

# EVALUATION OF SUSTAIN<sup>®</sup> ADJUVANT FOR IMPROVED HERBICIDE WEED EFFICACY IN DIRECT-SEEDED ONION

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## Introduction

Sustain<sup>®</sup> is a nonionic surfactant with a specific pinolene molecular weight polymer designed for soil applications. After application, the resin-based polymer binds the herbicides on the soil surface. The Sustain polymer is insoluble in water, hence the reason it helps to mitigate compounds from leaching or laterally moving. It does not completely inhibit lateral movement, but appears to keep more active ingredients of soil-applied herbicides in the target zone. In addition, Sustain is not rapidly degraded by microbes, and therefore could enhance the activity for soil-applied herbicides. Sustain also improves the contact, wetting, and adhesion of pesticides on plant leaves. The objective of this study was to evaluate weed control efficacy for herbicides applied with and without Sustain in direct-seeded bulb onion.

## Materials and Methods

A field study was conducted in 2011 at the Malheur Experiment Station near Ontario, Oregon to evaluate weed control efficacy with various herbicides applied preemergence (PRE) or postemergence (POST) with and without Sustain on direct-seeded bulb onion. The wheat stubble was flailed and the field plowed during fall 2010. Enough fertilizer to provide 21, 102, 102, 2, and 1 lb/acre of nitrogen, phosphate, sulfur, manganese, and boron, respectively, was applied during fall 2010. The field was groundhogged and 22-inch-wide beds formed. On April 6, 2001, the beds were harrowed and reshaped. Onion variety 'Vaquero' was planted on April 7 in double rows spaced 3 inches apart and 4 inch spacing within the row. Each pair of rows was planted on beds spaced 22 inches apart.

Herbicide treatments were laid out in randomized complete block design with four replications. Individual plots measured 7.33 ft (4 beds wide) by 27 ft long. On April 14, Lorsban 15G<sup>®</sup> at 3.7 oz/1,000 ft of row (chlorpyrifos at 0.101 lb ai/acre) was banded and the soil surface was rolled. Roundup<sup>®</sup> was applied at 22 fl oz/acre (glyphosate at 0.77 lb ae/acre) on April 22 to control all emerged weeds prior to onion emergence. The first furrow irrigation was applied on May 8 and lasted 24 hours to supply about 4 inches of water (including overflow). All subsequent irrigations (12 times from June 10 to August 29, 2011) were of the same duration and delivered the same amount of water.

Herbicide treatments included Prowl H2O<sup>®</sup> (pendimethalin) at 0.98 lb ai/acre applied PRE on May 4 with and without Sustain at 1.04 lb ai/acre, GoalTender<sup>®</sup> (oxyfluorfen) at 0.25 lb ai/acre applied POST on May 25 with and without Sustain at 1.04 lb ai/acre, Prowl H2O at 0.98 lb ai/acre PRE followed by Outlook<sup>®</sup> (dimethenamid-p) at 0.98 lb ai/acre POST with and without Sustain at 1.04

lb ai/acre, and a grower standard that included Prowl H2O at 0.98 lb ai/acre PRE followed by GoalTender at 0.25 lb ai/acre POST. A nontreated control was also included. All herbicide treatments were applied using a CO<sub>2</sub>-pressurized backpack sprayer with a boom equipped with 4 8002 EVS nozzles and calibrated to deliver 20 gal/acre at 35 PSI at 3 mph. Except for the nontreated control, all plots were sprayed with Poast (sethoxydim) at 0.287 lb ai/acre POST on May 24 to control grassy weeds.

Onion plants were sprayed with Movento<sup>®</sup> (spirotetramat) at 0.078 lb ai/acre tank-mixed with Pierce (crop oil concentrate) at 1.57 lb ai/acre on June 13 to control thrips. Plants were sidedressed with nitrogen at 225 lb/acre on June 21. Onion plants were sprayed again for thrips control on June 22 and July 5 using Radiant (spinetoram) at 0.078 lb ai/acre tank-mixed with a crop oil concentrate. Plots were visually evaluated for weed control and crop injury on June 27 and July 11 based on 0 to 100 percent; where 0 percent = no weed control or crop injury and 100 percent = complete weed control or complete crop kill.

