

## California Pepper Commission – Final Report, 2007

### Title: Weed Control Trials in Peppers

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**Timeline:** March 1, 2007 to February 28, 2008

**Summary:** This year's trial in the Coastal District indicated that all pretransplant herbicide treatments provided good early season weed control. Matrix provided the best early season weed control but was too phytotoxic to the peppers. Layby applications of Dacthal and Dual Magnum did not appear to provide significant weed control into August; however, post directed sprays of V-10142 provided good late season weed control. All herbicides appeared to reduce yield to some degree and Matrix and Sandea reduced yield below the other herbicides. These studies indicate that late season weed control in peppers continues to be a very difficult issue in the Coastal production district.

The South San Joaquin Valley trial investigated the utility of several preemergent herbicides applied at-planting and/or at layby in transplanted bell peppers. Dual Magnum 7.62 and Outlook 6.0 were the main herbicides that were evaluated, but Dacthal 75W, Matrix, Prowl H<sub>2</sub>O, Spartan 4F and V-10142 were also tested. At-planting applications of Dual Magnum and Outlook provided excellent weed control with very minor crop phytotoxicity. Layby applications of Dual Magnum, Prowl H<sub>2</sub>O, and Dacthal were also excellent at controlling weeds. V-10142 applied at layby also provided excellent weed control. Spartan applied at a low rate (0.1 lb a.i./A) at layby provided insufficient weed control over this spectrum of weeds. Matrix applied over-the-top at planting was too harsh on pepper transplants causing loss of stand, significant yield loss, and only mediocre weed control perhaps exacerbated by lack of pepper stand.

Overall, V-10142 provided an excellent late-season weed control option for peppers as it was safe for use as a directed spray and controlled many weed species. Valent Corp. has decided to not pursue registration of this material for use on peppers at this time due to long-term carryover issues. At transplanting applications of Dual Magnum provided good weed control 102 days after treatment (DAT) at the Fresno trial; however following the at transplanting application of Dual Magnum with layby applications of Dual Magnum, Dacthal or Prowl H<sub>2</sub>O provided nearly complete weed control. This level of weed control was not seen in the Monterey County trial; it is unclear why this occurred, but it may have been due to low weed pressure that made detecting differences among treatments at the site difficult. Dacthal is already registered for use on peppers and can provide a useful tool for late-season weed control in peppers. Prowl H<sub>2</sub>O was registered for use in 2008 and will provide good control

of key weeds in peppers (i.e. purslane, lambsquarters and pigweed). We are working with Syngenta Corp to clarify the wording of the Dual Magnum label to allow its use as a layby application for peppers. In all, these materials should provide growers producing peppers on un-mulched beds with options to deal with early as well as late-season weeds in peppers.

**Background:** Peppers are long-season vegetables that have several weed control challenges: They compete weakly with weeds for the first 40 to 60 days following transplanting. They are a long-season crop in many production districts that can be subject to flushes of both winter and summer weeds over the course of their growing cycle. The preemergence herbicides registered for peppers have gaps in the spectrum of weeds that they control (Smith et al., 2003). As a result, growers may spend from \$200 to \$350/acre (Klonsky et al., 1997) on weed management. Field selection, field sanitation, cultivation and the use of plastic mulches are cultural practices that reduce weed pressure in production fields. Fumigation provides substantial weed control and is frequently used in conjunction with plastic mulches which improves the level of weed control provided by both techniques. Goal Tender was registered in California in 2004 for use with plastic mulch and provides control of Little Mallow (*Malva parviflora*) which is only partially controlled by fumigants and other preemergence herbicides registered for use on peppers. However, many acres of peppers are not grown with plastic mulch, and weed control is a challenge. Devrinol, Prefar and Treflan are registered preemergence herbicides in peppers. Dual Magnum is registered under a 24C and provides good control of hairy nightshade (*Solanum sarrachoides*) and yellow nutsedge (*Cyperus esculentus*) which are not controlled by the other preemergent materials. Late season weed control is also an important issue in this crop. The objective of these studies was to examine at transplant and layby herbicide combinations for peppers that can provide long-term and economical weed control for peppers grown without plastic mulch.

### **Objectives:**

- 1) Examine weed control options at the following growth stages: 1) at transplant (Dual Magnum, and Outlook); 2) at layby (Dacthal, Prowl H2O and Dual Magnum); and 3) Post emergence treatments (Sanda and V-10142); and 4) late season rope wick applications (Rely and Roundup). Evaluations of weed control, crop safety and yield will be conducted.
- 2) Conduct the above trials in the Coastal and Central Valley production districts.

### **METHODS**

Field trials were conducted on the Central Coast (Monterey County) and South San Joaquin Valley (Fresno County) in 2007 to provide an evaluation of the test herbicides over a wider range of growing conditions and weed spectra.

