

# ONION RESPONSE TO VARIOUS OUTLOOK<sup>®</sup> HERBICIDE RATES APPLIED THROUGH IRRIGATION DRIP WITH AND WITHOUT FERTILIZER

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## Introduction

Application of dimethenamid-p (Outlook<sup>®</sup>) through irrigation drips to control yellow nutsedge in dry bulb onion grown in the Treasure Valley of eastern Oregon and southwestern Idaho was approved in 2016. Section 24C Special Local Need (SLN) No. OR-160004 allows applications of Outlook through irrigation drips for onion growers in Malheur County only. In Idaho, SLN No. ID-160001 restricts the use to Ada, Canyon, Gem, Owyhee, Payette, and Washington counties. Both labels reference the chemigation section of the federal label regarding restrictions and directions on how to properly chemigate Outlook in onion production. The user is required to have both the entire Outlook container label and the SLN label in their possession at the time of application.

The research conducted at the Oregon State University's Malheur Experiment Station near Ontario, Oregon indicated improved yellow nutsedge control with Outlook applied through the irrigation drip compared to broadcast spraying. The labels still limit the maximum use rate to 21 fl oz/acre/season (0.98 lb ai/acre/season). Sequential applications are allowed without going over 21 fl oz/acre/season. Applications through the irrigation drip are allowed starting when onions are at the 2-leaf but not after the 6-leaf stage. The current registration restricts the applications through the irrigation drip only to Spanish yellow onions and does not allow mixtures with fertilizer or any other pesticide.

The objective of this study was to evaluate the response of direct-seeded onions to a mixture of Outlook herbicide and liquid fertilizer applied through the irrigation drips. The study was conducted with onion variety 'Vaquero' and URAN fertilizer was used.

## Materials and Methods

A field study was conducted at the Malheur Experiment Station, Ontario, Oregon in 2017 to evaluate the response of onion variety 'Vaquero' to mixtures of Outlook herbicide plus nitrogen (N) fertilizer applied through the irrigation drip. Herbicide/fertilizer solution applications were initiated when onion plants were at the 2-leaf stage. Onion seeds of variety Vaquero were planted on April 7 in double rows spaced 3 inches apart with 4-inch seed spacing within each row. Each double row was planted on beds spaced 22 inches apart. Immediately after planting, onion rows received a 7-inch band of Lorsban<sup>®</sup> at 3.7 oz/1000 ft of row and the soil surface was rolled. The soil was an Owyhee silt loam with a pH 7.2 and 1.8% organic matter.

The study had randomized complete blocks with four replicates. Individual plots were 7.33 ft wide (4 beds) by 27 ft long. The study area (except the hand-weeded check plots) was treated with pendimethalin (Prowl<sup>®</sup> H<sub>2</sub>O) at 2.0 pt/acre (0.95 lb ai/acre) late pre-emergence on April 19. Postemergence application of Buctril<sup>®</sup> at 12 fl oz/acre (bromoxynil at 0.188 lb ai/acre) plus GoalTender<sup>®</sup> at 4 fl oz/acre (oxyfluorfen at 0.125 lb/ai acre) occurred when onion seedlings were at the 2- and 4-leaf stages. The study was sprayed with Poast<sup>®</sup> herbicide at 1.5 pt/acre (sethoxydim at 0.287 lb ai/acre) on June 4 to control grassy weeds.

In order to achieve uniform herbicide distribution in the top soil layer, each Outlook herbicide rate and URAN fertilizer to supply 20 lb N/acre was mixed into 35 gal of water and metered into the drip irrigation system at a continuous uniform rate of 5 gal/hour during the middle of the irrigation period. Applications were initiated when onion plants were at the 2-leaf stage on June 1. Sequential applications on a weekly or biweekly schedule continued through June 22 (Tables 1 and 2). The first fertilizer application to supply 30 lb N/acre was injected on May 4 to the entire study in order to correct soil nutrient deficiencies attributed to uncharacteristically high moisture from previous winter snow and spring precipitation. The final URAN fertilizer to supply 50 lb N/acre was applied on July 10.

Treatments for Outlook plus URAN fertilizer to supply 20 lb N/acre were applied on June 1, 8, 15, and 22. Treatments receiving standalone Outlook solution were fertilized using URAN solution to supply 20 lb N/acre the day after the Outlook plus fertilizer treatments. On July 20, 10 plants were identified randomly from each plot and measured from the ground to the tip of the longest fully extended leaf to determine the average plant height. All other operations including insect control followed recommended local production practices.

Plant tops were flailed and onion bulbs were lifted on September 6 and 7, respectively. Bulbs were hand-harvested from the two center beds on September 11 and graded on September 22. Bulbs were graded for yield and quality based on USDA standards as follows: bulbs without blemishes (U.S. No. 1), split bulbs (U.S. No. 2), bulbs infected with the fungus *Botrytis allii* in the neck or side, bulbs infected with the fungus *Fusarium oxysporum* (plate rot), bulbs infected with the fungus *Aspergillus niger* (black mold), and bulbs infected with unidentified bacteria in the external scales. The U.S. No. 1 bulbs were graded according to diameter: small (<2¼ inches), medium (2¼-3 inches), jumbo (3-4 inches), colossal (4-4¼ inches), and supercolossal (>4¼ inches). Marketable yield consisted of U.S. No.1 bulbs >2¼ inches.

