

CALIFORNIA MELON RESEARCH BOARD

2017 Research Final Report

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A. Evaluating the effect of timing of Sandea (halosulfuron) and clethodim herbicides to direct seeded and transplant melons.

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Summary

Field trials were established in honeydews (cv Summer Dew) and cantaloupes (cv Durango) in commercial fields in California to evaluate post emergence combinations of halosulfuron (Sandea) and clethodim (Select 2EC) herbicides applied at 3-5 leaves and 28 days after crop emergence for effects on melon injury and weed control. Similar treatments were evaluated in Arizona on honeydews (cv Sun Blushed), but included both direct seeded and transplants as a treatment variable. The herbicides used were Sandea (75% halosulfuron) at 1.0 oz/A, and Select (clethodim 26.4% ai) at 8 oz per acre. No surfactants were used. Treatment design was a randomized complete block with 3-4 replications; plot size was one bed (6.67 ft) by 20-30 feet long. Pre-emergent applications of halosulfuron had no discernable effect on crop phyto and only marginal weed control. In Arizona, significantly more crop phytotoxicity occurred in the treatments with POST halosulfuron and clethodim as compared to the other treatments. Crop injury exceeded 85% and resulted in dwarfed plants and/or death. In California, however, POST treatments caused no significant crop injury but significantly reduced weed pressure. The 3-5 leaf treatments, which were sprinkler incorporated, provided best overall weed control at all test locations, 81% weed control in the cantaloupe trial. No differences were observed in crop injury between seeded or transplants. Fruit production in California was similar across all treatments and there was no significant impact on yield. Arizona yields were significantly reduced in those treatments where crop injury occurred.

Introduction

There are a limited number of herbicides registered for melon production in California and Arizona. Shallow cultivation and nonselective herbicides with no soil activity can be effective if used after bed formation and before planting. Both contact (paraquat [Gramoxone]) and systemic (glyphosate [Roundup]) herbicides can be used. Curbit (ethafluralin) can be effective, but should be used with caution, as crop injury will occur if it is concentrated around the germinating melon seed by water or cultivation.

While used mainly for post emergence nutsedge control, halosulfuron (Sandea) is currently registered on melons for both pre and post emergence broadleaf weed control, including pigweed and purslane. It is safe to use on most melon types after they have three leaves and before blooming. Carryover in the soil is a consideration if sensitive crops are to follow (8 months for tomatoes, > 12 months for many leafy greens and brassica crops). As with many herbicides, efficacy is improved with sprinkler incorporation. One challenge with Sandea, however, is the preharvest interval required on the label of 57 days (57-day PHI). Post emergence applications likely will be more effective because of greater weed emergence after the

first irrigation (in furrow irrigated fields), but may be too late in the season since melons are usually harvested less than 90 days after emergence.

Unfortunately, halosulfuron does not control grasses, and therefore tank mixtures with clethodim (Select Max) herbicides may improve overall weed control in melons. Grass weed control is improved with the addition of adjuvants, and crop oil concentrate at 1% v/v is recommended on the label. However, crop oil concentrates are not recommended with halosulfuron because they increase the chance for phytotoxicity on the crop. Melon Board sponsored research in 2016 showed that a tankmix with Sandea and clethodim was effective and safe on the crop when no adjuvants were used, and that the addition of surfactants could significantly increase crop phyto.

The objectives of this trial were to evaluate both the timing and efficacy of PRE and POST emergence combinations of halosulfuron (Sandea) and clethodim (Select Max) herbicides used on direct seeded and transplanted melons in California and Arizona.

Methods

Three trial locations were established: a late season honeydew field with Jim Vincent south of Dos Palos, a second cantaloupe location with Bowles Farming north of Dos Palos, and a third trial at the Yuma Agriculture Center in Yuma, AZ. Two trials were performed to evaluate clethodim + Sandea (halosulfuron) application timing impacts on weed control and crop safety in honeydew and cantaloupe melons in California. While I had submitted a revised proposal to have at least one location use transplants, I was unable to find a cooperator in my area using transplants this year, and therefore both locations were direct seeded into commercial fields. The treatments were the same at both locations. In all, 10 different herbicide and timing combinations were evaluated (Table 1).

