EVALUATION OF ZIDUA® (PYROXASULFONE) AND WARRANT® (ACETOCHLOR) FOR WEED CONTROL IN DIRECT-SEEDED ONION

Joel Felix and Joey Ishida, Malheur Experiment Station, Oregon State University, Ontario, OR, 2012

Introduction

Specialty crops such as direct-seeded onions tend to have fewer herbicides that are registered for weed control than other agronomic crops. In fact most product labels include only major crops (wheat, corn, soybean, and cotton) when they are first registered. Therefore, new products must be evaluated on specialty crops for weed efficacy and crop response before they can be registered by the U.S. Environmental Protection Agency for use on specialty crops. Weed control in direct-seeded onion is essential in order to realize acceptable bulb size and yield. To that end, the weed program at the Malheur Experiment Station endeavors to evaluate new herbicides that come on the market and to determine their usefulness for weed control in direct-seeded onions grown under local production practices. The objective of this study was to evaluate Zidua® (pyroxasulfone) and Warrant® (acetochlor) for weed efficacy and tolerance by direct-seeded dry bulb onion grown under furrow irrigation.

Materials and Methods

A field study was established at the Malheur Experiment Station, Ontario, Oregon in 2012 to evaluate onion response to Zidua and Warrant herbicides. The study evaluated onion response and weed efficacy under furrow-irrigated conditions.

The wheat stubble was flailed and the field was plowed during fall of 2011. Phosphorus (P_2O_5), sulfur, and boron were applied at 100, 200, and 1 lb/acre, respectively. The field was later plowed, groundhogged, fumigated using Metam VLR 42 percent at 15 gal/acre, and 22-inch wide beds were formed. The field was sprayed with glyphosate at 22 fl oz/acre (0.77 lb ae/acre) on March 19, 2012 to control emerged weeds. The beds were harrowed and reshaped on March 23, 2012. Onion variety 'Vaquero' was planted on March 27 in double rows spaced 3 inches apart with 4-inch seed spacing within the row on beds spaced 22 inches apart.

The treatments were arranged in 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 of Prowl® H_2O, Zidua, and Warrant were applied on April 3 using a small plot backpack sprayer (Table 1). All postemergence treatments were applied May 15, 2012 when onion plants were at the two-leaf stage. All onions (except the untreated control) were sprayed again with GoalTender® and

Buctril® at 0.5 pt/acre, each equivalent to oxyfluorfen at 2 oz ai/acre and bromoxynil at 2 oz ai/acre, respectively on June 4, 2012. All onions (except the untreated control) were sprayed 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) were the same duration and delivered the same amount of water per event.

Plants were sidedressed with urea fertilizer to supply 200 lb/acre nitrogen on June 1. Onion plants were sprayed with Movento® (spirotetramat) at 0.078 lb ai/acre tankmixed 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® (methomyl) 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.

Onion 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. The data were subjected to analysis of variance and treatment means were compared using LSD at 0.05 percent level of confidence.

Results and Discussion

Evaluations on May 12 indicated an average onion injury of 20 percent when Zidua and Warrant were applied prior to onion emergence. Evaluations on June 12 (after application of other herbicides at the two-leaf stage) indicated 14 to 16 percent and 10 to 14 percent injury for plants treated with Zidua and Warrant, respectively (Table 1). When Zidua was applied at the two-leaf stage in a tank-mixture with Buctril and GoalTender, the injury was only 6 to 8 percent compared to 5 percent for the grower standard of GoalTender plus Buctril. Similarly, the injury was reduced to 4 to 9 percent when Warrant application was delayed until onions were at the two-leaf stage.

Mid-season control for common lambsquarters varied greatly for the different herbicide treatments ranging from 61 to 93 percent compared to 94 percent for the grower standard (Table 1). All herbicide treatments provided complete control for hairy nightshade and barnyardgrass. Control for redroot pigweed ranged from 95 to 100 percent across herbicide treatments.

The number of onion bulbs varied across herbicide treatments (Table 2). Except for the untreated control, there was no difference in the number of small bulbs when Zidua and Warrant were applied prior to onion emergence or at the two-leaf stage. Small bulbs (<2¼ inch diameter) ranged from 1,187 to 2,671 bulbs/acre across herbicide treatments compared to 1,484 for the grower standard. Medium bulbs (2¼-3 inch diameter) ranged from 2,967 to 11,869 bulbs/acre across experimental herbicides compared to 3,857 for the grower standard. Jumbo bulbs (3-4 inch diameter) varied from 64,094 to 84,271/acre compared to 52,521 for the grower standard. Colossal bulbs (4-4¼ inch diameter) ranged from 21,661 to 40,355 bulbs/acre across herbicide treatments. Except for the untreated control, there was no difference in supercolossal bulbs (>4¼ inch diameter) across different herbicide treatments. Similar numbers of U.S. No. 1 onion bulbs were obtained for Zidua and Warrant applied pre- and postemergence and the grower standard.

Small onion yield was similar across different herbicides and highest for the untreated control (Table 3). Yield for the medium, colossal, and supercolossal categories was similar across herbicide treatments. However, when grouped to generate the U. S. No. 1 category (medium to supercolossal), Zidua applied prior to onion emergence at 1.7 lb ai/acre and Warrant at 16 oz ai/acre resulted in reduced yield compared to the grower standard. It is likely weather conditions may have contributed to the results obtained in 2012. The weather was generally dry during spring when Zidua and Warrant were applied prior to onion emergence.

It is not clear why Warrant at 16 oz ai/acre reduced the yield, but not at the 18 oz ai/acre rate.

These results indicated that Zidua and Warrant may have a potential to be used for weed control in direct-seeded dry bulb onions. We will continue to evaluate these two products to generate more data on crop safety and weed efficacy.

