

# ONION RESPONSE TO DELAYED PRE-EMERGENCE APPLICATION OF SONALAN<sup>®</sup> HERBICIDE

---

*Joel Felix and Joey Ishida, Malheur Experiment Station, Oregon State University, Ontario, OR*

## Introduction

The importance of weed control in onion in order to maintain high productivity and quality cannot be overstated. With fewer products registered for weed control in specialty crops, it is essential to evaluate herbicides with potential for use to control weeds in direct-seeded onion. It is particularly essential to identify herbicides that could be used prior to onion emergence in order to minimize crop–weed competition. The objective of this study was to evaluate onion response and weed control with Sonalan<sup>®</sup> herbicide applied prior to onion emergence. The use pattern would be similar to that for Prowl<sup>®</sup> H<sub>2</sub>O (i.e., application after 75% of the planted onion seeds have germinated, but not yet emerged).

## Materials and Methods

A field study was conducted during summer 2021 at the Malheur Experiment Station to evaluate the potential use of Sonalan<sup>®</sup> herbicide for delayed pre-emergence application to control weeds in direct-seeded onion. The predominant soil was an Owyhee silt loam with a pH of 7.8 and 2.78% soil organic matter. Wheat stubble was flailed and the field was irrigated, disked, ripped, plowed, and groundhogged during fall 2020. Based on soil analysis, fertilizer was broadcast applied during fall 2020 at 100 lb nitrogen (N)/acre, 100 lb phosphorus/acre, 4 lb zinc/acre, and 2 lb boron/acre. The field was fumigated with K-Pam<sup>®</sup> at 15 gal/acre (Potassium N-methyldithiocarbamate 5.8 lb ai/gal) and beds were formed at 22-inch spacing on October 2, 2020.

The study area was sprayed with Roundup<sup>®</sup> at 1 quart/acre (1.13 lb ae/acre) on March 18, 2021 to control all emerged weed prior to initiating the study. The beds were harrowed down and onion seed of hybrid ‘Vaquero’ was seeded on March 26, 2021 in double rows spaced 3 inches apart with 4-inch seed spacing within each row. Each pair of rows was planted on beds spaced 22 inches apart. On March 26, 2021, each onion bed received a 7-inch band of Lorsban<sup>®</sup> 15G at 3.7 oz/1000 ft of row (chlorpyrifos 0.101 lb ai/acre) and the soil surface was rolled. The irrigation drip tape was installed thereafter.

The study had a randomized complete block design with four replicates. Individual plots were 7.33 ft wide (4 beds) by 27 ft long. All herbicide treatments were applied using a CO<sub>2</sub> pressurized backpack sprayer fitted with a boom equipped with 8002EVS Teejet nozzles calibrated to deliver 20 gal/acre for delayed pre-emergence and 35 gal/acre for all post emergence treatments.

Delayed pre-emergence herbicide treatments were Sonalan HFP at 2 or 2.5 pints/acre (ethalfluralin 0.75 or 0.94 lb ai/acre) or Prowl H<sub>2</sub>O at 2 pints/acre (pendimethalin 0.95 lb ai/acre)

applied on April 12, 2021. Early post emergence treatments to evaluate Sonalan HFP at the 2 or 2.5 pints/acre were applied on May 13, 2021 when onions were at the 2-leaf stage or June 1, 2021 when onions were at the 4-leaf stage (Table 1). Because of dry weather conditions during spring, the first irrigation was only 10 days after seeding, which was much earlier than normal. On May 11, a tank-mix of Poast<sup>®</sup> at 1.5 pints/acre (sethoxydim at 0.28 lb ai/acre) plus crop oil concentrate at 2 pints/acre was applied to control grassy weeds in all plots except the untreated and hand weeded controls.

In-season fertilizer was applied based on soil and tissue test results. Fertilizer was applied through drip irrigation on June 1 and June 22 to supply 100 lb N/acre on each incident. Preventative sprays for diseases and insects were applied as recommended for the area as follows.