The trial in Arizona with Barry Tickes had both transplants and direct seeded cantaloupes. At this location, 12 different treatments were evaluated (Table 1).

At the California test site, herbicide applications were made by hand using a backpack sprayer with 60 gpa of water equivalent. Plots were one bed (60 or 80 inches) by 30 feet long, using a RCB design with 4 replications. Herbicides used were Sandea (75% halosulfuron) at 1.0 oz/A, and Clethodim 2E (26.4% ai) at 8 oz per acre. No adjuvants were used for any of the treatments. POST treatments were made at about 4 true leaves in the honeydew field, and 2 true leaves in the cantaloupes. Both applications were sprinkler incorporated within 24 hours. At 28 days after emergence, POST treatments were applied as a directed spray to the outside and shoulder of the beds to minimize contact with foliage, and as an over-the-top application across the top of the bed. The 28-day application was not sprinkler incorporated.

At the Yuma location, herbicide applications were also made by hand using a backpack sprayer. A pre-plant application of Sandea was made immediately before planting on Aug 7. Plots were 1 bed (80 inches) by 20 feet long, using a RCB design with 3 replications. Sandea and Select 2EC (26.4% ai) were used without an adjuvant. All POST applications were made over-the-top. At 3-5 leaf treatment timing, sprinklers were used. Treatments made at 28 days were not incorporated with sprinklers.

Weed and crop phytotoxicity ratings were done using a subjective scale, where 0 = no weeds/no phyto, 1 = 1 - 7%, 2 = 7 - 25%, 3 = 25 - 50%, 4 = 50 - 75%, 5 = 75 - 93%, and 6 = 93 - 100% weeds or phyto. Ratings were made following the 3-5 leaf application, after the 28-day application, and at harvest. Cantaloupes and honeydew fruit counts were also made at harvest by counting all fruit in each plot. A representative sample was taken to determine fruit weight and °Brix. Both locations had a commercial picking crew go through the plots before a complete yield determination could be made, and therefore yields are based on fruit count data.

Table 1. 2017 Trial background and treatment information.

	<i>Cantaloupes</i>	<i>Honeydews</i>	<i>Cantaloupes</i>
<i>Location</i>	East of Turner Island Rd. near the terminus of Carlucci Rd. 37° 7' 45.15" N 120° 41' 4.782" W	Off Lexington Rd, between Cyprus and Eucalyptus Rds. 37° 1' 15.74" N 120° 39' 28.65" W	Yuma Agriculture Center 6425 W. 8 th St. Yuma, AZ
<i>Cooperator</i>	Bowles Ranch	Jimmy Vincent	Research Station
<i>Variety and plant date</i>	Durango, July 10	Summer Dew, June 2	Sun Blushed, Aug 7 (direct seed) and 8 th (transplant)
<i>Irrigation</i>	Sprinkler, then drip	Sprinkler, then furrow	Sprinkler, then furrow
<i>Sandea PRE treatments</i>	none	none	Aug 7
<i>POST directed & over-the-top treatments</i>	July 27 (2-3 leaves) Aug 7 (21 days after planting)	June 27 (4 leaves) July 10 (29 days after emergence)	Aug 21 (3-5 leaves) Sept 6 (28 days)
<i>Weed evaluation</i>	Aug 7, 18, 31, Oct 2	Aug 21	Aug 28, Sept 6, Sept 11
<i>Harvest</i>	Oct 1	Aug 22	Oct 20
<i>Treatments California Trials</i>	<ol style="list-style-type: none"> 1. UTC 2. Sandea POST 1 oz/A at 3 - 5 leaves, directed spray 3. Sandea POST 1 oz/A at 28 days after emergence, directed spray. 4. Sandea 1 oz/A + clethodim 8 oz/A at 3 - 5 leaves, directed spray 5. Sandea 1 oz/A + clethodim 8 oz/A at 28 days after emergence, direct spray 6. Sandea 1 oz/A POST at at 3 - 5 leaves, over-the-top 7. Sandea 1 oz/A POST 28 days after emergence, over-the-top 8. Sandea 1 oz/A + clethodim 8 oz/A at 3 - 5 leaves, over-the-top 9. Sandea 1 oz/A + clethodim 8 oz/A at 28 days after emergence, over-the-top 		
<i>Treatments Arizona Trial</i>	<ol style="list-style-type: none"> 1. Transplanted check, no herbicides 2. Sandea 1 oz/A pre-transplant – Transplants 3. Sandea 1 oz/A 3-5 leaves -- Transplants 4. Sandea 1 oz/A 28 days after transplanting – Transplants 5. Sandea 1 oz/A 3 – 5 leaves -- Direct Seed 6. Sandea 1 oz/A 28 days after emergence -- Direct Seed 7. Sandea 1 oz/A + Select 8 fl oz/A 3 – 5 leaves -- Transplants 8. Sandea 1 oz/A + Select 8 fl oz/A 28 days after transplanting -- Transplants 9. Sandea 1 oz/A + Select 8 fl oz/A 3 – 5 leaves -- Direct Seed 10. Sandea 1 oz/A + Select 8 fl oz/A 28 days after emergence -- Direct Seed 11. Sandea 1 oz/A pre-emergence -- Direct Seed 12. Seeded check, no herbicides 		