Weeds were counted and harvested from 1 yd<sup>2</sup> in the center 2 rows of each plot on July 20 to quantify biomass accumulation. Weeds from each plot were placed in paper bags and transported to the greenhouse to air-dry and later weighed to determine the biomass. Onion tops were flailed on September 9 and onion bulbs were lifted on September 12 and left on the ground to cure until September 19 when bulbs were handpicked from the center two rows to determine yield. Bulbs were graded for quality and yield on September 23 based on USDA standards.

## Results

There was no crop injury observed from any of the herbicide and Sustain treatments. Evaluations on June 27 (54 days after treatment) indicated improved weed control when Prowl H2O plus Sustain was applied prior to onion emergence compared to Prowl H2O alone (Table 1). The addition of Sustain into Prowl H2O improved control of common lambsquarters, redroot pigweed, and Pennsylvania smart weed by 30, 31, and 15 percent, respectively. Improved weed control with Prowl H2O plus Sustain was still apparent on July 11 (68 days after treatment). Control of common lambsquarters, redroot pigweed, and Pennsylvania smartweed improved 13, 18, and 16 percent, respectively for Prowl H2O plus Sustain compared to Prowl H2O alone (Table 2). Total weed biomass on July 20 (77 days after treatment) was 10 oz/yd<sup>2</sup> for plots treated with Prowl H2O plus Sustain compared to 17 oz/yd<sup>2</sup> for Prowl H2O alone (Table 2).

The grower standard (Prowl H2O followed by GoalTender) provided the greatest onion yield (1,003.9 cwt/acre) compared to the other herbicide treatments (Table 3). This was expected because plots treated with Prowl H2O with and without Sustain did not receive post-emergence applications like the grower standard. The GoalTender with and without Sustain treatments did not receive the preemergence application of Prowl H2O. Similarly, Prowl H2O with and without Sustain followed by Outlook or Dual Magnum treatments were not treated with postemergence GoalTender, which is more effective on weeds that have already emerged.

The results indicated that the application of Prowl H2O plus Sustain prior to onion emergence improved weed control compared to Prowl H2O alone. The study will be repeated in 2012 to confirm these results.

Table 1. Weed control on June 27, 2011 (54 days after treatment) with various herbicides applied with and without Sustain at the Malheur Experiment Station, Ontario, OR.

Treatment	Rate lb ai/acre	Application timing <sup>b</sup>	Crop injury --- % ---	Weed control <sup>a</sup>				
				Common lambsquarters ----- % -----	Hairy nightshade	Redroot pigweed	Pennsylvania smartweed	Kochia
Untreated			0	0	0	0	0	0
Prowl H2O	0.98	A	0	96 a	78 c	85 a	96 a	94 a
Sustain	1.04	A						
Prowl H2O	0.98	A	0	66 b	83 bc	54 b	81 b	80 a
GoalTender	0.25	B	0	74 b	100 a	100 a	95 a	98 a
Sustain	1.04	B						
GoalTender	0.25	B	0	73 b	99 a	99 a	86 ab	89 a
Prowl H2O	0.98	A	0	74 b	84 bc	98 a	91 ab	98 a
Sustain	1.04	A						
Outlook	0.98	B						
Sustain	1.04	B						
Prowl H2O	0.98	A	0	73 b	97 ab	95 a	90 ab	94 a
Outlook	0.98	B						
Prowl H2O	0.98	A						
Sustain	1.04	A	0	98 a	90 abc	91 a	85 ab	98 a
Dual Magnum	1.27	B						
Sustain	1.04	B						
Prowl H2O	0.98	A						
GoalTender	0.25	B	0	99 a	99 a	100 a	93 ab	98 a

(grower standard)

<sup>a</sup> Means within a column followed by the same letter are not significantly different according to LSD  $P = 0.05$ .

