California Melon Board Report – Dec 1, 2012

I. Project Title: Melon tolerance and weed control with new herbicides

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IV. Project Objectives: Determine the tolerance of cantaloupe and honeydew melons to potential new herbicides. Determine the efficacy of those herbicides for weed control. Possible "new" herbicides for melons include linuron (Lorox), metolachlor (Dual Magnum), flumioxazin (Chateau), sulfentrazone (Spartan), pendimethalin (Prowl H_2O), clomazone (Cerano) and fomesafen (Reflex).

V. Summary of Research Results: Weed control in melons is difficult due to the limited availability of registered herbicides. Field trials in 2012 included Lorox, Dual Magnum, Château, Prowl H_2O, Spartan (new name is Zeus), Reflex, Command, and a combination treatment – Spartan plus Dual Magnum. Two cantaloupe varieties, and a honeydew melon and a watermelon variety were tested for tolerance and weed control with these herbicides. Herbicide applications were made after planting, but prior to crop emergence and incorporated with sprinkler irrigation. Dual Magnum and Command were the highest yielding treatments in 2012. Weed control was very good with these treatments, and crop safety was also good. Other treatments provided good weed control, but the melon stand was reduced by some treatments and even when stands were not reduced, some reduction in growth was seen. The combination of Dual Magnum and Spartan was attempted, as each of these materials has been shown to be effective and moderately safe in previous years. The rates of one or both of these materials may need to be reduced to improve crop safety, or perhaps mechanical incorporation may need to be used.

VI. Research Procedures: On May 16, 2012, melon seed of four varieties (Cantaloupe – Oro Rico and Esteem; Honeydew melon – Saturno; Watermelon-Charleston Grey) was planted into 60-inch beds. Every other bed was planted, thus allowing 120 inches between seed lines. Only one variety was planted per 220 ft. long bed. Individual herbicide plots were 20 ft. by 40 ft. (across all four varieties) and were replicated four times. Herbicide treatments (Table 1) were applied on May 17 following melon seeding, and on the same day, the entire plot area was sprinkler irrigated (0.5 inches) to incorporate the herbicides. The experiment used a randomized complete block design with 4 replications. Each plot was 8 beds (2 – 60" beds per melon variety) and 20 feet long. Melon stand was measured for each species on June 8, by counting the number of emerged melons in the center meter of each plot. Melon vigor was visually assessed (0 to 10 scale, with 0 = no melons, and 10 = good melon stand and growth) on June 14, June 29, and July 12, in each plot, noting chlorosis, leaf abnormalities, and any reduction in stand, growth or vigor. Weed control by species was visually assessed (0 to 100 scale, with 0 = no control) on June 14, June 20, June 29, and July 12, 2012. Cantaloupes were harvested in

August (5 harvest dates), Honeydew melons on Aug 29 and Sept 5th, and watermelon on Aug 17 and Aug 23. Mature marketable fruit were harvested, counted and weighed for each plot.

Results

Melon stand counts on June 8th varied among treatments for Esteem cantaloupe, but were not statistically different for the other varieties (Table 2). Dual Magnum, Spartan, and Command appeared to have better melon stands overall, compared to other treatments. However, the combination of Spartan and Dual was generally more injurious than other treatments. Melon vigor varied among treatments for all melon types on June 14th (Table 3). Reflex or the combination of Spartan plus Dual Magnum was the most injurious to the cantaloupes at this date. Honeydew melon was more tolerant to reflex, but was still set back by the Spartan plus Dual Magnum combo or Prowl H_2O. Prowl H_2O was also the most injurious to watermelon on June 14th.

By June 29th, melon vigor had improved slightly for many treatments (Table 4). However, the combination of Spartan and Dual was generally more injurious than other treatments to the cantaloupes. Lorox was the most injurious to honeydew melon. In 2012, the rate of Lorox was lowered from 2.0 lbs to 1.25 lbs/a in order to reduce injury (seen in 2011), but injury was still observed. By July 12, only the combination of Spartan and Dual Magnum or Reflex were still causing noticeable cantaloupe injury; Honeydew melon and watermelon were no longer affected by treatment (Table 5).