The Arizona trial used a 0 – 100% phyto and weed control scale, where 100% injury = death of plants. Total melon yield was measured in each plot, with no evaluation of marketability.

Results: California

To improve plant stand, both the cantaloupe and honeydew test plots were sprinkler irrigated after emergence, at 2 – 4 true leaves depending on location. The first application of Sandea herbicide was applied at this time, which significantly improved weed control as compared to the 28-day application.

Weed pressure was very low at the honeydew trial (Table 2), with almost no weeds for the entire season at this location even though the plot area was not cultivated or hand weeded. Therefore, only the last

rating at harvest is shown. This is likely a result of following Roundup Ready cotton, which eliminated most of the weeds in this field the previous year. At season end, there was a slight, though significant, reduction in the number of broadleaf weeds (pigweed, lambsquarters, and Venice mallow were the dominant weeds at this location) in all herbicide treatments as compared to the untreated control. No crop injury was observed at any time regardless of method of application. Yields were good, over 1100 boxes per acre of mostly 4-6 lb fruit. There was no significant difference in fruit size or marketable yield between any of the treatments.

Weed pressure was much higher at the cantaloupe trial. Main weeds at this location were field bindweed, pigweed, purslane, nightshade, puncture vine, and volunteer wheat. Broadleaf weeds were significantly less as compared to the untreated plots on all evaluation dates except the first (Table 3). Sandea applied at 3-5 leaves significantly reduced weed pressure as compared to the 28 days after emergence treatment (81% weed control compared to 16%). The method of application – directed vs. over-the-top – did not significantly impact weed control or crop phytotoxicity. As in the honeydew trial, crop injury was minimal for any treatment – slight yellowing was observed on the leaves after the Sandea+clethodim POST application applied at 28 days. This phytotoxicity faded quickly, and had no significant impact on yield. Average yields for this trial were 1076 boxes per acre and °Brix was 11.6.

Results from the trials in California show Sandea applied at 3 – 5 leaves to be safe and effective when incorporated with sprinklers on both honeydew and cantaloupes. The addition of clethodim did not improve weed control, since there were few grassy weeds within the test area, but it did slightly increase crop phyto with the over-the-top application at 28 days. However, results from Arizona were much different.

Results: Arizona

The Arizona trial had more treatments as a result of the addition of evaluating transplants with the herbicide treatments, plus the addition of Sandea applied pre-plant. The trial was not a factorial design and therefore interactions could not be analyzed, but the main effects of herbicide, timing of application, and planting method are shown in Table 4. Results are shown as % weed control or % phyto as compared to the untreated control plots. Therefore, control plots were not included in the statistical analysis.

Junglerice, pigweed, and purslane were the dominant weeds at this location. Sandea herbicide significantly improved weed control after the 3-5 day treatment application. Combining clethodim (Select) and Sandea further increased weed control in this trial to > 85%. Weed control was significantly better when applied at 3-5 leaves as compared to a preplant/pre-emergence application.