Data were subjected to analysis of variance and the treatment means were compared using protected LSD at the 0.05% level of confidence.

## Results

Onion emergence was observed on May 3, 2017. Evaluations on July 20 (60 days after emergence) indicated a variable onion plant stand across treatments but there was no effect on plant height (Table 1). Differences in plant stand were attributed to wet conditions during spring from uncharacteristically high snow amounts during winter and high precipitation in spring. Plant stand ranged from 102,423 to 109,466 plants/acre across Outlook treatments applied through the irrigation drip compared to 107,344 plants/acre for the grower standard and 109,607 plants/acre for the hand-weeded check.

Rotten bulb amounts were similar across herbicide treatments and ranged from 0 to 5.6 cwt/acre (Table 2). Yield for various onion categories varied widely across herbicide treatments. Marketable bulb yield for plants treated with the weekly sequential application of Outlook at 7 fl oz/acre with and without fertilizer was 1067.5 and 1036.6 cwt/acre, respectively. Similar yield was also recorded for plants treated with weekly sequential application of Outlook at 6, 5, 5, 5 fl oz/acre mixed with fertilizer (1080.8 cwt/acre) and 1015.5 cwt/acre for Outlook without fertilizer.

Sequential application of Outlook at 21 fl oz/acre on a biweekly schedule produced the lowest marketable yield regardless of whether Outlook was applied alone (927.3 cwt/acre) or mixed with fertilizer (934 cwt/acre) compared to 1131.7 cwt/acre for the hand-weeded check. Marketable yield for the grower standard and hand-weeded check was similar to Outlook applied sequentially at 7 fl oz/acre or 6, 5, 5, 5 fl oz/acre on a weekly schedule.

These results indicated no adverse effects when Outlook was applied through the irrigation drip with or without URAN fertilizer solution to onion variety Vaquero starting at the 2-leaf stage. The study will be repeated in 2018 to confirm these results. The 2 years of data will be used to solicit changes to the SLN label to allow mixing Outlook with liquid fertilizer in applications made through irrigation drips in the Treasure Valley of eastern Oregon and southwestern Idaho.

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Table 1. Onion plant stand and height on July 20 and number of harvested bulbs in response to various Outlook (dimethenamid-p) herbicide treatments applied with and without liquid fertilizer through the irrigation drip at the Malheur Experiment Station, Ontario, OR, 2017.

Treatment	With fertilizer	Rate <sup>a</sup> fl oz/acre	Timing <sup>b</sup>	Plant					Marketable				Total
				Plant stand No./acre	height cm	<2¼ in <sup>c</sup>	US No. 2	Plate rot	2¼-3 in	3-4 in	4-4¼ in	>4¼ in	
Outlook	Yes	7	A = 2 leaf	109,466 ab	84.2 ab	297 a	148 b	1,780 ab	4,599 ab	57,121 ab	30,266 ab	8,012 ab	99,998 a
Outlook	Yes	7	14 days after A										
Outlook	Yes	7	21 days after A										
Outlook	No	7	A = 2 leaf	102,324 c	87.1 a	593 a	1039 a	1,484 b	2,819 ab	42,878 b	35,459 ab	8,012 ab	89,167 b
Outlook	No	7	7 days after A										
Outlook	No	7	14 D after A										
Outlook	Yes	6	A = 2 leaf	107,344 abc	84.3 ab	445 a	445 ab	1,929 ab	3,116 ab	52,521 ab	32,789 ab	8,754 ab	97,179 ab
Outlook	Yes	5	7 days after A										
Outlook	Yes	5	14 days after A										
Outlook	Yes	5	21 days after A										
Outlook	No	6	A = 2 leaf	103,738 bc	83.6 ab	445 a	445 ab	1,039 b	3,412 ab	51,631 ab	29,376 ab	8,605 ab	93,025 ab
Outlook	No	5	7 days after A										
Outlook	No	5	14 days after A										
Outlook	No	5	21 days after A										
Outlook	Yes	21	A = 2 leaf	110,597 a	83.6 ab	297 a	445 ab	4,006 a	5,935 ab	64,984 a	22,997 b	3,412 b	97,328 ab
Outlook	Yes	21	14 days after A										
Outlook	No	21	A = 2 leaf	106,284 abc	82.8 b	0 a	445 ab	3,116 ab	9,199 a	52,373 ab	25,816 b	6,528 ab	93,915 ab
Outlook	No	21	14 days after A										
Outlook-Grower standard		21	A = 2 leaf-broadcast	107,344 abc	87.0 a	445 a	1,039 a	2,522 ab	2,671 ab	39,762 b	42,729 a	11,572 a	96,734 ab
Hand-weeded check				109,607 ab	85.1 ab	1,039 a	1187 a	3,412 ab	2,374 b	43,916 b	38,427 ab	11,869 a	96,586 ab
LSD (P = 0.05)				6,390.1	3.90	1,082.7	860.4	2,498.9	6,635.5	17,562.0	15,458.0	6,009.3	8,479.7

<sup>a</sup>Herbicide rate; Outlook (dimethenamid-p) 5 fl oz/acre = 0.234 lb ai/acre; 6 fl oz/acre = 0.28 lb ai/acre; 7 fl oz/acre = 0.328 lb ai/acre; 21 fl oz/acre = 0.98lb ai/acre.