Purslane control on was good to excellent with all treatments except Lorox (Table 6). The treatments maintained good purslane control through July 12th, with Dual Magnum being the only treatment where purslane control declined substantially. Dual Magnum also was also weak on purslane in 2011.

Pigweed (a mixture of *Amaranthus blitoides* – prostrate pigweed and *A. retroflexus* – redroot pigweed) control was excellent with treatments other than Lorox and Command (Table 7). Dual Magnum, Reflex and Spartan were the most effective treatments, maintaining 95% or better pigweed control through July 12th. Command was very weak on pigweed.

Lambsquarters control was good to excellent initially with all treatments (Table 8). Dual Magnum was less effective than other treatments against lambsquarters, as the season progressed.

Yellow nutsedge control was initially very good with Dual Magnum, Reflex, or the combination of Spartan and Dual Magnum (Table 9). Dual Magnum alone or with Spartan was still the best treatments on July 12th for nutsedge suppression; Nutsedge control with reflex declined 20% between June 14 and July 12th.

Black nightshade control was good to excellent with all treatments (Table 10). Command was the weakest treatment for nightshade control, however, even this treatment provided 85% control by late June. Nightshade was sparse throughout the plots and control would have likely been lower if populations were higher.

Grass weed pressure was low in 2012, with the major species being stinkgrass (*Eragrostis cilianensis*) and barnyardgrass (*Echinochloa crus-galli*). Most treatments were very effective against the grasses (Table 11). The one treatment with poor grass control in this trial was Spartan. It would be expected that Reflex and Chateau would also have mediocre grass control, since these are known primarily as broadleaf herbicides.

The yield (number) of Esteem cantaloupe fruit did not vary by harvest date except for the third harvest on August 20th (Table 12). On the third harvest, both Lorox and Reflex plots had

lower number of fruit than did the untreated plots. The total number of fruit harvested was also lowest for the Reflex plots, with Command and Dual Magnum plots having the highest number of marketable Esteem cantaloupe. Esteem cantaloupe fruit weight followed a similar pattern as fruit number (Table 13). Average fruit size was about 3 lbs for most treatments, but was around 2.8 lbs per fruit in the Lorox plots and only about 2.2 lbs per fruit in the untreated plots. Fruit weight was probably reduced by weed competition in the untreated plots, but a combination of herbicide toxicity and competition likely reduced fruit weight in the Lorox plots. Esteem cantaloupe vigor ratings made on July 12th were positively correlated with number of fruit (r^2=0.855***) and with fruit weight (r^2=0.716***). Esteem cantaloupe stand measurements made on June 8th were also positively correlated with number of fruit (r^2=0.527***) and with fruit weight (r^2=0.304*).

The yield (number) of Oro Rico cantaloupe fruit picked in the first, second and fifth harvest varied by treatment, but total from all five harvests did not vary (Table 14). Total fruit weight of Oro Rico cantaloupes also followed the same pattern as fruit number (Table 15). Overall cantaloupes, Dual Magnum and Command were the best treatments for yield. Oro Rico cantaloupe vigor ratings made on July 12th were positively correlated with number of fruit (r^2=0.763***) and with fruit weight (r^2=0.741***). Oro Rico cantaloupe stand measurements made on June 8th were also positively correlated with number of fruit (r^2=0.562***) and with fruit weight (r^2=0.475**). Control of the individual weed species was not correlated with cantaloupe yields.

The number of honeydew melons did not differ by harvest date, but was lowest in the untreated plots overall (Tables 16 and 17). Both Spartan and Reflex plots had the largest number and weight of harvested honeydew melons. Spartan or Reflex were also among the best treatments for honeydew melons in 2011. As noted in 2011, honeydew melon numbers in 2012 were also very low yielding in Lorox treated plots. Yield was not correlated with honeydew melon stand measured on June 8th or with vigor measured on July 12th. However, yield was positively correlated to July 12th weed control (purslane - r^2=0.649***, pigweed - r^2=0.488**, lambsquarters - r^2=0.621***, nutsedge - r^2=0.472**, and grass - r^2=0.407**).

Watermelon yields were similar in all treated plots compared to the untreated plots (Tables 18 and 19). Dual Magnum and Reflex treated plots were among the best in terms of watermelon yield. Watermelon stand measurements made on June 8th were also positively correlated with number of fruit (r^2=0.346*) and watermelon vigor measurements made on July 12th were also positively correlated with number of fruit (r^2=0.592***) and with fruit weight (r^2=0.600**).

