

# RESPONSE OF FIVE YELLOW ONION CULTIVARS TO OUTLOOK<sup>®</sup> APPLIED THROUGH DRIP IRRIGATION

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## Introduction

In the spring of 2016, section 24C Special Local Need (SLN) registrations were obtained for the application of dimethenamid-p (Outlook<sup>®</sup>) herbicide through drip irrigation systems in the Treasure Valley of eastern Oregon and southwestern Idaho. There are important factors to note regarding this registration. SLN No. OR-160004 allows for applications of Outlook through drip irrigation 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 drip irrigation compared to Outlook applied by 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 as long as the total amount does not exceed 21 fl oz/acre/season. Applications through drip irrigation are allowed starting when onions are at the 2-leaf but not after the 6-leaf stage. The current registration restricts the applications through drip irrigation only to Spanish yellow onions.

Because earlier studies on the application of Outlook through drip irrigation were conducted using only one cultivar, 'Vaquero', this project was designed as a follow-up study to evaluate the response of five yellow onion cultivars; 'Sedona', Vaquero, 'Joaquin', '16000', and 'Hamilton'.

## Materials and Methods

A field study was conducted at the Malheur Experiment Station, Ontario, Oregon in 2016 to evaluate the response of five yellow onion cultivars to Outlook herbicide applied through drip irrigation. Onion seeds of cultivars Sedona, Vaquero, Joaquin, 16000, and Hamilton were planted on March 18, 2016 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. Planting was done with customized John Deere Flexi Planter units equipped with disc openers. Immediately after planting, the onion rows received a 7-inch band of Lorsban<sup>®</sup> at 3.7 oz/1,000 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 a split-plot design with treatments arranged in randomized complete blocks with four replicates. Onion cultivars formed the main plot onto which herbicide treatments were randomly assigned as split-plots. Individual plots were 7.33 ft wide (4 beds) by 45 ft long. The

study area (except the hand-weeded control 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 6, 2016. Postemergence application of Buctril at 8 fl oz/acre (0.125lb ai/acre) plus GoalTender at 4 fl oz/acre (0.125 lb ai/acre) was done when onions were at the 2- and 4-leaf stages.

In order to achieve uniform herbicide distribution in the top soil layer, each Outlook herbicide rate 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 irrigation period. Applications were initiated when onion plants were at the 2-leaf stage and were made on May 10, 17, and 24, 2016 (Tables 1-4). On June 6, 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. The same procedure was followed to determine plant height on June 16. All other operations followed recommended local production practices.

Plant tops were flailed and onion bulbs were lifted on September 6 and 7, 2016. Bulbs were hand-harvested from the two center beds on September 12 and graded on September 22. Bulbs were graded for yield and quality based on USDA standards as follows: bulbs without blemishes (No. 1s), 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), bulbs infected with the fungus *Aspergillus niger* (black mold), and bulbs infected with unidentified bacteria in the external scales. The 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 No.1 bulbs >2¼ inches.

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

## Results

Evaluations on June 21 (28 days after the last herbicide application) indicated no effect on onion plant stand/acre nor did the herbicides affect plant height (Table 1). Plant stand on June 21 ranged from 95,351 to 96,800 plants/acre across Outlook treatments applied through drip irrigation compared to 94,721 plants/acre for the grower standard and 89,957 plants/acre for the hand-weeded control. Onion plant height on June 21 was similar across treatments and ranged from 27.4 inches to 28.8 inches/plant. These results are similar to our earlier observations in 2014-2015.

Average onion yield across five cultivars was not affected by any of the Outlook treatments (Table 2). Yield for small, No. 2, medium, jumbo, colossal, and supercolossal differed among cultivars (Table 3). However, no differences in yield were related to herbicide treatments and there was no interaction between onion cultivars and herbicide rates. These results suggested differences in yield were due to cultivar differences and not herbicide rates (Table 3). A similar response was observed for the number of onion bulbs (Table 4).

Follow-up studies will evaluate the response of red and white onion cultivars to Outlook herbicide applied through drip irrigation systems. Growers are advised to be extra careful as they adopt this application technique because of the potential for onion injury if one is not precise in determining the area being treated and/or measuring the product. It is critical that Outlook herbicide be mixed into water and the solution metered into the drip irrigation system for 8 to 10 hours.

