

EVALUATION OF SUSTAIN[®] ADJUVANT FOR IMPROVED HERBICIDE WEED EFFICACY IN DIRECT-SEEDED ONION

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Introduction

Sustain[®] is a nonionic surfactant containing a specific pinolene polymer designed to improve product performance in the soil and plants. When applied to the soil, the resin-based polymer binds the herbicides on the soil surface to improve product performance. It is believed that the Sustain polymer is insoluble in water, hence the reason it helps to keep compounds from leaching or moving laterally. It does not provide complete suppression of 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 with and without Sustain in direct-seeded bulb onion.

Materials and Methods

A field study was conducted in 2012 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 2011. Urea fertilizer was applied during fall 2011 to provide 100, 200, and 1 lb/acre of phosphate, sulfur, and boron, respectively. The field was plowed, disked, and 22-inch-wide beds formed. The beds were harrowed and reshaped on March 19, 2012. Onion variety ‘Vaquero’ was planted on March 27 in double rows spaced 3 inches apart and 4-inch seed spacing within the row on beds spaced 22 inches apart.

Herbicide treatments were arranged in randomized complete block design with four replications. Individual plots measured 7.33 ft (4 beds wide) by 27 ft long. Lorsban[®] 15G (chlorpyrifos at 0.101 lb ai/acre) was banded at 3.7 oz/1,000 ft of row over the top of the onion rows on April 5 and the soil surface was rolled. Roundup[®] was applied at 22 fl oz/acre (glyphosate at 0.77 lb ae/acre) on April 22 to control emerged weeds prior to onion emergence. The first furrow irrigation was applied on May 12 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) lasted the same duration and delivered the same amount of water.

Herbicide treatments included Prowl[®] H₂O (pendimethalin) at 0.98 lb ai/acre applied PRE on April 3 with and without Sustain at 1.04 lb ai/acre (Table 1). POST treatments were applied on

May 15 when onions were at the two-leaf stage. A grower standard that included Prowl H₂O at 0.98 lb ai/acre PRE followed by GoalTender[®] (oxyfluorfen) at 0.25 lb ai/acre POST and the nontreated control were also included. On June 4, onions (except the untreated control) were sprayed with Poast[®] (sethoxydim) at 0.287 lb ai/acre POST to control grassy weeds. All onions (except the untreated control) were sprayed again with GoalTender and Buctril[®] (bromoxynil) at the rates of 0.5 pt/acre each equivalent to oxyfluorfen at 2 oz ai/acre and bromoxynil at 2 oz ai/acre, respectively, on June 4, 2012. All herbicide treatments were applied using a CO₂-pressurized backpack sprayer with a boom equipped with four 8002 EVS nozzles and calibrated to deliver 20 gal/acre at 35 PSI at 3 mph.

The first furrow irrigation was applied on May 12 and lasted 24 hours to supply about 4 inches of water (including runoff). All subsequent irrigations (16 times from May 21 to August 30, 2012) were the same duration and delivered the same amount of water.

Onion plants were sidedressed with urea fertilizer to supply 200 lb/acre of nitrogen on June 1. Onion plants were sprayed with Movento[®] (spirotetramat) at 0.078 lb ai/acre tank-mixed with Prime Oil (crop oil concentrate) at 1.57 lb ai/acre on June 11 and 18 to control thrips. Plants were aerially sprayed for thrips control on June 25 using Radiant[®] (spinetoram) at 0.078 lb ai/acre tank-mixed with a crop oil concentrate. Subsequent aerial sprays for thrips control were on July 14, 21, August 3 and 11 using Lannate[®] (methomyl) at 0.9 lb ai/acre. Plants were visually evaluated for weed control and crop injury on May 12 and June 12 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.

Onion plant tops were flailed on September 7 and bulbs lifted on September 10, 2012. Bulbs were hand-harvested from the two center rows on September 12 and graded on September 19, 2012. The data were subjected to analysis of variance and treatment means were compared using LSD at 0.05 percent level of confidence.

Results

There was no crop injury observed from any of the herbicide and Sustain treatments (Table 1). Evaluations on June 12 (61 days after treatment) indicated a similar level of weed control when Prowl H₂O was applied with or without Sustain prior to onion emergence (Table 1). Application of Prowl H₂O plus Sustain prior to onion emergence provided 88 percent control of common lambsquarters compared to 80 percent for Prowl H₂O alone. Control for redroot pigweed, hairy nightshade, and barnyardgrass was also similar for Prowl H₂O with and without Sustain. These results contrast with our findings in 2011 (Felix and Ishida 2012) when Prowl H₂O plus Sustain improved common lambsquarters and redroot pigweed by 20 and 31 percent, respectively. It is possible that the differences in weed control between 2011 and 2012 could be attributed to variation in weather conditions between the years. The weather during 2011 was generally cool and wet compared to drier and warmer conditions in 2012. Tank-mixing GoalTender with Sustain improved common lambsquarters control by 5 percent compared to GoalTender alone (Table 1). Hairy nightshade and barnyardgrass control was similar across the treatments.

The yield for small onion (<2.25 inch diameter) was similar across herbicide treatment combination and highest for the untreated control (Table 2). Medium category (2¼-3 inch diameter) yield was similar across treatments and ranged from 11.2 to 29 cwt/acre. The jumbo category (3-4 inch diameter) yield ranged from 225.2 to 721.3 cwt/acre across herbicide

treatments. The yield for colossal bulbs (4-4¼ inch diameter) was higher in the Prowl H₂O plus Sustain treatment (479.7 cwt/acre) compared to Prowl H₂O alone (269.3 cwt/acre). However, the colossal yield was similar for treatments that were applied at the two-leaf stage with and without Sustain. Yield for the U.S. No. 1 bulbs was higher in the Prowl H₂O plus Sustain (1,169.3 cwt/acre) compared to Prowl H₂O alone (1,065.2 cwt/acre). The increase in U.S. No. 1 bulbs for the Prowl H₂O plus Sustain was mainly influenced by the high yield in the jumbo category.

