

EVALUATION OF PREEMERGENCE AND POSTEMERGENCE HERBICIDES FOR WEED CONTROL IN DIRECT-SEEDED ONION

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Introduction

There are relatively few herbicides registered for weed control in direct-seeded onion. Thus, evaluation of herbicides for possible use to control weeds in onion is essential in order to minimize yield losses from weed competition and realize acceptable bulb size. Onions are vulnerable to weed competition because of the slow early development and lack of a complete canopy cover to shade weeds. The weed control research program at 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 objectives of this study were to evaluate an experimental herbicide coded A16003, Dual II Magnum[®], and Reflex[®] for weed control efficacy and to assess the tolerance of direct-seeded onion to these herbicides under furrow-irrigation conditions.

Material and Methods

A field study was established at Malheur Experiment Station, Ontario, Oregon in 2013 to evaluate onion response to various herbicide combinations applied pre or post onion emergence in a field previously planted to wheat. The wheat stubble was flailed and the field was plowed during fall 2012. The soil was Owyhee silt loam with a pH of 7.2 and 1.83% organic matter. Based on a soil test, 150 lb phosphate/acre and 100 lb sulfur/acre were broadcast in the fall of 2012 and the field was plowed and groundhogged. After fall fertilization the field was fumigated with Vapam[®] (metam sodium) at 16 gal/acre and simultaneously bedded on a 22-inch row spacing. On March 19, 2013, the beds were harrowed and flattened and supplemental common lambsquarters, pigweed, hairy nightshade, and kochia weed seeds were uniformly distributed across the study area using a hand spreader.

Onion variety 'Vaquero' was planted on March 19 in double rows spaced 3 inches apart with 4-inch seed spacing within each row on the 22-inch beds. Lorsban[®] 15G at 3.7 oz/1,000 ft of row (chlorpyrifos 0.101 lb ai/acre) was banded over the top of onion rows on March 26 and the soil surface was rolled.

Experimental preemergence herbicides were applied on April 1, including A16003 (bicyclopyrone) at 0.54 or 0.71 oz ai/acre and Dual II Magnum (s-metolachlor) at 15.3 or 20.3 oz ai/acre. The herbicide Reflex (fomesafen) was applied post-emergence on May 8 at 0.25, 0.5 or 1.0 pt/acre (0.25, 0.5 or 1.0 oz ai/acre) when onions were at the 2-leaf stage. The complete list of

herbicide treatments and rates is contained in Tables 1 and 2. The grower standard of Prowl[®] H₂O followed by Buctril[®] and GoalTender[®] were included.

The study was a randomized complete block design with four replications. Individual plots measured 7.33 ft (4 rows wide) and 27 ft long. Herbicide treatments were applied using a CO₂ pressurized backpack sprayer fitted with a boom equipped with four EVS8002 flat-fan nozzles to deliver a spray volume of 20 gal/acre. All plots (except the untreated control) were sprayed again with GoalTender and Buctril at the rates of 0.5 pt/acre each equivalent to oxyfluorfen at 2 oz ai/acre and bromoxynil at 2 oz ai/acre, respectively, on May 13 and June 3, 2013. Plants were also sprayed (except the untreated control) with SelectMax[®] (clethodim) at 1.46 oz ai/acre plus NIS (non-ionic surfactant) at 0.25% v/v on April 24 to control grassy weeds.

The first furrow irrigation was on March 28 and lasted 24 hours to supply about 4 inches of water (including runoff). All subsequent irrigations (19 times from April 16 to August 27, 2013) lasted the same duration and delivered the same amount of water.

