EVALUATION OF HERBICIDES FOR WEED CONTROL IN DIRECT-SEEDED ONIONS

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Introduction

Evaluation of herbicides for weed control is a necessary step before being registered by the U.S. Environmental Protection Agency (EPA) for use on crops. Weed control in onion is essential in order to realize acceptable size and improve overall bulb yield. The herbicide Pyroxasulfone (KIH-485) is being evaluated and developed by Kumiai Chemical Industry for use on several crops. The weed program at the Malheur Experiment Station endeavors to evaluate new herbicides and determine use rates for direct-seeded onions grown under furrow irrigation.

Materials and Methods

A field study was conducted in 2009 at the Malheur Experiment Station, Ontario, Oregon to evaluate onion response and weed control with KIH-485 and Spartan® herbicides. Wheat stubble was flailed during fall 2008, the field was irrigated and later moldboard plowed and disked to create a seedbed suitable for onion production. Thereafter, 22-inch-wide beds were created to facilitate furrow irrigation. The study followed a randomized complete block design with 4 replications and individual plots were 7.33 ft wide (4 rows) by 30.0 ft long.

Onion seeds ('Vaquero') were planted on March 26, 2009 in double rows spaced 3.7 inches apart on each 22-inch bed. Chlorpyrifos (Lorsban® 15G) was banded at 0.125 lb ai/acre (3.7 oz/1,000 ft of row) on March 31 as a preventive measure against onion maggot. The study area was treated with sethoxydim at 0.28 lb ai/acre (Poast® herbicide + Mor-Act® crop oil concentrate at 1.5 + 2 pt/acre), respectively, to control volunteer wheat. All treatments (except the control) were later sprayed with pendimethalin at 1 lb ai/acre (Prowl® H_2O at 2.1 pt/acre). Herbicide treatments were applied on May 15 using a CO_2-pressurized backpack sprayer fitted with a boom equipped with four Teejet 8008EVS nozzles and calibrated to deliver 20 gal/acre of spray solution.

Except for the untreated control, all plots were sprayed with bromoxynil and oxyfluorfen at 0.125 lb ai/acre (Buctril® and Goal® 2XL herbicides at 0.5pt/acre) each on May 23. The soil was fertilized on June 10 with a compound fertilizer to supply 175 and 2 lb/acre of nitrogen and zinc, respectively. Plots were sprayed with spinosad 0.125 lb ai/acre + Azadirachtin 0.0123 lb ai/acre (Success® [8 oz/acre] plus Aza-Direct® [16 oz/acre] plus

Ad-wet® non-ionic surfactant [1 qt/acre]) on June 11 to control thrips. The trial was sprayed for thrips control again on June 19 using the same product mix. Irrigation was scheduled to maintain moisture at a level suitable for onion production.

Visual evaluations for onion injury and weed control were conducted on May 22, June 10, and June 26 based on a 0 percent for no injury or weed control to 100 percent for total crop damage or excellent weed control. Onions were harvested at maturity from 20 ft of the 2 center rows on September 15 and graded based on USDA standards on September 17, 2009. The data were subjected to analysis of variance and means compared using the least significance difference (LSD, P = 0.05).

Results and Discussion

Visual evaluations on May 22, 2009 indicated no injury to onions treated with KIH-485 at 2 oz/acre, fluroxypyr at 1.05 oz ai/acre (Starane® Ultra, 0.35 pt/acre), and flumioxazin at 1.5 oz ai/acre (Chateau®, 2.95 oz/acre) (Table 1). However, onions growing in plots treated with sulfentrazone at 1.5 oz ai/acre (Spartan, 3 fl oz/acre) exhibited severe injury (79 percent) compared to the untreated control. The injury was characterized by droopy and yellowing of the leaves. All herbicide treatments provided 95 percent control of common lambsquarters and pigweed species. Control of hairy nightshade ranged from 93 to 95 percent and was similar across herbicide treatments. Follow up evaluations on June 10 indicated onion injury from Spartan had not abated, and was as high as 75 percent compared to the untreated control (Table 2). Control of common lambsquarters, pigweed species, and hairy nightshade was 100 percent. Visual evaluation on June 26 indicated 83 percent onion injury from Spartan applied at 3 fl oz/acre. Control for common lambsquarters, pigweed species, and hairy nightshade was still at 100 percent (Table 3).