Unlike California, however, all but the PRE plant application of Sandea caused significant crop injury – an average of 70% in the treatments that received herbicide applications at 3-5 days or at 28 days. The addition of clethodim (Select) doubled the amount of crop phyto, from 36.9% to 84.6% (Table 4). There was no significant difference between transplants or direct seed on the amount of crop phyto observed. Fruit production was significantly reduced from the 3-5 and 28-day treatments as compared to the PRE Sandea treatment. Due to extreme variability in the yield data, however, there was no correlation between crop injury and treatment yield.

Acknowledgements

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Table 2. Crop phyto, weed control, and honeydew fruit production and estimated yield, Dos Palos 2017.

Herbicide treatment	Timing	Placement	fruit size distribution, % per plot (1)				fruit count	total plot wt	TMY (2) lbs/A	cartons/A		fruit size distribution, lbs (3)			Weed pressure (4) Crop		
			L > 6 lbs	M	S < 4 lbs					L > 6 lbs	M 4-6 lbs	95% CL	Mean	95% CL	BL	Grass	Phyto
1 UTC			16.0%	66.1%	17.9%	52.5	256.1	45,813	244.3	1010.0	3.8	4.9	5.9	1.25	0.75	0	
2 Sandea 1 oz/A	3-5 leaves	directed	15.1%	62.6%	22.3%	54.8	245.7	41,581	208.9	868.0	3.7	4.5	5.1	0	0	0	
3 Sandea 1 oz/A	28 days	directed	18.5%	67.3%	14.2%	54.3	313.1	58,505	361.4	1311.6	4.7	5.8	6.7	0.25	0.25	0	
4 Sandea + clethodim 8 oz/A	3-5 leaves	directed	15.9%	65.5%	18.6%	51.8	257.1	45,577	242.0	994.6	4.0	5.0	6.1	0.25	0	0	
5 Sandea + clethodim 8 oz/A	28 days	directed	17.8%	64.3%	17.8%	55.0	286.4	51,251	304.9	1098.5	4.3	5.2	5.8	0.25	0	0	
6 Sandea 1 oz/A	3-5 leaves	over-the-top	15.1%	72.4%	12.5%	56.3	306.1	58,327	292.8	1408.1	4.5	5.4	6.9	0	0.25	0	
7 Sandea 1 oz/A	28 days	over-the-top	15.0%	72.5%	12.5%	58.8	326.9	62,331	312.3	1506.7	5.1	5.6	6.0	0	0	0	
8 Sandea + clethodim 8 oz/A	3-5 leaves	over-the-top	11.6%	74.2%	14.3%	57.3	276.7	51,686	199.7	1277.6	4.1	4.8	5.1	0.25	0	0	
9 Sandea + clethodim 8 oz/A	28 days	over-the-top	15.6%	66.9%	18.4%	51.3	241.0	42,848	223.3	955.2	3.8	4.7	5.6	0.5	0	0	
		Average	15.6%	68.0%	16.5%	54.6	278.8	50879.8	265.5	1158.9	4.2	5.1	5.9	0.3	0.1	0.0	
		LSD 0.05	ns	ns	ns	ns	48.3	---	---	---	---	---	---	0.67	ns	---	
		CV,%	38	13.2	31.9	11.8	11.9	---	---	---	---	---	---	137	283	---	

- 1) Fruit size based on number of fruit per plot, L = > than 6 lbs, M = 4 to 6 lbs, S = < 4 lbs.
 2) TMY = total marketable yield, calculated from the M and L fruit size. Carton = 30 lbs
 3) Fruit size based on weight of 10 melons per plot, 95% confidence levels of weight of fruit per treatment.
 4) Ratings scale: 0 = no weeds/no phyto, 1 = <10%, 2 = <25%, 3 = < 50%, 4 = <75%, 5 < 90%, 6 = >90% weeds or phyto
 LSD 0.05 = Least significant difference at the 95% confidence level. NS = not significant. --- = not enough data to perform statistical analysis

CV = coefficient of variation																
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Table 3. Weed control, crop phytotoxicity, and cantaloupe yield at Bowles trial location, 2017.