Table 1. Onion plant stand and height averaged across five cultivars in response to various Outlook (dimethenamid-p) herbicide rates applied through the irrigation drip at the Malheur Experiment Station, Ontario, OR 2016

	Rate <sup>a</sup> (fl oz/acre)	Timing <sup>b</sup>	Plant stand (no./acre)		Height (inches)	
			Jun 6	Jun 21	Jun 6	Jun 21
Outlook	11, 10	A, C	94,163	95,351	21.3	28.5
Outlook	7, 7, 7	A, B, C	98,784	95,541	21.3	27.4
Outlook	21	A	97,750	96,800	21.2	28.6
Outlook	28, 14	A, C	95,196	95,434	21.3	27.7
Outlook	21	A**	88,923	94,721	21.1	28.8
Weed-free			90,646	89,957	20.4	28.1
LSD (0.05)			NS	NS	NS	NS

<sup>a</sup>Herbicide rate; Outlook (dimethenamid-p) 7 fl oz/acre = 0.328 lb ai/acre; 10 fl oz/acre = 0.47 lb ai/acre; 11 fl oz/acre = 0.516 lb ai/acre; 14 fl oz/acre = 0.656 lb ai/acre; 21 fl oz/acre = 0.98 lb ai/acre; 28 fl oz/acre = 1.31 lb ai/acre. All treatments (except hand weeded) were sprayed with Prowl H<sub>2</sub>O late preemergence followed by Buctril and GoalTender.

<sup>b</sup>Herbicide application timing; A = onions at 2-leaf stage (May 10); A\*\*standard Outlook herbicide broadcast applied on May 10; B = 7 days after A (May 17); C = 2 weeks after A (May 24).

Table 2. Onion yield averaged across five cultivars in response to various Outlook (dimethenamid-p) herbicide rates applied through the irrigation drip at the Malheur Experiment Station, Ontario, OR, 2016.

	Rate <sup>a</sup> (fl oz/acre)	Timing <sup>b</sup>	Marketable <sup>c</sup>							Total
			<2¼ in <sup>c</sup>	No. 2	Plate rot	2¼-3 in	3-4 in	4-4¼ in	>4¼ in	
Outlook	11, 10	A, C	18.7	10.5	0.0	25.3	494.5	394.3	181.1	1,095.2
Outlook	7, 7, 7	A, B, C	15.7	5.7	0.6	25.9	537.4	346.3	147.8	1,057.4
Outlook	21	A	17.8	6.7	0.6	22.9	527.5	377.7	155.2	1,083.3
Outlook	28, 14	A, C	22.3	3.7	0.7	19.3	531.0	368.8	153.8	1,072.9
Outlook	21	A**	19.6	4.3	0.8	14.2	531.1	425.9	223.8	1,195.0
Weed-free			17.8	8.0	1.8	17.4	480.2	362.0	181.8	1,041.4
LSD (0.05)			NS	NS	NS	NS	NS	NS	NS	NS

<sup>a</sup>Herbicide rate; Outlook (dimethenamid-p) 7 fl oz/acre = 0.328 lb ai/acre; 10 fl oz/acre = 0.47 lb ai/acre; 11 fl oz/acre = 0.516 lb ai/acre; 14 fl oz/acre = 0.656 lb ai/acre; 21 fl oz/acre = 0.98 lb ai/acre; 28 fl oz/acre = 1.31 lb ai/acre.

<sup>b</sup>Herbicide application timing; A = onions at 2-leaf stage (May 10); A\*\*standard Outlook broadcast applied on May 10; B = 7 days after A (May 17); C = 2 weeks after A (May 24). All treatments (except hand weeded) were sprayed with Prowl H<sub>2</sub>O late preemergence followed by Buctril and GoalTender.

<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 No.1 bulbs >2¼ inches.

Table 3. Onion yield in response to various Outlook (dimethenamid-p) herbicide rates applied through the irrigation drip at the Malheur Experiment Station, Ontario, OR, 2016.