Marketable dry bulb onion yield reflected herbicide injury observed during onion growth. The untreated control had the lowest yield of 82 cwt/acre (Table 4). Treating dry bulb onions with Spartan at 3 oz/acre when the onions were at the 2-leaf stage resulted in the lowest yield (712 cwt/acre) compared to other herbicide treatments.

Conclusion

The experimental herbicide KIH-485 controlled common lambsquarters, pigweed species, and hairy nightshade similarly to registered herbicides for use on onions. No onion injury was observed in plots treated with KIH-485. Studies to test the utility of KIH-485 as a pre-emergence application and in tankmix combinations will be conducted in 2010.

Table 1. Weed control in onion with different herbicides on May 22 at the Malheur Experiment Station, Ontario, OR, 2009.

Treatment	Rate	Timing	Crop injury	Weed control[†]		
				Common lambsquarters	pigweed spp.	Hairy nightshade
			---------- % ----------			
Untreated control			0.0 B	0.0 B	0.0 b	0.00 b
Prowl	2 pt/a	Loop	0.0 B	95.0 A	95.0 a	94.50 a
Chateau	2.95 oz/a	2-LF				
Buctril	0.5 pt/a	2-LF				
Buctril	0.5 pt/a	4-LF				
Goal 2XL	1 pt/a	4-LF				
Prowl	2 pt/a	Loop	0.0 B	95.0 A	95.0 a	93.75 a
KIH-485	2.0 oz/a	2-LF				
Buctril	0.5 pt/a	2-LF				
Buctril	0.5 pt/a	4-LF				
Goal 2XL	1 pt/a	4-LF				
Prowl	2 pt/a	Loop	78.8 a	95.0 A	95.0 a	92.63 a
Spartan 4F	3.0 fl oz/a	2-LF				
Buctril	0.5 pt/a	2-LF				
Buctril	0.5 pt/a	4-LF				
Goal 2XL	0.5 pt/a	4-LF				
Prowl	2 pt/a	Loop	0.0 b	95.0 A	95.0 a	93.13 a
Buctril	0.5 pt/a	2-LF				
Starane Ultra	0.35 pt/a	2-LF				
Buctril	0.5 pt/a	4-LF				
Goal 2XL	0.5 pt/a	4-LF				

[†]Means within a column followed by same letter do not significantly differ (P = 0.05, LSD).

Table 2. Weed control in onions with different herbicides on June 10 at the Malheur Experiment Station, Ontario, OR, 2009.

Treatment	Rate	Timing	Crop injury	Weed control[†]		
				Common lambsquarters	pigweed spp.	Hairy nightshade
			---------- % ----------			
Untreated control			55.0 b	0.0 b	0.0 b	0.0 b
Prowl	2 pt/a	Loop	0.0 c	100.0 a	100.0 a	100.0 a
Chateau	2.95 oz/a	2-LF				
Buctril	0.5 pt/a	2-LF				
Buctril	0.5 pt/a	4-LF				
Goal 2XL	1 pt/a	4-LF				
Prowl	2 pt/a	Loop	0.0 c	100.0 a	100.0 a	100.0 a
KIH-485	2.0 oz/a	2-LF				
Buctril	0.5 pt/a	2-LF				
Buctril	0.5 pt/a	4-LF				
Goal 2XL	1 pt/a	4-LF				
Prowl	2 pt/a	Loop	75.0 a	100.0 a	100.0 a	100.0 a
Spartan 4F	3.0 fl oz/a	2-LF				
Buctril	0.5 pt/a	2-LF				
Buctril	0.5 pt/a	4-LF				
Goal 2XL	0.5 pt/a	4-LF				
Prowl	2 pt/a	Loop	0.0 c	100.0 a	100.0 a	100.0 a
Buctril	0.5 pt/a	2-LF				
Starane Ultra	0.35 pt/a	2-LF				
Buctril	0.5 pt/a	4-LF				
Goal 2XL	0.5 pt/a	4-LF				

[†]Means within a column followed by same letter do not significantly differ (P = 0.05, LSD).