In conclusion, Dual Magnum and Command were the highest yielding treatments in 2012. Weed control was very good with these treatments, and crop safety was also good. Other treatments provided good weed control, but the melon stand was reduced by some treatments and even when stands were not reduced, some reduction in growth was seen. The combination of Dual Magnum and Spartan was attempted, as each of these materials has been shown to be effective and moderately safe in previous years. The rates of one or both of these materials may need to be reduced to improve crop safety, or perhaps mechanical incorporation may need to be used.

Table 1. Treatments and rates for weed control in melons.

	Timing	Rate
Lorox	PRE	1.25 lb ai/a
Dual Magnum	PRE	1.25 lb ai/a
Chateau	PRE	1.5 oz ai/a
Prowl H_2O	PRE	1.40 lb ai/a
Spartan	PRE	0.10 lb ai/a
Reflex	PRE	0.20 lb ai/a
Command	PRE	0.75 lb ai/a
Spartan + Dual Magnum	PRE	0.10 + 1.25
Untreated		

Table 2. Stand count (#/m of row) on June 8, 2012

Treatment	Esteem Cantaloupe	Oro Rico Cantaloupe	Saturno Honeydew	Charleston Grey Watermelon
	----------(#/m of row)----------			
Lorox	6.5	4.5	7.5	5.0
Dual Magnum	11.0	7.2	8.2	6.2
Chateau	3.2	5.2	7.0	6.2
Prowl H_2O	7.8	5.8	11.5	4.5
Spartan	8.2	7.0	9.5	6.0
Reflex	2.5	3.0	9.8	5.2
Command	9.5	7.0	12.8	6.0
Spartan + Dual	3.8	4.2	5.2	5.0
Untreated	11.0	7.2	12.8	4.8
LSD .05	6.0	NS	NS	NS

Table 3. Vigor rating (0-10 scale, 0 = dead, 10 = healthy) on June 14, 2012.

Treatment	Esteem Cantaloupe	Oro Rico Cantaloupe	Saturno Honeydew	Charleston Grey Watermelon
	----------(0-10 scale)----------			
Lorox	6.5	7.5	6.5	9.0
Dual Magnum	9.8	9.0	9.5	9.5
Chateau	6.5	7.2	7.8	8.8
Prowl H_2O	4.5	4.8	6.2	4.8
Spartan	6.5	6.0	9.2	8.2
Reflex	3.0	2.8	9.0	8.2
Command	8.5	9.2	10.0	8.0
Spartan + Dual	3.8	3.2	6.0	6.8
Untreated	9.8	8.8	9.8	6.8
LSD .05	4.4	3.7	2.7	2.7

Table 4. Vigor rating (0-10 scale, 0 = dead, 10 = healthy) on June 29, 2012.

Treatment	Esteem Cantaloupe	Oro Rico Cantaloupe	Saturno Honeydew	Charleston Grey Watermelon
	----------(0-10 scale)----------			
Lorox	6.5	8.0	6.5	9.0
Dual Magnum	9.8	9.5	9.5	9.5
Chateau	6.5	8.0	8.2	9.0
Prowl H_2O	6.2	6.0	7.8	5.5
Spartan	7.2	6.5	9.5	8.8
Reflex	3.0	3.2	9.5	8.5
Command	8.8	9.2	10.0	8.5
Spartan + Dual	4.2	3.5	7.2	7.0
Untreated	9.8	8.2	9.8	7.2
LSD .05	4.3	3.6	2.3	NS

Table 5. Vigor rating (0-10 scale, 0 = dead, 10 = healthy) on July 12, 2012.

Treatment	Esteem Cantaloupe	Oro Rico Cantaloupe	Saturno Honeydew	Charleston Grey Watermelon
	----------(0-10 scale)----------			
Lorox	6.5	8.5	7.0	9.0
Dual Magnum	10.0	9.8	9.5	9.8
Chateau	7.0	9.0	8.5	9.0
Prowl H_2O	7.2	6.0	8.5	7.2
Spartan	7.8	7.2	9.8	9.2
Reflex	3.0	3.5	9.8	9.2
Command	8.8	9.2	10.0	9.0
Spartan + Dual	5.2	4.2	8.2	8.0
Untreated	9.8	8.2	9.2	7.2
LSD .05	4.1	3.4	NS	NS

Table 6. Purslane control (%) relative to treatment and date.