<sup>b</sup> Application timing: A = preemergence, B = postemergence.

Table 2. Weed control on July 11, 2011 (68 days after treatment) and dry weight on July 20, 2011 for different herbicides applied with and without Sustain at the Malheur Experiment Station, Ontario, OR.

Treatment	Rate lb ai/acre	Application timing <sup>b</sup>	Weed control <sup>a</sup>					Weed dry weight oz/yd <sup>2</sup>
			Common lambsquarters	Hairy nightshade	Redroot pigweed	Pennsylvania smartweed	Kochia	
			----- % -----					
Untreated			0	0	0	0	0	34
Prowl H2O	0.98	A	93 a	63 c	81 b	99 a	96 ab	10 b
Sustain	1.04	A						
Prowl H2O	0.98	A	80 b	79 bc	63 c	83 bc	93 abc	17 a
GoalTender	0.25	B	95 a	100 a	100 a	91 abc	90 bc	2 cd
Sustain	1.04	B						
GoalTender	0.25	B	96 a	95 ab	99 a	80 c	85 c	8 bc
Prowl H2O	0.98	A	98 a	83 abc	97 ab	95 ab	100 ab	2 cd
Sustain	1.04	A						
Outlook	0.98	B						
Sustain	1.04	B						
Prowl H2O	0.98	A	89 ab	95 ab	96 ab	89 abc	93 abc	2 cd
Outlook	0.98	B						
Prowl H2O	0.98	A	98 a	80 abc	95 ab	90 abc	99 ab	5 bcd
Sustain	1.04	A						
Dual Magnum	1.27	B						
Sustain	1.04	B						
Prowl H2O	0.98	A	98 a	100 a	100 a	91 abc	100 a	<1 d
GoalTender	0.25	B						

(Grower standard)

<sup>a</sup> Means within a column followed by the same letter are not significantly different according to LSD  $P = 0.05$ .

<sup>b</sup> Application timing: A = preemergence, B = postemergence.

Table 3. Onion yield in response to different herbicides applied with and without Sustain at the Malheur Experiment Station, Ontario, OR, 2011.

Treatment	Rate	Application timing <sup>b</sup>	Onion yield <sup>a</sup>					U.S # 1
			Small	Medium	Jumbo	Colossal	Super colossal	
lb ai/acre		cwt/acre						
Untreated			2.4	0	0	0	0	0
Prowl H2O	0.98	A	11.8 ab	148.8 a	591.9 bc	53.2 b	0 b	793.8 b
Sustain	1.04	A						
Prowl H2O	0.98	A	11.7 ab	89.0 ab	572.8 c	52.8 b	6.3 ab	720.9 b
GoalTender	0.25	B	9.9 ab	49.5 b	714.6 ab	80.0 b	9.7 ab	853.7 b
Sustain	1.04	B						
GoalTender	0.25	B	9.8 ab	72.8 ab	700.2 abc	44.8 b	0 b	817.7 b
Prowl H2O	0.98	A	4.9 ab	74.7 ab	631.7 bc	67.2 b	6.8 ab	780.4 b
Sustain	1.04	A						
Outlook	0.98	B						
Sustain	1.04	B						
Prowl H2O	0.98	A	8.2 ab	59.5 ab	686.9 abc	81.4 b	6.6 ab	834.4 b
Outlook	0.98	B						
Prowl H2O	0.98	A						
Sustain	1.04	A	12.4 a	91.1 ab	608.8 bc	49.0 b	0 b	748.9 b
Dual Magnum	1.27	B						
Sustain	1.04	B						
Prowl H2O	0.98	A						
GoalTender	0.25	B	3.9 b	21.7 b	787.2 a	176.9 a	12.6 a	1,003.9 a

(Grower standard)

<sup>a</sup> Means within a column followed by the same letter are not significantly different according to LSD  $P = 0.05$ .

<sup>b</sup> Application timing: A = preemergence, B = postemergence.