Plants were sidedressed with urea on May 30 to supply nitrogen at 150 lb/acre. Onion 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 4 to control thrips. Onions were aerially sprayed for thrips control on June 13 using Radiant[®] at 10 oz/acre (spinetoram at 1.25 oz ai/acre) tank-mixed with Aza-Direct[®] at 16 oz/acre (azadirachtin at 0.197 lb ai/acre) plus a crop oil concentrate at 1 qt/100 gal of water. Subsequent aerial sprays for thrips control were on July 26 and July 14 using Radiant at 1.25 oz ai/acre, and on July 21 and 31 using Lannate at 0.9 lb ai/acre each. Onions were visually evaluated for crop injury on April 26 and May 12, 2013. Weed control was evaluated subjectively on May 12 and June 24. Evaluations were based on 0 to 100%; where 0% = no weed control or crop injury and 100% = complete weed control or complete crop kill.

Plant tops were flailed and onion bulbs were lifted on September 10, 2013. Bulbs were hand-harvested from the two center rows on September 13 and graded on September 17, 2013. Bulbs were graded for quality and yield based on USDA standards. Data were subjected to analysis of variance and the treatment means were compared using LSD at 0.05% level of confidence.

Results and Discussion

Onion emergence was observed on April 12, 2013. Evaluations conducted on April 26 and May 12 indicated no apparent onion injury from herbicides applied prior to onion emergence (data not shown). Subsequent evaluation on May 20 did not show onion injury, suggesting onion tolerance to the herbicides (Table 1). Onion plant stand on May 20 was similar and ranged from 128,040 to 135,300 plants/acre across treatments (Table 1). The average common lambsquarters control on June 24 with bicyclopyrone applied prior to onion emergence was 96% compared to 66-81% when applied postemergence. Postemergence treatments that included Reflex provided complete control for common lambsquarters. Pigweed control ranged from 90 to 100% across herbicide treatments. Control for kochia ranged from 59 to 93% across herbicide treatments. These results were similar to the control provided by the grower standard of Prowl H₂O followed by Buctril and GoalTender.

Small-size onion yield varied among herbicide treatments and ranged from 4 to 23 cwt/acre compared to 32.7 cwt/acre for the untreated control (Table 2). Marketable onion yield for treatments that received bicyclopyrone prior to onion emergence was 1,081 and 1,252 cwt/acre,

which was 43 and 30% greater than plants treated with bicyclopyrone postemergence at the same rates. Delayed application of postemergence bicyclopyrone may have contributed to the reduction in yield. Yield for treatments treated with Dual II Magnum and postemergence Reflex did not reduce marketable onion yield compared to a grower standard of Prowl H₂O followed by Butril and GoalTender.

These results indicated possible tolerance of onion to preemergence applied bicyclopyrone and Dual II Magnum. Also, application of Reflex as a tank-mix herbicide partner with Butril or GoalTender looks promising. These treatments will be evaluated further during the 2014 cropping season.

DISCLAIMER: *This report is intended to inform the industry of the research being conducted to develop products for weed control in onion. Herbicides applied in this study may not be registered for use on onion and do not conform to current label requirements. Always read and follow the label when making herbicide applications.*

Table 1. Plant stand and onion injury on May 20 and weed control on June 24, 2013 at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2013.

Treatment	Rate pt/acre	Application timing ^a	Plant stand ^b no./acre	Injury	Weed control		
					common lambsquarters %	pigweed species	kochia
Untreated check			135,300	0	0	0	0
A16003 (bicyclopyrone)	0.16	PREPRE	132,000	0	95	99	86
GoalTender	0.25	POST					
Buctril	1.0	POST					
GoalTender	0.5	POST					
Buctril	0.5	POST					
A16003 (bicyclopyrone)	0.214	PREPRE	128,040	0	96	97	71
GoalTender	0.25	POST					
Buctril	0.5	POST					
A16003 (bicyclopyrone)	0.16	POST	130,570	0	66	88	71
GoalTender	0.25	POST					
Buctril	0.5	POST					
A16003 (bicyclopyrone)	0.214	POST	134,090	0	81	90	59
GoalTender	0.25	POST					
Buctril	0.5	POST					
Prowl H ₂ O	2.0	PRE	132,990	0	100	95	89
Reflex	0.25	POST					
GoalTender	0.25	POST					
Buctril	0.5	POST					
Prowl H ₂ O	2.0	PRE	132,000	0	99	97	93
Reflex	0.5	POST					
GoalTender	0.25	POST					
Buctril	0.5	POST					
Prowl H ₂ O	2.0	PRE	125,840	0	100	100	93
Reflex	1.0	POST					
GoalTender	0.25	POST					
Buctril	0.5	POST					
Dual II Magnum	1.0	PRE	131,340	0	89	94	73
GoalTender	0.25	POST					
Buctril	0.5	POST					
Dual II Magnum	1.33	PRE	130,020	0	93	93	80
GoalTender	0.25	POST					
Buctril	0.5	POST					
Prowl H ₂ O	2.0	PRE	133,320	0	100	100	93
GoalTender	0.25	POST					
Buctril	0.5	POST					
Hand weeded			129,250	0	100	96	100
LSD ($P = 0.05$)			7,201	0	16	8	19