The results indicated that the application of Prowl H₂O plus Sustain prior to onion emergence may improve some weed control compared to Prowl H₂O alone. The results varied between 2 years, suggesting that the performance could be influenced by the weather. However, the improved weed control did not result in improved onion yield. The study will be repeated in 2013 to confirm these results.

References

Felix, J., and J. Ishida. 2012. Evaluation of Sustain[®] adjuvant for improved herbicide weed efficacy in direct-seeded onion. Malheur Experiment Station Annual Report 2011, Ext/CrS 141:87-91.

Table 1. Weed control in onion on June 12 (70 days after treatment) with various herbicides applied with and without Sustain® at the Malheur Experiment Station, Ontario, OR, 2012.

Treatment	Application		Crop injury --- % ---	Weed control ^a			
	Rate lb ai/a	timing ^b		Common lambsquarters	Hairy nightshade	Redroot pigweed	Barnyardgrass
Untreated			0	0	0 b	0 c	0 b
Prowl H ₂ O	0.98	A	0	88 bc	98 a	76 b	100 a
Sustain	1.04	A					
Prowl H ₂ O	0.98	A	0	80 c	98 a	73 b	100 a
Prowl H ₂ O	0.98	A	0	93 ab	100 a	98 a	100 a
GoalTender	0.25	B					
Sustain	1.04	B					
Prowl H ₂ O	0.98	A	0	88 bc	100 a	93 a	100 a
GoalTender	0.25	B					
Prowl H ₂ O	0.98	A	0	96 a	100 a	99 a	100 a
GoalTender	0.25	B					
Buctril	0.125	B					
Sustain	1.04	B					
Prowl H ₂ O	0.98	A	0	93 ab	100 a	96 a	100 a
GoalTender	0.25	B					
Buctril	0.125	B					
Prowl H ₂ O	0.98	A	0	99 a	100 a	100 a	100 a
Outlook	0.98	B					
Sustain	1.04	B					
Prowl H ₂ O	0.98	A	0	98 a	100 a	99 a	100 a
Dual Magnum	1.27	B					
Sustain	1.04	B					
Prowl H ₂ O	0.98	A	0	91 ab	100 a	95 a	100 a
GoalTender	0.25	B					

(grower standard)

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

^b Application timing; A = preemergence (April 3, 2012), B = postemergence (May 15, 2012). All treatments (except for the untreated control) received an additional GoalTender plus Buctril application on June 4, 2012.

Table 2. Onion yield in response to different herbicides applied with and without Sustain® at the Malheur Experiment Station, Ontario, OR, 2012.

Treatment	Rate lb ai/acre	Application timing ^b	Onion yield ^a							Total yield
			Marketable yield grade							
			Small <2¼ in	Medium 2¼-3 in	Jumbo 3-4 in	Colossal 4-4¼ in	S Colossal >4¼ in	U.S. No.1 2¼->4¼ in	cwt/acre	
Untreated			22.2 a	14.2 a	0.0 b	0.0 c	0.0 c	14.2 d	36.3 d	
Prowl H ₂ O	0.98	A	5.8 b	15.5 a	592.2 a	479.7 a	81.6 abc	1,169.3 abc	1,175.2 abc	
Sustain	1.04	A								
Prowl H ₂ O	0.98	A	3.9 b	23.9 a	721.3 a	269.3 b	50.9 bc	1,065.2 c	1,069.1 c	
Prowl H ₂ O	0.98	A	4.9 b	26.9 a	646.5 a	413.2 ab	53.6 bc	1,140.2 abc	1,145.1 abc	
GoalTender	0.25	B								
Sustain	1.04	B								
Prowl H ₂ O	0.98	A	5.6 b	29.0 a	544.9 a	464.7 a	80.4 abc	1,119.0 bc	1,124.7 bc	
GoalTender	0.25	B								
Prowl H ₂ O	0.98	A	2.7 b	17.0 a	225.2 a	473.8 a	169.2 a	1,212.1 ab	1,214.8 ab	
GoalTender	0.25	B								
Buctril	0.125	B								
Sustain	1.04	B								
Prowl H ₂ O	0.98	A	3.9 b	19.7 a	574.1 a	478.7 a	112.3 ab	1,184.8 abc	1,188.6 abc	
GoalTender	0.25	B								
Buctril	0.125	B								
Prowl H ₂ O	0.98	A	3.9 b	11.2 a	609.7 a	521.4 a	117.6 ab	1,259.8 a	1,263.8 a	
Outlook	0.98	B								
Sustain	1.04	B								
Prowl H ₂ O	0.98	A	9.1 b	19.5 a	545.2 a	499.2 a	94.1 abc	1,158.0 abc	1,167.0 abc	
Dual Magnum	1.27	B								
Sustain	1.04	B								
Prowl H ₂ O	0.98	A	3.6 b	19.3 a	630.3 a	361.8 ab	88.8 abc	1,100.3 bc	1,103.9 bc	
GoalTender	0.25	B								

(grower standard)

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

^b Application timing; A = preemergence (April 3, 2012), B = postemergence (May 15, 2012). All treatments (except for the untreated control) received an additional GoalTender plus Buctril application on June 4, 2012.