), medium (2¼-3 inches), jumbo (3-4 inches), colossal (4-4¼ inches), and supercolossal (>4¼ inches); and U.S. No. 1 was composed of medium through colossal.

Table 3. Onion yield in response to various herbicides applied on direct-seeded onion at the Malheur Experiment Station at Ontario, OR, 2012.

Treatment	Rate oz ai/acre	Application timing	Onion yield ^a						
			Small	Medium	Jumbo	Colossal	Supercolossal	U.S. No. 1	Total number
Untreated			28.7	15.3	1.4	0.0	0.0	16.7	45.4
Prowl H2O (Grower std)	15.2	Pre-emergence	0.8	14.1	501.0	417.8	100.6	1,033.5	1,034.3
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H2O	15.20	Pre-emergence	4.7	26.7	556.5	442.2	52.5	1,078.0	1,082.7
Starane Ultra	1.95	2-leaf							
Prowl H2O	15.20	Pre-emergence	4.8	23.6	463.0	461.6	102.2	1,050.3	1,055.1
Starane Ultra	1.95	2-leaf							
Buctril	2.00	2-leaf							
Prowl H2O	15.2	Pre-emergence	6.6	28.8	672.6	320.1	59.7	1,081.0	1,087.7
GoalTender	2.00	2-leaf							
Prowl H2O	15.20	Pre-emergence	4.7	11.5	587.2	541.7	99.4	1,239.9	1,244.5
Starane Ultra	1.95	2-leaf							
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H2O	15.20	Pre-emergence	7.0	21.5	568.0	271.9	31.1	892.6	899.9
Reflex	4.00	2-leaf							
Sharpen	0.71	Pre-emergence	12.9	31.7	329.6	175.7	28.9	565.9	579.8
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Nortron	10.00	Pre-emergence	6.3	21.2	516.2	370.3	99.5	1,007.1	1,013.4
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Dual II Magnum	15.3	Pre-emergence	6.8	40.3	641.0	229.6	33.0	943.9	950.8
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Dual II Magnum	20.3	Pre-emergence	11.0	47.3	507.2	269.7	50.6	874.8	885.9
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Handweeded			2.2	18.3	545.8	528.6	153.4	1,246.0	1,248.2
LSD (<i>P</i> = 0.05)			12.7	23.7	152.2	172.4	90.6	874.8	210.8

^a Onion were graded to size as follows: small (<2¼ inches), medium (2¼-3 inches), jumbo (3-4 inches), colossal (4-4¼ inches), and supercolossal (>4¼ inches); and U.S. No. 1 was composed of medium through colossal.