^aPREPRE = preemergence to weed and onion; PRE = preemergence to weeds; POST = postemergence when onion is at the 2-leaf stage.

^bPlants within the two center rows of each plot were counted on May 20, 2013.

Table 2. Onion yield in response to weed control with different herbicides at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2013

Treatment	Rate pt/acre	Application timing ^a	Marketable yield by grade					
			small	medium	jumbo	colossal	super- colossal	total
			<2¼ inch	2¼-3 inch	3-4 inch	4-4¼ inch	>4¼ inch	2¼->4 inch
Untreated check			32.7	0.0	0.0	0.0	0.0	0.0
A16003 (bicyclopyrone)	0.16	PREPRE	5.9	37.0	700.9	436.7	77.3	1,251.9
GoalTender	0.25	POST						
Buctril	1.0	POST						
GoalTender	0.5	POST						
Buctril	0.5	POST						
A16003 (bicyclopyrone)	0.214	PREPRE	8.2	52.5	722.6	264.0	42.2	1,081.3
GoalTender	0.25	POST						
Buctril	0.5	POST						
A16003 (bicyclopyrone)	0.16	POST	26.0	138.5	513.7	55.4	6.2	713.7
GoalTender	0.25	POST						
Buctril	0.5	POST						
A16003 (bicyclopyrone)	0.214	POST	22.7	114.1	538.3	95.0	6.3	753.7
GoalTender	0.25	POST						
Buctril	0.5	POST						
Prowl H ₂ O	2.0	PRE	4.1	29.6	731.1	448.8	88.5	1,298.1
Reflex	0.25	POST						
GoalTender	0.25	POST						
Buctril	0.5	POST						
Prowl H ₂ O	2.0	PRE	6.4	36.6	695.7	378.3	103.3	1,213.9
Reflex	0.5	POST						
GoalTender	0.25	POST						
Buctril	0.5	POST						
Prowl H ₂ O	2.0	PRE	7.9	30.9	631.7	438.0	94.2	1,194.8
Reflex	1.0	POST						
GoalTender	0.25	POST						
Buctril	0.5	POST						
Dual II Magnum	1.0	PRE	13.9	45.1	715.4	267.5	33.5	1,061.6
GoalTender	0.25	POST						
Buctril	0.5	POST						
Dual II Magnum	1.33	PRE	5.7	49.7	680.2	374.6	78.1	1,182.6
GoalTender	0.25	POST						
Buctril	0.5	POST						
Prowl H ₂ O	2.0	PRE	7.2	37.0	702.3	369.6	86.2	1,195.3
GoalTender	0.25	POST						
Buctril	0.5	POST						
Hand weeded			6.3	43.9	379.2	39.4	3.7	466.2
LSD (<i>P</i> = 0.05)			24.0	25.3	108.2	149.5	60.9	159.8

^aPREPRE = preemergence to weed and onion; PRE = preemergence to weeds; POST = post-emergence when onion is at the 2-leaf stage.