- June 4, 2021 — M-Pede 5.6 pints/acre + Aza-Direct<sup>®</sup> 12 fl oz/acre (azadirachtin 0.0093 lb ai/acre)
- June 11, 2021 — Aza-Direct<sup>®</sup> 16 fl oz/acre (azadirachtin 0.0123 lb ai/acre) + Movento<sup>®</sup> 5 fl oz/acre (spirotetramat 0.078 lb ai/acre)
- June 14, 2021 — Aza-Direct<sup>®</sup> 16 fl oz/acre (azadirachtin 0.0123 lb ai/acre) + Persist<sup>®</sup> Ultra 1% v/v (methyl esters of canola oil 85% + alkyl phenol ethoxylate 12%).
- June 22, 2021 — Movento<sup>®</sup> 3.5 fl oz/acre (spirotetramat 0.051 lb ai/acre) + Exirel<sup>®</sup> 13.5 fl oz/acre (cyantraniliprole 0.0875 lb ai/acre) + Persist Ultra 1% v/v (methyl esters of canola oil 85% + alkyl phenol ethoxylate 12%).
- July 2, 2021 — Exirel<sup>®</sup> 20 fl oz/acre (cyantraniliprole 0.13 lb ai/acre) + Dyne- Amic<sup>®</sup> adjuvant 0.25% v/v (methyl esters of C16-C18 fatty acids, polyalkyleneoxide modified polydimethylsiloxane, alkylphenol ethoxylate 99%).
- July 12, 2021 — Exirel<sup>®</sup> 20 fl oz/acre (cyantraniliprole 0.13 lb ai/acre) + HSMOC 0.125% v/v.
- July 21, 2021 — Agri-Mek<sup>®</sup> 3.5 fl oz/acre (abamectin 0.0191 lb ai/acre) + Dyne- Amic<sup>®</sup> adjuvant 0.125% v/v (methyl esters of C16-C18 fatty acids, polyalkyleneoxide modified polydimethylsiloxane, alkylphenol ethoxylate 99%).

Visible onion plant injury and weed control were assessed based on a scale of 0% (no onion injury or no weed control) to 100% (complete onion plant killed or complete weed control). Weed control was assessed on May 20 (38 days after the delayed pre-emergence treatment or 7 days after the 2-leaf stage application timing).

The field was drip irrigated 23 times from April 5 to August 17, 2021. Each irrigation event lasted 12 hours.

Plant tops were flailed on August 30, and onion bulbs were lifted on August 31, 2021 and left in the field to cure. Bulbs were hand harvested from the two center beds on September 3, 2021. Bulbs were graded for yield and quality based on USDA standards as follows: bulbs without blemishes (U.S. No. 1), split bulbs (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 super colossal (>4¼ inches). Marketable yield consisted of U.S. No.1 bulbs greater than 2¼ inches in diameter.

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 April 20, 2021. Evaluations of May 20, 2021 indicated no visible onion injury across herbicide treatments (Table 1). Common lambsquarters control on May 20 was  $\geq 99\%$ , hairy nightshade  $\geq 90\%$ , and 100% control for pigweed species across herbicide treatments.

Weeds were counted within the two center rows on July 1, 2021 as a measure to confirm the visible weed control ratings (Table 2). The number of common lambsquarters in the two center rows in Sonalan containing treatment was  $\leq 6$  plants/99 ft<sup>2</sup> compared to 1 for the grower standard and 645 for the untreated control, pigweed species in those treatments was  $\leq 11$  plants/99 ft<sup>2</sup> compared to 5 for the grower standard and 149 for the untreated control, grassy weeds were  $\leq 1$  weeds/99 ft<sup>2</sup> across Sonalan treatments. All herbicide treatments had a high number of hairy nightshade that ranged from 107 to 122 plants/99 ft<sup>2</sup> across Sonalan treatments compared to 101 plants/99 ft<sup>2</sup> for the grower standard. The combined number of other weeds (flixweed, ladythumb, annual sowthistle, and black medic) was  $\leq 6$  plants/99 ft<sup>2</sup>. Not surprisingly, the total number of weeds was similar across herbicide treatments with total weed number ranging from 125 to 136 plants/99 ft<sup>2</sup> across Sonalan treatments compared to 110 plants/99 ft<sup>2</sup> for the grower standard.

Total marketable yield (bulbs 2¼ to >4¼ inches in diameter) was similar across herbicide treatments (Table 3). The greatest marketable yield was obtained when Sonalan was applied delayed pre-emergence at 2 pints/acre, which was comparable to that for Prowl H<sub>2</sub>O at 2 pints/acre at the same application timing.

The results demonstrated that Sonalan could be used safely to manage weeds in onion under the testing conditions.

## Acknowledgements

This project was partly funded by the Idaho-Eastern Oregon Onion Committee, Oregon State University, the Malheur County Education Service District, and supported by Formula Grant nos. 2021-31100-06041 and 2021-31200-06041 from the USDA National Institute of Food and Agriculture.

