

# EVALUATION OF KIH-485 HERBICIDE FOR WEED CONTROL IN DIRECT-SEEDED ONION

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## Introduction

Herbicide evaluation for weed control in specialty crops is a necessary step before the product can be registered by the U.S. Environmental Protection Agency (EPA) for use. Weed control in direct-seeded onion is essential in order to realize acceptable size and bulb yield. The herbicide KIH-485 (pyroxasulfone) 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. The objective of this study was to evaluate onion tolerance of KIH-485 and weed efficacy under local conditions.

## Materials and Methods

A field study was conducted in 2010 at the Malheur Experiment Station, Ontario, Oregon to evaluate onion response and weed control with KIH-485 herbicide. The field was plowed and disked to create a seedbed suitable for onion production. Twenty-two-inch-wide beds were made to facilitate furrow irrigation.

The study had a randomized complete block design with 4 replications of all herbicide treatments and individual plots were 7.33 ft wide (4 rows) by 30.0 ft long. Pre-plant-incorporated (PPI) treatments were applied on March 23 and the soil was harrowed twice to incorporate the herbicide in the soil. Onion seeds of variety 'Vaquero' were planted on March 24, 2010 in double rows spaced 3.7 inches apart and 3.93 inches within the row on 22-inch beds. Lorsban<sup>®</sup> 15G (chlorpyrifos) was banded at 3.7 oz/1,000 ft of row (0.125 lb ai/acre) over the entire field on March 29 as a preventive measure against onion maggot. The study area was irrigated on March 30 to stimulate onion germination and emergence. Pre-emergence herbicide treatments were applied on April 6 and at the 1-leaf stage on May 14. All plots (except the untreated control) were sprayed with Prowl<sup>®</sup> H<sub>2</sub>O at 2.1 pt/acre (pendimethalin at 1 lb ai/acre) on April 27. The 2-leaf post-emergence herbicide treatments were applied on May 31. All herbicide treatments were applied using a CO<sub>2</sub>-pressurized backpack sprayer fitted with a boom equipped with four Teejet 8002EVS nozzles and calibrated to deliver 20 gal/acre of spray solution.

Plants were sprayed with Lorsban<sup>®</sup> 4E at 1 qt/acre (chlorpyrifos at 1 lb ai/acre) on May 6 to control onion maggot. Fertilizer was applied on June 8 to supply 250, 180, 9, 5, 4, and 1 lb/acre of nitrogen, phosphorus, potassium, zinc, manganese, and boron, respectively. Plants were

sprayed with Movento<sup>®</sup> at 5 fl oz/acre (spirotetramat at 1.25 oz ai/acre) on June 23 for thrips control. Subsequent spraying for thrips control on June 30 used Success<sup>®</sup> at 8 oz/acre plus Aza-Direct<sup>®</sup> at 16 oz/acre plus Ad-wet<sup>®</sup> non-ionic surfactant at 1 qt/acre (spinosad at 0.125 lb ai/acre + azadirachtin at 0.0123 lb ai/acre + Ad-wet at 1.25% V/V). The trial was sprayed for thrips control again on August 26 using Lannate<sup>®</sup> at 3 pt/acre (methomyl at 0.9 lb ai/acre). Irrigation was scheduled to maintain moisture at a level suitable for onion production.

Visual evaluations for onion injury and weed control were conducted on June 7, July 22, and September 7 based on a visual scale of 0-100 percent where 0 percent = no injury or no weed control and 100 percent = total crop damage or complete weed control. Onions were lifted on September 14 and hand harvested from 27 ft of the 2 center rows on September 16. Onions were graded based on USDA standards on September 20, 2010. 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 June 7 indicated complete weed control for all treatments (data not presented). Onion plant injury on June 7 was moderate, ranging from 8 to 18 percent for the different herbicide treatments (Table 1). The average onion injury was 14 percent when KIH-485 was applied at 1.25 or 2 oz/acre and incorporated (PPI) in the soil before onions were planted. Application of KIH-485 at 1.25 or 2.0 oz/acre before onion emergence (PRE) resulted in 14 to 18 percent onion injury. Visual evaluations on July 22 indicated onion injury had subsided and only ranged from 1 to 6 percent (Table 1). Control of pigweed on July 22 ranged from 88 to 99 percent, with few differences among herbicide treatments. Hairy nightshade control ranged from 87 to 97 percent and again with few differences among herbicide treatments. Control for common lambsquarters ranged from 69 to 94 percent, with the PPI application of KIH-485 providing the greatest control. Late season control for common lambsquarters ranged from 68 to 94 percent. The results indicated reduced control for common lambsquarters when KIH-485 was applied, starting when the onions were at the 2-leaf stage.

The total number of onion bulbs per acre varied among herbicide treatments (Table 2). The lowest number of onion bulbs (98,890/acre) was recorded when KIH-485 was applied PPI at 2 oz/acre. Similarly, the number of onion bulbs was reduced when KIH-485 was applied PPI at 1.25 oz/acre. The total dry bulb onion yield varied among herbicide treatments and ranged from 564 to 698 cwt/acre. The marketable yield ranged from 368 to 551 cwt/acre. The results suggest that KIH-485 may be a suitable herbicide for weed control in onion; however, more studies are needed to verify these results and gather more data before contacting the product manufacture for a label expansion to include onions.