	Rate <sup>a</sup> (fl oz/acre)	Timing <sup>b</sup>	Marketable <sup>c</sup>							
			<2¼ in <sup>c</sup>	No. 2	Plate Rot	2¼-3 in	3-4 in	4-4¼ in	>4¼ in	Total
cwt/acre										
<b>Sedona</b>										
Outlook	11, 10	A, C	22.3	23.3	0.0	40.1	675.5	229.0	28.5	973.1
Outlook	7, 7, 7	A, B, C	11.9	6.4	1.3	31.8	679.1	200.6	35.6	947.2
Outlook	21	A	14.8	11.8	0.9	25.1	608.6	312.8	20.3	966.8
Outlook	28, 14	A, C	11.9	9.1	0.0	28.1	681.0	225.2	19.3	953.6
Outlook	21	A**	29.7	6.3	1.2	14.8	641.6	301.1	56.4	1013.9
Weed-free			25.2	11.9	1.0	22.7	577.9	261.2	46.4	908.2
<b>Vaquero</b>										
Outlook	11, 10	A, C	14.8	9.7	0.0	16.1	318.6	527.3	256.7	1118.7
Outlook	7, 7, 7	A, B, C	10.4	1.5	0.0	14.9	410.2	465.0	190.0	1080.1
Outlook	21	A	7.4	5.2	1.4	21.4	476.5	413.8	207.1	1118.7
Outlook	28, 14	A, C	17.8	0.0	1.0	12.0	412.3	519.5	202.8	1146.6
Outlook	21	A**	8.9	0.0	0.9	15.5	349.4	453.7	313.1	1131.8
Weed-free			8.9	13.6	4.5	9.9	300.8	419.2	243.6	973.5
<b>Joaquin</b>										
Outlook	11, 10	A, C	11.9	1.0	0.0	21.2	330.9	533.7	306.9	1192.7
Outlook	7, 7, 7	A, B, C	19.3	0.0	0.4	21.2	400.3	497.5	268.4	1187.5
Outlook	21	A	14.8	3.9	0.9	13.9	420.0	510.1	284.6	1228.6
Outlook	28, 14	A, C	16.3	2.5	1.4	10.1	425.5	493.8	256.8	1186.2
Outlook	21	A**	22.3	3.6	0.4	6.1	278.1	584.0	403.1	1271.4
Weed-free			17.8	0.2	1.3	15.2	340.4	512.6	306.2	1174.3
<b>16000</b>										
Outlook	11, 10	A, C	17.8	3.4	0.0	11.7	425.6	531.6	304.9	1273.8
Outlook	7, 7, 7	A, B, C	14.8	13.4	1.4	17.9	474.4	448.8	236.4	1177.6
Outlook	21	A	20.8	7.1	0.0	20.6	432.8	505.5	217.1	1176.1
Outlook	28, 14	A, C	31.2	2.3	0.8	16.1	407.5	489.8	281.1	1194.5
Outlook	21	A**	20.8	0.8	1.3	15.1	697.8	519.8	330.6	1563.2
Weed-free			7.4	2.1	0.5	13.1	472.1	459.1	301.4	1245.7
<b>Hamilton</b>										
Outlook	11, 10	A, C	26.7	15.2	0.0	37.2	722.0	150.1	8.3	917.6
Outlook	7, 7, 7	A, B, C	22.3	7.2	0.0	43.6	722.9	119.7	8.7	894.9
Outlook	21	A	31.2	5.3	0.0	33.6	699.7	146.2	46.7	926.2
Outlook	28, 14	A, C	34.1	4.6	0.2	30.1	728.9	115.4	9.2	883.6
Outlook	21	A**	16.3	10.8	0.4	19.5	688.6	270.7	15.9	994.8
Weed-free			29.7	12.3	1.7	26.2	709.9	157.9	11.4	905.3
LSD (0.05) Cultivar			6.0	5.2	NS	5.3	86.4	34.3	39.6	80.0
LSD (0.05) Herbicide treatments			NS	NS	NS	NS	NS	NS	NS	87.6
LSD (0.05) (Cultivar x herbicide treatments)			NS	NS	NS	NS	NS	NS	NS	NS

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<sup>b</sup>Herbicide application timing; A = onions at 2-leaf stage (May 10); A\*\*standard Outlook broadcast applied on May 10; B = 7 days after A (May 17); C = 2 weeks after A (May 24). All treatments (except hand weeded) were sprayed with ProwlH<sub>2</sub>O late preemergence followed by Buctril and GoalTender.