Acknowledgements

This project was funded by the Idaho-Eastern Oregon Onion Committee in cooperation with Oregon State University, Malheur Experiment Station.

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	Timing[a]	Crop injury	Weed control			
				Common lambsquarters	Hairy nightshade	Redroot pigweed	Barnyardgrass
	oz ai/acre		%				
Untreated			0	0	0	0	0
Zidua**	1.28	Preemerg	16.3	61	100	95	100
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Zidua**	1.70	Preemerg	13.8	70	100	95	100
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Prowl H_2O	15.20	Preemerg	6.3	95	100	100	100
Zidua	1.28	2-leaf					
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Prowl H_2O	15.2	Preemerg	7.5	94	100	100	100
Zidua	1.70	2-leaf					
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Warrant**	8.00	Preemerg	13.8	63	100	95	100
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Warrant	16.00	Preemerg	10.0	61	100	93	100
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Warrant**	18.00	Preemerg	2.5	80	100	95	100
GoalTender	2.00	2-leaf					
Prowl H_2O	15.2	Preemerg	3.8	91	100	100	100
Warrant	8.00	2-leaf					
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Prowl H_2O	15.2	Preemerg	8.8	94	100	98	100
Warrant	8.00	2-leaf					
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Prowl H_2O	15.2	Preemerg	6.3	93	100	100	100
Warrant	18.00	2-leaf					
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
Prowl H_2O	15.2	Preemerg	5.0	94	100	99	100
Buctril	2.00	2-leaf					
GoalTender	2.00	2-leaf					
LSD (P = 0.05)			7.4	14	NS	4	NS

**Visual evaluation on May 12, 2012 (prior to two-leaf treatments) indicate an average of 20 percent injury for these preemergence treatments.

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	Application timing	Number of onion bulbs[a]						
			Small	Medium	Jumbo	Colossal	Supercolossal	U.S. No. 1	Total number
	oz ai/acre		---------- no./acre ----------						
Untreated			35,311	0	0	0	0	0	35,311
Zidua	1.28	Preemergence	1,187	10,979	70,622	24,332	2,967	108,900	110,087
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Zidua	1.70	Preemergence	2,374	10,682	67,654	21,661	3,561	103,559	105,933
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H_2O	15.20	Preemergence	2,374	4,154	76,853	33,827	2,374	117,208	119,582
Zidua	1.28	2-leaf							
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H_2O	15.2	Preemergence	2,374	9,792	77,150	26,706	3,561	117,208	119,582
Zidua	1.70	2-leaf							
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Warrant	8.00	Preemergence	1,484	5,341	84,271	24,035	2,374	116,022	117,505
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Warrant	16.00	Preemergence	2,671	11,869	60,830	22,255	2,374	97,328	99,998
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Warrant	18.00	Preemergence	2,374	5,935	74,776	31,750	4,451	116,912	119,286
GoalTender	2.00	2-leaf							
Prowl H_2O	15.2	Preemergence	1,484	5,044	64,094	36,795	3,264	109,197	110,680
Warrant	16.00	2-leaf							
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H_2O	15.2	Preemergence	2,671	2,967	67,951	33,531	5,638	110,087	112,757
Warrant	8.00	2-leaf							
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H_2O	15.2	Preemergence	1,780	6,231	78,337	29,376	5,638	119,582	121,363
Warrant	18.00	2-leaf							
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H_2O (Grower std)	15.2	Preemergence	1,484	3,857	52,521	40,355	8,012	104,746	106,229
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
LSD (P = 0.05)			12,836	5,565	19,785	11,252	4,753	17,453	21,484

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

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	Application timing	Onion yield[a]						
			Small	Medium	Jumbo	Colossal	Supercolossal	U.S. No. 1	Total number
	oz ai/acre		cwt/acre						
Untreated			13.5	0.0	0.0	0.0	0.0	0.0	13.5
Zidua	1.28	Preemergence	2.3	41.9	585.9	299.7	47.5	974.9	977.2
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Zidua	1.70	Preemergence	3.3	38.5	546.5	266.7	57.3	908.9	912.2
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H_2O	15.20	Preemergence	3.7	14.8	666.4	421.0	41.0	1,143.2	1,147.0
Zidua	1.28	2-leaf							
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H_2O	15.2	Preemergence	6.2	34.7	636.5	334.9	60.4	1,066.4	1,072.6
Zidua	1.70	2-leaf							
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Warrant	8.00	Preemergence	4.4	20.4	657.2	289.3	40.1	1,007.1	1,011.5
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Warrant	16.00	Preemergence	3.9	44.7	506.6	278.0	38.3	867.6	871.5
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Warrant	18.00	Preemergence	5.5	24.3	623.7	389.3	67.5	1,104.8	1,110.3
GoalTender	2.00	2-leaf							
Prowl H_2O	15.2	Preemergence	4.1	19.6	571.8	467.5	53.0	1,111.9	1,116.0
Warrant	16.00	2-leaf							
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H_2O	15.2	Preemergence	4.9	11.8	598.7	426.8	94.8	1,132.0	1,137.0
Warrant	8.00	2-leaf							
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H_2O	15.2	Preemergence	2.8	22.3	670.6	355.1	80.6	1,128.6	1,131.4
Warrant	18.00	2-leaf							
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
Prowl H_2O (Grower std)	15.2	Preemergence	3.8	14.9	474.1	525.6	135.0	1,149.5	1,153.2
Buctril	2.00	2-leaf							
GoalTender	2.00	2-leaf							
LSD (*P* = 0.05)			7.9	20.0	162.7	147.1	81.3	178.2	176.1

[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 bulbs.