Table 1. Early, mid- and late-season weed control in direct-seeded onion treated with KIH-485 and other herbicides at Malheur Experiment Station, Ontario, OR 2010.

Treatment	Rate per acre	Timing	Weed control					
			Crop injury <sup>a</sup>		Redroot pigweed	Hairy nightshade	Common lambsquarters	
			Jun 7	Jul 22	Jul 22	Jul 22	Jul 22	Sep 7
1 Untreated			0 e	34 a	0 c	0 c	0 e	0 e
2 KIH-485	1.25 oz	PPI	15 ab	4 b	97 ab	97 a	94 ab	94 ab
GoalTender	0.25 pt	2-lf	----- % -----					
3 KIH-485	1.25 oz	PRE	16 a	6 b	97 ab	92 ab	76 bcd	70 cd
GoalTender	0.25 pt	2-lf						
4 KIH-485	1.25 oz	2-lf	13 a-d	1 b	89 b	88 b	69 d	68 d
GoalTender	0.25 pt	2-lf						
5 KIH-485	2.0 oz	PPI	13 a-d	6 b	100 a	97 a	96 a	95 a
GoalTender	0.25 pt	2-lf						
6 KIH-485	2 oz	PRE	14 abc	5 b	97 ab	87 b	84 a-d	83 a-d
GoalTender	0.25 pt	2-lf						
7 KIH-485	2 oz	2-lf	13 a-d	3 b	88 b	90 ab	71 cd	70 cd
GoalTender	0.25 pt	2-lf						
8 KIH-485	1.25 oz	1-lf	9 cd	1 b	97 ab	91 ab	84 a-d	81 a-d
GoalTender	0.25 pt	2-lf						
9 KIH-485	1.25 oz	PRE	18 a	4 b	95 ab	90 ab	78 bcd	74 bcd
GoalTender	0.5 pt	3-lf						
10 KIH-485	1.25 oz	2-lf	10 bcd	1 b	99 a	97 a	89 abc	89 abc
Buctril	0.5 pt	2-lf						
11 Grower std. <sup>b</sup>			8 d	3 b	92 ab	90 ab	88 abc	88 a-d

<sup>a</sup> Means within a column followed by the same letter do not significantly differ (LSD,  $P = 0.05$ ).

<sup>b</sup> Grower standard was treated with Prowl H<sub>2</sub>O at 2 pt/acre (pendimethalin at 1 lb ai/acre) before onion emergence, followed by Buctril and Goal 2XL herbicides at 0.5pt /acre (bromoxynil and oxyfluorfen at 0.125 lb ai/acre).

Table 2. Dry bulb onion yield in response to KIH-485 herbicide applied to control weeds at Malheur Experiment Station, Ontario, OR, 2010.

Treatment	Rate per acre	Timing	Onion bulbs/acre	Onion yield <sup>a</sup>					
				Total	Small	Medium	Jumbo	Colossal	Marketable
				----- cwt/acre -----					
1 Untreated			88440 e	98 c	70 a	24 e	5 d	0 a	17 d
2 KIH-485	1.25 oz	PPI	110990 cd	644 ab	14 b	104 d	520 ab	6 a	526 ab
GoalTender	0.25 pt	2-lf							
3 KIH-485	1.25 oz	PRE	118470 abc	633 ab	14 b	163 abc	449 abc	8 a	457 abc
GoalTender	0.25 pt	2-lf							
4 KIH-485	1.25 oz	2-lf	119130 abc	583 b	16 b	199 ab	368 c	0 a	368 c
GoalTender	0.25 pt	2-lf							
5 KIH-485	2.0 oz	PPI	98890 de	564 b	16 b	91 d	453 abc	4 a	457 abc
GoalTender	0.25 pt	2-lf							
6 KIH-485	2 oz	PRE	123530 abc	617 ab	19 b	196 ab	399 bc	3 a	402 bc
GoalTender	0.25 pt	2-lf							
7 KIH-485	2 oz	2-lf	127160 ab	615 ab	17 b	210 a	387 bc	1 a	388 bc
GoalTender	0.25 pt	2-lf							
8 KIH-485	1.25 oz	1-lf	128150 a	641 ab	19 b	182 abc	439 abc	1 a	441 abc
GoalTender	0.25 pt	2-lf							
9 KIH-485	1.25 oz	PRE	114400 bc	604 b	16 b	146 bcd	441 abc	1 a	442 abc
GoalTender	0.5 pt	3-lf							
10 KIH-485	1.25 oz	2-lf	123530 abc	698 a	14 b	133 cd	548 a	2 a	551 a
Buctril	0.5 pt	2-lf							
11 Grower std <sup>b</sup>	1.5 pt		125730 ab	597 b	19 b	217 a	361 c	0 a	361 c

<sup>a</sup> Means within a column followed by the same letter do not significantly differ (LSD,  $P = 0.05$ ).

<sup>b</sup> Grower standard was treated with Prowl H<sub>2</sub>O at 2 pt/acre (pendimethalin at 1 lb ai/acre) before onion emergence, followed by post-emergence application of Buctril and Goal 2XL herbicides at 0.5 pt/acre (bromoxynil and oxyfluorfen at 0.125 lb ai/acre) when onions were at the 2-leaf stage.