**Central Coast Trial Methods:** The following trial was established with a cooperating grower near King City. Pretransplant applications were made on May 28 and the peppers were transplanted on May 29. Layby applications of Dacthal and Dual Magnum were made on July 2 and post directed applications of V-10142 were made on June 28. Each plot was one 40-inch bed wide by 20 feet long and replicated four times in a randomized complete block design. The field was sprinkler irrigated until layby at which time one drip line was installed in the middle of the bed and was used to irrigate the crop the remainder of the season.

Pretransplant treatments were applied to the entire bed in 74 gallons of water per acre with two passes of 1-8008E teejet nozzle at 30 psi. Layby and post directed applications were made with directed spray to the base of the plant using two passes of a one nozzle wand with an 8008E teejet nozzle per seed line at 30 psi applying 148 gallons of water per acre. Yield was conducted on October 22 by harvesting a 10 foot strip in the middle of each plot and separating red, green, turning and culled fruit. All fruit was counted and weighted. The soil type at the site was a Lockwood gravelly loam (pH = 7.2; sand – 55%, silt – 29% and clay – 16%) and the variety was pimento.

***Fresno County Trial Methods:*** On April 19, 2007 the bell pepper variety “Taurus” was transplanted in single rows into 40” beds. Within row spacing was 9” between plants. Plot size was two 40-inch beds x 70 feet of row length and replicated 4 times in a Randomized Complete Block Design. All herbicide applications were applied to the entire plot with a CO<sub>2</sub> backpack sprayer at 30 psi and XR 8003evs Teejet nozzle tips mounted on a two nozzle boom with a water volume of 30 gallons per acre.

The at-planting treatments of Dual Magnum, Matrix, and Outlook were applied over-the-top post transplant.

The field was sprinkler irrigated applying 0.50 inch of water immediately following transplanting and more water was applied the following day. Sprinkler irrigation continued as needed for a few weeks and then switched to furrow irrigation. On May 28-31 the whole field was machine cultivated and hand weeded. No irrigation water was applied until after the layby herbicide treatments.

Layby applications of the preemergence herbicides, Dacthal, Dual, Prowl H<sub>2</sub>O, V-10142, and Spartan were made on June 8 (50 DAT) as directed sprays to the base of the plants using drop nozzles. Furrow irrigation was used to water in the herbicides. The experiment included an untreated check.

Plots were evaluated for phytotoxicity to the peppers and weed control on May 17 (28 Days after transplanting [DAT]) and July 30 (52 Days after layby, 102 DAT). Throughout the season the pepper stand was very uniform and was only affected by the Matrix applications. A portion of each plot (25’ row) was hand harvested on July 30 (west bed only). See **Table 1** for a list of treatments and results.

## **RESULTS**

***Central Coast Results:*** There was low to moderate weed pressure at this site. On the first weed evaluation date on June 21 there were good differences among the treatments. Only pretransplant applications were evaluated on this day as the layby and post directed applications had not yet been applied. All treatments provided moderate weed control except for Matrix which provide good weed control, but had unacceptable phytotoxicity (Table 1). The second weed evaluation was conducted on July 2. Layby and post directed applications had not been applied yet. Weed pressure was lower on this evaluation date because weed evaluations were made of the uncultivated seedlines (Table 2). Total weeds and time to weed were not significantly different among treatments. Phytotoxicity was still high for Matrix.

The third evaluation date on August 9 had low weed populations. The sequential application of 0.52 lb of V-10142 provided complete weed control on this date (Table 3). Weed populations were higher on the fourth weed evaluation on September 5 which was a measure of late season weed pressure. The layby treatments did not improve weed control over the untreated control (Table 4); however, the sequential application of V-10142 provided the best weed control. In past years we have seen that the percent of red fruit was a sensitive measure of stress on the peppers caused by the herbicides. None of the herbicides had a lower percent of red fruit than the untreated control (Table 5); V-10142 at 0.30 lb a.i./A had a greater percent of red fruit. Nearly all herbicide treatments had lower tonnage and number of fruit than the untreated. This was a surprising result that we have not observed in prior years. Matrix and Sandea both had lower tonnage and number of fruit than the other herbicide treatments. Two sequential applications of 0.52 lb/A of V-10142 had the lowest mean fruit weight.

**Fresno County Results:** Untreated plots rapidly became very weedy. The major weeds that were most uniformly distributed throughout the field this year were tumble, prostrate, and redroot pigweeds, black nightshade, groundcherry, and purslane. Lambsquarters and sowthistle were also present throughout, but not as heavy pressure. London rocket, shepherdspurse, puncturevine, and junglerice were also present, but were not as uniformly distributed throughout the field. Volunteer wheat was the most plentiful grass weed. At layby all weeds were removed with a hand weeding sandwiched between two machine cultivations. Although new seedlings continued to germinate, the weed pressure was not nearly as great.

Planting to layby results: **Matrix** - On May 4 crop phytotoxicity became visually evident especially in Matrix treated plots (Table 6). Pepper plants were very yellow, while this symptom was barely noticeable in Dual Magnum and Outlook treated plants. On May 17 when complete ratings were taken many of the Matrix plants had died and others were severely stunted. This had an obvious effect on crop yield. Weed control of all weeds was excellent. **Dual Magnum and Outlook** – provided excellent broadleaf and grass weed control until layby. Even at harvest broadleaf weed control from the at-planting application was good. Pepper yield was not affected by these herbicides.