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Table 4. Number of onion bulbs in response to various Outlook (dimethenamid-p) herbicide rates applied through the irrigation drip at the Malheur Experiment Station, Ontario, OR, 2016.

Rate <sup>a</sup> (fl oz/acre)	Timing <sup>b</sup>	<2¼ in <sup>c</sup>	No. 2	Plate Rot	Marketable <sup>c</sup>				Total	
					2¼-3 in	3-4 in	4-4¼ in	>4¼ in		
		Number/acre								
<b>Sedona</b>										
Outlook	11, 10	A, C	1,929	0	427	9,199	77,743	18,101	1,780	106,823
Outlook	7, 7, 7	A, B, C	890	148	193	8,012	81,749	16,023	2,225	108,010
Outlook	21	A	1,335	148	261	6,231	69,287	25,222	1,335	102,075
Outlook	28, 14	A, C	890	0	172	6,825	79,375	17,359	1,187	104,746
Outlook	21	A**	890	148	582	3,857	71,215	23,738	3,709	102,520
Weed-free			1,039	148	472	5,638	65,281	19,881	2,819	93,618
<b>Vaquero</b>										
Outlook	11, 10	A, C	742	0	279	4,006	32,937	38,130	14,837	89,909
Outlook	7, 7, 7	A, B, C	297	0	154	3,857	44,955	34,421	10,979	94,212
Outlook	21	A	297	297	136	4,451	52,225	31,602	12,166	100,443
Outlook	28, 14	A, C	0	148	312	2,967	43,174	38,723	12,018	96,882
Outlook	21	A**	0	148	163	3,709	36,201	34,569	17,804	92,283
Weed-free			890	445	142	2,374	30,860	30,563	13,946	77,743
<b>Joaquin</b>										
Outlook	11, 10	A, C	148	0	228	5,193	35,904	41,691	17,952	100,740
Outlook	7, 7, 7	A, B, C	0	297	329	5,044	45,103	37,536	16,172	103,856
Outlook	21	A	297	297	267	3,412	45,548	38,278	17,507	104,746
Outlook	28, 14	A, C	148	445	306	2,522	45,400	37,536	15,727	101,185
Outlook	21	A**	297	297	457	1,484	30,712	42,729	23,738	98,663
Weed-free			148	297	341	4,154	36,349	38,130	18,101	96,734
<b>16000</b>										
Outlook	11, 10	A, C	445	0	294	3,116	45,845	39,465	18,397	106,823
Outlook	7, 7, 7	A, B, C	1187	445	246	4,451	53,263	34,272	13,946	105,933
Outlook	21	A	742	0	401	5,044	45,993	38,130	13,353	102,520
Outlook	28, 14	A, C	297	148	534	4,154	45,548	37,833	16,765	104,301
Outlook	21	A**	148	148	362	3,857	43,174	39,613	18,991	105,636
Weed-free			148	297	86	3,561	51,334	33,827	17,507	106,229
<b>Hamilton</b>										
Outlook	11, 10	A, C	1,484	0	593	9,050	83,530	12,018	593	105,191
Outlook	7, 7, 7	A, B, C	742	0	427	10,534	85,607	9,792	593	106,526
Outlook	21	A	445	0	596	7,715	82,788	11,572	3,116	105,191
Outlook	28, 14	A, C	593	148	653	7,418	86,794	9,495	593	104,301
Outlook	21	A**	1,039	148	267	4,748	75,963	21,810	1,039	103,559
Weed-free			1,335	297	528	6,083	81,898	13,353	742	102,075
LSD (0.05) Cultivar			121	NS	NS	1,185	5,482	2,899	2,272	4,911
LSD (0.05) Herbicide treatments			NS	499	NS	NS	NS	NS	NS	5,380
LSD (0.05) (Cultivar x herbicide treatments)			NS	NS	NS	2,903	NS	NS	NS	NS

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