Herbicide treatment	Timing	Placement	7-Aug				18-Aug			31-Aug			2-Oct		Estimated Yield, boxes/A				
			Stand	Rating BL	Grasses	Crop Phyto	BL	Rating Grasses	Crop Phyto	BL	Rating Grasses	Crop Phyto	Weeds	Fruit #/plot	6	9	12	15	Total
1 UTC	none	none	13.5	0.8	0.3	0	1.3	0.3	0	1.8	0	0	2.3	47.0	369	432	184	96	1081
2 Sandea 1 oz/A	3-5 leaves	directed	13.25	0.0	0.0	0	0.5	0.3	0	0.0	0	0	0.5	48.3	379	443	189	99	1110
3 Sandea 1 oz/A	28 days	directed	14.25	0.8	0.3	0	1.3	0.3	0	1.0	0	0	2.5	47.0	369	432	184	96	1081
4 Sandea + clethodim 8 oz/A	3-5 leaves	directed	13.5	0.5	0.3	0	0.3	0.3	0	0.0	0	0	0.8	52.5	412	482	206	108	1208
5 Sandea + clethodim 8 oz/A	28 days	directed	16.75	0.8	0.0	0	1.0	0.0	0	0.8	0	0	1.5	47.0	369	432	184	96	1081
6 Sandea 1 oz/A	3-5 leaves	over-the-top	11.25	0.0	0.0	0	0.0	0.0	0	0.0	0	0	0.5	47.3	371	434	185	97	1087
7 Sandea 1 oz/A	28 days	over-the-top	10.25	0.8	0.3	0	1.0	0.3	0	1.5	0	0	2.3	46.3	363	425	182	95	1064
8 Sandea + clethodim 8 oz/A	3-5 leaves	over-the-top	13.25	0.3	0.3	0	0.0	0.3	0	0.0	0	0	0.0	47.8	375	438	187	98	1099
9 Sandea + clethodim 8 oz/A	28 days	over-the-top	12.25	0.5	0.0	0	1.0	0.5	1.25	1.0	0.25	0	1.5	38.0	298	349	149	78	874
		Average	13.14	0.47	0.14	0.00	0.69	0.22	0.14	0.67	0.03	0.00	1.31	46.78	367	430	184	96	1076
		LSD 0.05	ns	ns	ns	---	0.78	ns	---	0.81	---	---	1.5	ns	---	---	---	---	---
		CV, %	20.9	182.9	281	---	76.2	201.9	---	83.2	---	---	79.1	15.1	---	---	---	---	---
Main effect of timing	3 - 5 leaves		12.8	0.19	0.13	0.00	0.19	0.19	0.00	0.00	0.00	0.00	0.44	48.94	384	449	192	100	1126
	28 days		13.4	0.69	0.13	0.00	1.06	0.25	0.31	1.06	0.06	0.00	1.94	44.56	350	409	175	91	1025
	f-test		ns	**	ns	---	***	ns	---	***	---	---	***	*	---	---	---	---	*
main effect of placement		directed	14.4	0.50	0.13	0.00	0.75	0.19	0.00	0.44	0.00	0.00	1.31	48.69	382	447	191	100	1120
		over-the-top	11.8	0.38	0.13	0.00	0.50	0.25	0.31	0.63	0.06	0.00	1.06	44.81	352	411	176	92	1031
		f-test	*	ns	ns	---	ns	ns	---	ns	---	---	ns	ns	---	---	---	---	ns

Ratings scale: 0 = no weeds/no phyto, 1 = <10%, 2 = <25%, 3 = <50%, 4 = <75%, 5 < 90%, 6 = >90% weeds or phyto

BL = broadleaf weeds, Grass = grassy weeds

LSD 0.05 = Least significant difference at the 95% confidence level. NS = not significant. --- = not enough data to perform statistical analysis

CV = coefficient of variation

f-test, *, **, *** significant at 0.05, 0.01, and 0.001 respectively

Table 4. Weed control, crop injury, and crop yield at the Yuma Agriculture Station test site, 2017.