Treatment	June 14	June 20	June 29	July 12
	----------(#/m of row)----------			
Lorox	45	41	50	70
Dual Magnum	94	86	85	78
Chateau	97	92	91	91
Prowl H_2O	94	91	91	94
Spartan	98	97	96	95
Reflex	82	85	86	90
Command	97	95	95	98
Spartan + Dual	99	99	99	95
Untreated	0	0	0	0
LSD .05	14	12	16	18

Table 7. Pigweed control (%) relative to treatment and date.

Treatment	June 14	June 20	June 29	July 12
	----------(#/m of row)----------			
Lorox	60	60	68	78
Dual Magnum	99	100	100	100
Chateau	98	87	88	88
Prowl H_2O	97	94	85	78
Spartan	98	96	95	95
Reflex	100	100	100	98
Command	60	50	41	22
Spartan + Dual	100	100	100	100
Untreated	0	0	0	0
LSD .05	16	13	15	18

Table 8. Lambsquarters control (%) relative to treatment and date.

Treatment	June 14	June 20	June 29	July 12
	----------(#/m of row)----------			
Lorox	80	85	86	78
Dual Magnum	89	82	81	72
Chateau	99	95	92	92
Prowl H_2O	100	100	100	100
Spartan	100	100	100	100
Reflex	96	94	94	90
Command	100	100	100	97
Spartan + Dual	100	100	100	100
Untreated	0	0	0	0
LSD .05	8	9	10	14

Table 9. Yellow nutsedge control (%) relative to treatment and date.

Treatment	June 14	June 20	June 29	July 12
	----------(#/m of row)----------			
Lorox	70	65	60	82
Dual Magnum	99	95	91	90
Chateau	35	32	35	35
Prowl H_2O	60	50	38	30
Spartan	76	72	75	70
Reflex	88	80	78	70
Command	32	32	32	40
Spartan + Dual	97	96	95	95
Untreated	0	0	0	0
LSD .05	36	34	35	39

Table 10. Black Nightshade control (%) relative to treatment and date.

Treatment	June 20	June 29
	-----(#/m of row)------	
Lorox	81	92
Dual Magnum	85	98
Chateau	89	95
Prowl H_2O	86	98
Spartan	93	98
Reflex	95	100
Command	75	85
Spartan + Dual	99	100
Untreated	0	0
LSD .05	11	11

Table 11. Grass control (%) relative to treatment and date.

Treatment	June 29	July 12
	-----(#/m of row)------	
Lorox	90	95
Dual Magnum	98	100
Chateau	86	90
Prowl H_2O	96	98
Spartan	71	52
Reflex	89	94
Command	100	92
Spartan + Dual	99	98
Untreated	0	0
LSD .05	19	22

Table 12. Esteem cantaloupe yield (#/20ft) relative to harvest date.

	----------August----------					
Treatment	13	16	20	23	28	Total
	----------(#/20ft of row)----------					
Lorox	4	16	12	5	4	41
Dual Magnum	8	16	28	11	6	70
Chateau	10	19	13	6	4	52
Prowl H_2O	7	13	20	9	4	54
Spartan	5	13	18	12	8	56
Reflex	2	15	7	6	4	34
Command	8	23	20	5	3	60
Spartan + Dual	4	10	17	7	5	43
Untreated	2	13	22	9	6	52
LSD .05	NS	NS	9	NS	NS	21

Table 13. Esteem cantaloupe yield (lbs/20ft) relative to harvest date.