Table 1. Onion response and weed control with Sonalan (ethalfluralin) or Prowl H<sub>2</sub>O (pendimethalin) at the Malheur Experiment Station, Oregon State University, Ontario, OR 2021

Treatment <sup>a</sup>	Rate fl oz/a	Timing <sup>b</sup>	Application date	Plant stand No./acre	Injury	Weed control (5/20/2021) <sup>c</sup>		
						Common lambsquarters -----	Hairy nightshade %	Pigweed species -----
Untreated			--	127,820 a	0 -	0 -	0 -	0 -
Sonalan HFP	32	LPRE	4/12	122,650 a	0 a	100 a	90 a	100 a
Brox 2EC	12	2&4-leaf	5/13 & 6/1					
GoalTender	4	2&4-leaf	5/13 & 6/1					
Sonalan HFP	40	LPRE	4/12	122,320 a	0 a	99 a	90 a	100 a
Brox 2EC	12	2&4-leaf	5/13 & 6/1					
GoalTender	4	2&4-leaf	5/13 & 6/1					
Sonalan HFP	32	2-leaf	May 13	122,870 a	0 a	99 a	90 a	100 a
Brox 2EC	12	2&4-leaf	5/13 & 6/1					
GoalTender	4	2&4-leaf	5/13 & 6/1					
Sonalan HFP	40	2-leaf	5/13	115,610 a	0 a	100 a	90 a	100 a
Brox 2EC	12	2&4-leaf	5/13 & 6/1					
GoalTender	4	2&4-leaf	5/13 & 6/1					
Prowl H <sub>2</sub> O	32	LPRE	4/12	126,500 a	0 a	100 a	90 a	100 a
Brox 2EC	12	2&4-leaf	5/13 & 6/1					
GoalTender	4	2&4-leaf	5/13 & 6/1					
LSD (P = 0.05)				NS	NS	NS	NS	NS

<sup>a</sup> Herbicide treatments: Sonalan 32 fl oz/acre = ethalfluralin 0.75 lb ai/acre; Sonalan 40 fl oz/acre = ethalfluralin 0.94 lb ai/acre; Prowl H<sub>2</sub>O 32 fl oz/acre = pendimethalin 0.95 lb ai/acre; Brox 2EC 12 fl oz/a = bromoxynil 0.188 lb ai/acre; GoalTender 4 fl oz/acre = oxyfluorfen 0.125 lb ai/acre.

<sup>b</sup> Application timing: LPRE = delayed pre-emergence (prior to onion emergence) applied on 4/12/2021; 2- & 4-leaf = onion at 2- and 4-leaf stage applied on 5/13 & 6/1/2021.

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

Table 2. Number of weed and total fresh weight of weeds on July 1 in response to delayed pre-emergence application of Sonalan herbicide, Malheur Experiment Station, Oregon State University, Ontario, OR, 2021.

Treatment <sup>1</sup>	Product rate fl oz/acre	Growth stage <sup>2</sup>	Application date	Number of weeds <sup>2</sup>					Total weed fresh weight	
				Common lambsquarters	Pigweeds	Hairy nightshade	Grasses	Other weeds		Total weeds
Untreated <sup>3</sup>				645 a	149 a	9677 a	0 a	594 a	11065 a	691.4 a
Sonalan HFP	32	Delayed-PRE	4/12	4 b	5 b	114 b	1 a	4 b	128 b	46.5 b
Roundup PowerMax	22	Delayed-PRE	4/12							
Moxy 2EC	12	2 & 4 leaf	5/13 & 6/1							
GoalTender	4	2 & 4 leaf	5/13 & 6/1							
Sonalan HFP	40	Delayed-PRE	4/12	6 b	8 b	107 b	1 a	3 b	125 b	36.8 b
Roundup PowerMax	22	Delayed-PRE	4/12							
Moxy 2EC	12	2 & 4 leaf	5/13 & 6/1							
GoalTender	4	2 & 4 leaf	5/13 & 6/1							
Roundup PowerMax	22	Delayed-PRE	4/12	3 b	5 b	122 b	1 a	4 b	134 b	54.2 b
Sonalan HFP	32	2 leaf	5/13							
Moxy 2EC	12	2 & 4 leaf	5/13 & 6/1							
GoalTender	4	2 & 4 leaf	5/13 & 6/1							
Roundup PowerMax	22	Delayed-PRE	4/12	4 b	11 b	116 b	0 a	6 b	136 b	46.6 b
Sonalan HFP	40	2 leaf	5/13							
Moxy 2EC	12	2 & 4 leaf	5/13 & 6/1							
GoalTender	4	2 & 4 leaf	5/13 & 6/1							
Prowl H2O (Grower std)	32	Delayed-PRE	4/12	1 b	5 b	101 b	0 a	3 b	110 b	40.0 b
Roundup PowerMax	22	Delayed-PRE	4/12							
Moxy 2EC	12	2 & 4 leaf	5/13 & 6/1							
GoalTender	4	2 & 4 leaf	5/13 & 6/1							
LSD (P=0.05)				265	79	1,872	NS	474	2,105	292.8