Herbicide Treatment	Rate	Unit	timing (1)	Plant method	%control on 28-Aug (2)				%control on 6-Sep				11-Sep phyto, %	Oct 20 harvest (3)		
					Junglerice	Purslane	Pigweed	crop phyto, %	Junglerice	Purslane	Pigweed	crop phyto, %		Weight	lbs/A	Brix
1 Transplant Check	0		none	Transplant	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	1866.9	8.8
2 Sandea	1	oz/A	Pretransplant	Transplant	26.7	28.3	26.7	0.0	50.0	26.7	30.0	0.0	0.0	19.3	6015.4	11.2
3 Sandea	1	oz/A	3-5 leaves	Transplant	41.7	61.7	76.7	20.0	36.7	46.7	46.7	85.0	88.3	4.7	1452.0	9.1
4 Sandea	1	oz/A	28 DAT	Transplant	--	--	--	--	--	--	--	--	25.3	3.7	1140.9	8.3
5 Sandea	1	oz/A	3-5 leaves	seed	41.7	83.3	83.3	48.3	70.0	71.7	71.7	80.0	83.3	11.0	3422.6	9.0
6 Sandea	1	oz/A	28 DAE	seed	--	--	--	--	--	--	--	--	24.7	9.0	2800.3	8.7
7 Sandea+Select	1+8	oz/A + fl oz/A	3-5 leaves	Transplant	86.7	90.0	91.7	83.3	86.7	100.0	100.0	93.3	93.3	11.2	3474.4	8.2
8 Sandea+Select	1+8	oz/A + fl oz/A	28 DAT	Transplant	--	--	--	--	--	--	--	--	76.7	4.3	1348.3	8.2
9 Sandea+Select	1+8	oz/A + fl oz/A	3-5 leaves	seed	83.3	93.3	92.3	85.0	61.7	96.7	96.7	91.7	91.7	3.8	1192.7	9.5
10 Sandea+Select	1+8	oz/A + fl oz/A	28 DAE	seed	--	--	--	--	--	--	--	--	76.7	3.8	1192.7	8.5
11 Sandea	1	oz/A	Preemergence	seed	19.3	15.0	15.0	1.7	46.7	20.0	20.0	0.0	0.0	24.3	7571.1	8.7
12 Seeded Check	0		none	seed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.3	6948.9	9.8
Average					49.9	61.9	64.3	39.7	58.6	60.3	60.8	58.3	56.0	10.3	3202.2	9.0
LSD 0.05					26.6	28.1	22.9	12.8	ns	53.1	43.5	8.6	27.9	15.3	4758	ns
CV, %					29.3	24.9	19.6	17.8	46.9	48.4	39.3	8.1	29.1	87.7	87.7	35.3
Main effect of herbicide																
Sandea					32.3	47.1	50.4	17.5	50.8	41.3	42.1	41.3	36.9	12	3733	7.7
Sandea+Select					85.0	91.7	92.0	84.2	74.2	98.3	98.3	92.5	84.6	5.8	1802	7.8
F-test					***	**	*	***	ns	**	***	*	***	ns	ns	ns
Main effect of timing																
PRE					23.0	21.7	20.8	0.8	48.3	23.3	25.0	0.0	0.0	21.8	6793.3	9.9
3-5 leaves					63.3	82.1	86.0	59.2	63.8	78.8	78.8	87.5	89.2	7.7	2385.4	8.9
28 days post					--	--	--	--	--	--	--	--	50.8	5.2	1620.5	8.4
LSD 0.05					29.3	22.1	15.8	31.8	ns	39.4	35.4	*	21.3	10.4	3230	ns
Main effect of plant method																
Transplant					51.7	60.0	65.0	34.4	57.8	57.8	58.9	59.4	56.7	8.6	2686.2	9.0
Direct seed					48.1	63.9	63.6	45.0	59.4	62.8	62.8	57.2	55.3	10.4	3235.9	8.9
F-test					ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

1) DAT = days after transplanting, DAE = days after emergence

2) % control relative to untreated checks, where 0% = no weed control/crop phyto, and 100% = complete weed control/crop death.

Untreated checks are shown for comparison only and not included in the statistical analysis.

-- = no data because the 28 day treatments had not been applied

3) total weight of melons per plot. No evaluation on marketability.

LSD 0.05 = Least significant difference at the 95% confidence level. NS = not significant.

CV = coefficient of variation

t-test, *, **, *** significant at 0.05, 0.01, and 0.001 respectively