<sup>b</sup>Herbicide application timing; A = onions at 2-leaf stage (Jun 1, 2017); B = 7 days after A (Jun 8, 2017); C = 14 days after A (Jun 15, 2017); D = 21 days after A (Jun 15, 2017); E = 28 days after A (Jun 22, 2017).

<sup>c</sup>The bulbs were graded according to diameter: small (<2¼ inches), medium (2¼-3 inches), jumbo (3-4 inches), colossal (4-4¼ inches), and supercolossal (>4¼ inches). Marketable yield is composed of medium, jumbo, colossal, and supercolossal grades. Split bulbs (No. 2s), bulbs infected with the fungus *Botrytis allii* in the neck or side, bulbs infected with the fungus *Fusarium oxysporum* (plate rot). Marketable yield consists of U.S. No.1 bulbs >2¼ inches.

Table 2. Onion yield in response of various Outlook (dimethenamid-p) herbicide treatments applied with and without liquid fertilizer through the irrigation drip at the Malheur Experiment Station, Ontario, OR, 2017.

Treatment	With fertilizer	Rate <sup>a</sup> fl oz/acre	Timing <sup>b</sup>	Plant stand No./acre	Plant height cm	Plate rot	US No. 2	<2¼ in <sup>c</sup>	Marketable				Total
									2¼-3 in	3-4 in	4-4¼ in	>4¼ in	
Outlook	Yes	7	A = 2 leaf	109,466 ab	84.2 ab	2.3a	0.4 b	3.2 abc	18.3a	514.3 ab	401.0 abc	133.9ab	1,067.5 ab
Outlook	Yes	7	14 days after A										
Outlook	Yes	7	21 days after A										
Outlook	No	7	A = 2 leaf	102,324 c	87.1 a	3.7a	7.4 ab	2.7 bc	11.2a	421.5 ab	471.2 abc	132.7ab	1,036.6 ab
Outlook	No	7	7 days after A										
Outlook	No	7	14 days after A										
Outlook	Yes	6	A = 2 leaf	107,344 abc	84.3 ab	2.0a	5.1 ab	3.1 abc	12.0a	493.1 ab	433.2 abc	142.5ab	1,080.8 ab
Outlook	Yes	5	7 days after A										
Outlook	Yes	5	14 days after A										
Outlook	Yes	5	21 days after A										
Outlook	No	6	A = 2 leaf	103,738 bc	83.6 ab	1.9a	3.4 ab	1.4 c	13.3a	475.9 ab	382.6 abc	142.7ab	1,014.5 ab
Outlook	No	5	7 days after A										
Outlook	No	5	14 days after A										
Outlook	No	5	21 days after A										
Outlook	Yes	21	A = 2 leaf	110,597 a	83.6 ab	2.4a	3.1 ab	6.8 a	23.7a	552.0 a	299.6 c	58.7b	934.0 b
Outlook	Yes	21	14 days after A										
Outlook	No	21	A = 2 leaf	106,284 abc	82.8 b	0.0a	2.9 ab	5.1 abc	35.1a	442.5 ab	341.8bc	108.0ab	927.3 b
Outlook	No	21	14 days after A										
Outlook-Grower standard		21	A = 2 leaf-broadcast	107,344 abc	87.0 a	3.7a	9.7 a	3.5 abc	10.6a	380.6 b	568.8 a	186.9a	1,146.9 a
Hand-weeded check				109,607 ab	85.1 ab	5.6	10.1 a	5.6 ab	9.8a	411.9 b	513.1 ab	196.9a	1,131.7 a
LSD (P = 0.05)				6,390.1	3.9	NS	8.9	3.9	26.5	134.2	211.2	98.8	177.4

<sup>a</sup>Herbicide rate; Outlook (dimethenamid-p) 5 fl oz/acre = 0.234 lb ai/acre; 6 fl oz/acre = 0.28 lb ai/acre; 7 fl oz/acre = 0.328 lb ai/acre; 21 fl oz/acre = 0.98lb ai/acre.

<sup>b</sup>Herbicide application timing; A = onions at 2-leaf stage (Jun 1, 2017); B = 7 days after A (Jun 8, 2017); C = 14 days after A (Jun 15, 2017); D = 21 days after A (Jun 15, 2017); E = 28 days after A (Jun 22, 2017).

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