	August					
Treatment	13	16	20	23	28	Total
	(lbs/20ft of row)					
Lorox	13.9	49.6	36.2	12.9	10.8	123.5
Dual Magnum	23.1	50.2	87.5	33.6	16.0	210.5
Chateau	33.7	62.5	39.7	20.6	12.6	169.2
Prowl H_2O	21.5	37.8	61.1	22.0	9.4	151.8
Spartan	16.2	35.6	60.8	35.7	19.2	167.5
Reflex	5.7	49.4	24.5	20.7	11.8	112.0
Command	25.5	71.5	61.0	14.0	8.8	180.7
Spartan + Dual	13.8	35.2	55.2	19.1	13.0	136.3
Untreated	6.4	33.3	62.5	25.6	13.6	114.1
LSD .05	NS	NS	29.8	NS	NS	65.6

Table 14. Oro Rico cantaloupe yield (#/20ft) relative to harvest date.

	August					
Treatment	13	17	20	23	28	Total
	(#/20ft of row)					
Lorox	3	30	16	9	6	64
Dual Magnum	8	26	22	9	7	72
Chateau	10	31	17	10	5	72
Prowl H_2O	1	12	9	8	7	37
Spartan	4	21	13	10	13	61
Reflex	2	11	14	9	7	43
Command	5	26	18	10	5	64
Spartan + Dual	0	6	10	11	13	40
Untreated	2	14	13	8	6	44
LSD .05	4	14	NS	NS	7	NS

Table 15. Oro Rico cantaloupe yield (lbs/20ft) relative to harvest date.

	August					
Treatment	13	16	20	23	28	Total
	(lbs/20ft of row)					
Lorox	8.6	91.4	39.2	25.4	16.0	180.5
Dual Magnum	24.5	80.8	63.7	23.0	15.0	199.5
Chateau	32.3	93.0	46.2	28.4	13.9	213.7
Prowl H_2O	2.5	38.3	27.6	24.2	22.8	115.4
Spartan	13.7	68.3	50.2	24.0	19.5	175.7
Reflex	6.8	35.3	42.7	23.8	19.9	128.4
Command	14.7	75.5	51.0	24.8	14.6	180.6
Spartan + Dual	0.0	19.7	31.5	32.3	36.2	119.7
Untreated	5.0	36.4	34.3	18.5	15.3	109.7
LSD .05	13.2	44.8	NS	NS	19.0	NS

Table 16. Saturno honeydew melon yield (#/20ft) relative to harvest date.

Treatment	Aug 29	Sept.5	Total
	-------(#/20ft of row)----------		
Lorox	22	20	42
Dual Magnum	29	22	51
Chateau	29	20	49
Prowl H_2O	22	25	47
Spartan	32	29	61
Reflex	31	32	63
Command	28	26	54
Spartan + Dual	25	29	54
Untreated	12	14	27
LSD .05	NS	NS	15

Table 17. Saturno honeydew melon yield (lbs/20ft) relative to harvest date.

Treatment	Aug 29	Sept.5	Total
	-------(lbs/20ft of row)----------		
Lorox	112.2	84.8	197.0
Dual Magnum	146.0	84.2	230.2
Chateau	161.4	78.0	239.4
Prowl H_2O	114.1	87.6	201.7
Spartan	163.3	97.3	260.6
Reflex	173.8	111.8	285.6
Command	130.0	84.5	214.5
Spartan + Dual	139.7	115.3	255.0
Untreated	59.4	47.0	106.3
LSD .05	NS	NS	62.6

Table 18. Charleston Grey watermelon yield (#/25ft) relative to harvest date.

	----------August----------		
Treatment	17	23	Total
	-------(#/20ft of row)----------		
Lorox	6	14	20
Dual Magnum	10	11	22
Chateau	10	8	19
Prowl H_2O	9	8	17
Spartan	9	10	18
Reflex	6	15	23
Command	10	6	16
Spartan + Dual	8	9	17
Untreated	4	4	8
LSD .05	4	NS	7

Table 19. Charleston Grey watermelon yield (lbs/20ft) relative to harvest date.

	August		
Treatment	17	23	Total
	(lbs/20ft of row)		
Lorox	140.1	192.3	332.4
Dual Magnum	173.0	148.4	321.3
Chateau	192.4	104.0	296.4
Prowl H_2O	172.9	94.0	266.9
Spartan	162.4	104.9	267.3
Reflex	117.6	184.8	314.2
Command	153.8	67.7	221.6
Spartan + Dual	169.3	117.4	286.7
Untreated	59.0	42.6	101.6
LSD .05	62.0	NS	105.0