Table 3. Weed control in onion with different herbicides on June 26 at the Malheur Experiment Station, Ontario, OR, 2009.

Treatment	Rate	Unit	Timing	Crop injury	Weed control[†]		
					Common lambsquarters	pigweed spp.	Hairy nightshade
				---------- % ----------			
Untreated control				75.0 b	0.0 b	0.0 b	0.0 b
Prowl	2	pt/a	Loop	0.0 c	100.0 a	100.0 a	100.0 a
Chateau	2.95	oz/a	2-LF				
Buctril	0.5	pt/a	2-LF				
Buctril	0.5	pt/a	4-LF				
Goal 2XL	1	pt/a	4-LF				
Prowl	2	pt/a	Loop	0.0 c	100.0 a	100.0 a	100.0 a
KIH-485	2.0	oz/a	2-LF				
Buctril	0.5	pt/a	2-LF				
Buctril	0.5	pt/a	4-LF				
Goal 2XL	1	pt/a	4-LF				
Prowl	2	pt/a	Loop	82.5 a	100.0 a	100.0 a	100.0 a
Spartan 4F	3.0	fl oz/a	2-LF				
Buctril	0.5	pt/a	2-LF				
Buctril	0.5	pt/a	4-LF				
Goal 2XL	0.5	pt/a	4-LF				
Prowl	2	pt/a	Loop	0.0 c	100.0 a	100.0 a	100.0 a
Buctril	0.5	pt/a	2-LF				
Starane Ultra	0.35	pt/a	2-LF				
Buctril	0.5	pt/a	4-LF				
Goal 2XL	0.5	pt/a	4-LF				

[†]Means within a column followed by same letter do not significantly differ (P = 0.05, LSD).

Table 4. Onion yield in response to herbicide application at the Malheur Experiment Station, Ontario, OR, 2009.

			Yield[†]						
			Nonmarketable		Marketable				
Treatment	Rate	Timing	Rot	Small	Medium	Jumbo	Colossal	Super colossal	Total
			cwt/acre						
Untreated			3.1 a	130.9 a	76.4 a	3.9 c	0.0 c	1.9 a	82.2 c
Prowl	2 pt/a	Loop	2.3 a	9.4 b	68.4 a	719.6 a	82.6 a	2.5 a	873.1 a
Chateau	2.95 oz/a	2-LF							
Buctril	0.5 pt/a	4-LF							
Goal 2XL	1 pt/a	4-LF							
Prowl	2 pt/a	Loop	0.0 a	25.8 b	128.3 a	713.0 a	42.9 b	0.0 a	884.2 a
KIH-485	2.0 oz/a	2-LF							
Buctril	0.5 pt/a	2-LF							
Buctril	0.5 pt/a	4-LF							
Goal 2XL	1 pt/a	4-LF							
Prowl	2 pt/a	Loop	2.7 a	45.8 b	169.6 a	480.7 b	61.6 ab	0.0 a	711.8 b
Spartan 4F	3.0 fl oz/a	2-LF							
Buctril	0.5 pt/a	2-LF							
Buctril	0.5 pt/a	4-LF							
Goal 2XL	0.5 pt/a	4-LF							
Prowl	2 pt/a	Loop	0.7 a	12.3 b	122.2 a	716.4 a	34.1 bc	2.3 a	874.9 a
Buctril	0.5 pt/a	2-LF							
Starane Ultra	0.35 pt/a	2-LF							
Buctril	0.5 pt/a	4-LF							
Goal 2XL	0.5 pt/a	4-LF							

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