<sup>1</sup>Herbicide treatments: Sonalan 2 pints/acre = ethalfluralin 0.75 lb ai/acre; Sonalan 3 pints/acre = ethalfluralin 1.13 lb ai/acre; Prowl H2O 2 pints/acre = pendimethalin 0.95 lb ai/acre; Brox 2EC 12 fl oz/acre = bromoxynil 0.188 lb ai/acre; GoalTender 4 fl oz/acre = oxyfluorfen 0.125 lb ai/acre.

<sup>2</sup>Application timing: LPRE = late pre-emergence (prior to onion emergence) applied on 4/12/2021; 2 & 4-leaf = onion at 2- & 4-leaf stages applied on 5/13/2021 and June 1, 2021, respectively.

Table 3. Onion yield (cwt/acre) in response to Zidua® SC herbicide applied at various rates and growth stages, Malheur Experiment Station, Oregon State University, Ontario, OR, 2021.

Treatment <sup>1</sup>	Rate fl oz/acre	Growth stage	Application date	Rot	US No. 2	Small	Marketable yield by grade <sup>2</sup>				Total	Total bulbs
							2¼-3 in	3-4 in	4-4¼ in	>4¼ in		
				----- cwt/acre -----								
Untreated <sup>3</sup>				0.0 a	0.0 a	0.0 b	0.0 c	0.0 b	0.0 c	0.0 b	0.0 c	0.0 c
Sonalan HFP	32.0	Delayed-PRE	4/12	0.0 a	0.0 a	29.5 a	51.4 a	668.3 a	143.8 b	3.8 b	867.2 a	896.8 ab
Roundup PowerMax	22	Delayed-PRE	4/12									
Moxy 2EC	12	POST1 & 2	5/13 & 6/1									
GoalTender	4	POST1 & 2	5/13 & 6/1									
Sonalan HFP	2.5	Delayed-PRE	4/12	0.0 a	0.0 a	23.0 a	63.2 a	672.1 a	146.4 b	8.3 b	890.0 a	913.0 ab
Roundup PowerMax	22	Delayed-PRE	4/12									
Moxy 2EC	12	POST1 & 2	5/13 & 6/1									
GoalTender	4	POST1 & 2	5/13 & 6/1									
Roundup PowerMax	22	Delayed-PRE	4/12	0.0 a	0.0 a	26.2 a	68.0 a	662.5 a	107.6 b	13.6 b	851.7 a	877.9 ab
Sonalan HFP	2.0	EPOST	5/13									
Moxy 2EC	12	POST1 & 2	5/13 & 6/1									
GoalTender	4	POST1 & 2	5/13 & 6/1									
Roundup PowerMax	22	Delayed-PRE	4/12	0.0 a	1.3 a	16.4 a	57.2 a	617.8 a	151.1 b	20.7 ab	846.8 a	864.5 b
Sonalan HFP	40	EPOST	5/13									
Moxy 2EC	12	POST1 & 2	5/13 & 6/1									
GoalTender	4	POST1 & 2	5/13 & 6/1									
Prowl H2O (Grower std)	32.0	Delayed-PRE	4/12	0.6 a	2.1 a	19.3 a	34.9 a	704.3 a	247.5 a	57.6 a	1044.3 a	1,066.2 a
Roundup PowerMax	22	Delayed-PRE	4/12									
Moxy 2EC	12	POST1 & 2	5/13 & 6/1									
GoalTender	4	POST1 & 2	5/13 & 6/1									
LSD (P=0.05)				NS	NS	NS	NS	NS	94.1	40.2	NS	201.6

<sup>1</sup>All late-pre-emergence treatments (LPRE) included Roundup 22 fl oz/acre = glyphosate 0.75 lb ae/acre. Sonalan lb ai/acre; Sonalan oz/acre = pyroxasulfone 1.43 lb ai/acre; Brox 2EC 12 fl oz/acre = bromoxynil 0.188 lb ai/acre; GoalTender 4 fl oz/acre = oxyfluorfen 0.125 lb ai/acre; Prowl H<sub>2</sub>O 32 fl oz/acre = pendimethalin 0.95 lb ai/acre. <sup>2</sup>Means within a column followed by the same letter are not significantly different (P = 0.05, LSD).