Layby to harvest results: Some of the Dual Magnum and Outlook treated at-planting plots were followed with layby applications of Dacthal, Dual Magnum, and Prowl H<sub>2</sub>O to obtain season long weed control. All of these herbicides treatments provided excellent broadleaf weed control on the whole and by species. Prowl was a little weaker on nightshades. There was no phytotoxicity observed with any of the layby applications. Pepper yields were excellent with all of these combinations.

**Dacthal, Spartan, and V-10142** – were applied to weed free, untreated plots at layby to evaluate their performance compared to an untreated check. Yields were lower in these plots, but that was due to the early competition from the weeds and was **not** due to the herbicides. Weed control by these herbicides was not as good as in plots receiving an at-planting herbicide application. **Dacthal** was applied at label rate and provided excellent control of pigweeds, lambsquarters, and sowthistle. It was slightly weaker on purslane, and less

effective on nightshades, but still provided decent control. **Spartan** was tried at a very low rate and this resulted in insufficient broadleaf weed control, especially of nightshades and purslane. A slightly higher rate needs to be tried as no phytotoxicity was observed in the peppers. **V-10142** was tried at two rates and weed control was virtually equal at both rates. This product was excellent on most of the broadleaf weeds, especially purslane, but not as effective on nightshades.

## Central Coast Evaluations

Table 1. Weed count (no. weeds per 40 ft<sup>2</sup>) and phytotoxicity rating of pretransplant treatments on June 21 (24 DAT).

Pretransplant treatment	Material/A	Night-shade	Shepherd's Purse	Purslane	Sow Thistle	Lambs-quarter	Total weeds	Phyto <sup>1</sup>
Untreated		11.3	8.8	1.3	1.8	0.5	24.0	0.0
Dual Magnum 7.62	1.50 pts	4.0	2.3	0.0	0.5	0.8	7.5	0.3
Outlook 6.0	0.80 pt	4.0	2.3	0.0	1.5	0.3	8.5	0.8
Spartan 4F	0.13 lb	14.5	6.3	0.0	0.5	0.8	22.8	0.6
Matrix SG25	0.12 lb	3.3	0.3	0.0	0.0	0.0	3.5	3.0
Dual Magnum 7.62	1.50 pts	4.5	2.0	1.0	0.3	0.5	8.5	0.0
Dual Magnum 7.62	1.50 pts	2.5	2.3	0.3	0.3	0.5	6.0	0.8
Outlook 6.0	0.80 pt	3.8	3.3	0.5	0.8	0.5	8.8	1.4
Outlook 6.0	0.80 pt	4.3	2.0	0.0	0.5	0.5	7.5	1.3
LSD (0.05)		6.1	2.9	0.9	1.3	1.0	8.4	1.3

1- Scale: 0=no crop injury to 10=crop dead

Table 2. Weed count (no. weeds per 20 ft<sup>2</sup>) and phytotoxicity rating of pretransplant treatments on July 2 (35 DAT).

Pretransplant treatment	Material/A	Night-shade	Shepherd's Purse	Purslane	Lambs-quarter	Total weeds	Weed time hrs/Acre	Phyto <sup>1</sup>
Untreated	----	1.8	1.3	0.5	0.5	4.0	3.6	0.0
Dual Magnum 7.62	1.50 pts	2.0	0.0	0.8	0.3	3.5	3.4	0.0
Outlook 6.0	0.80 pt	1.0	0.5	0.0	0.0	1.5	2.2	0.0
Spartan 4F	0.13 lb	4.0	0.8	0.3	0.8	5.7	4.9	0.0
Matrix SG25	0.12 lb	4.5	1.0	0.0	0.3	6.3	4.2	3.5
Dual Magnum 7.62	1.50 pts	1.5	0.0	0.3	0.0	1.8	3.0	0.0
Dual Magnum 7.62	1.50 pts	0.5	0.5	0.3	0.0	1.3	2.4	0.0
Outlook 6.0	0.80 pt	2.0	0.8	0.3	0.5	3.5	3.8	1.0
Outlook 6.0	0.80 pt	0.8	1.0	0.0	0.0	2.3	2.3	1.0
LSD (0.05)		n.s.	1.0	0.7	n.s.	n.s.	n.s.	0.7

1- Scale: 0=no crop injury to 10=crop dead

Table 3. Weed count (no. weeds per 20 ft<sup>2</sup>) and phytotoxicity rating on August 9 (73 days after pretransplant treatments and 36 days after layby treatment)

Pretransplant treatment	Material/A	Layby/ Post directed	Material/A	Night- shade	Shepherd's Purse	Purslane	Total weeds	Phyto <sup>1</sup>
Untreated	----	Untreated	----	0.8	0.3	0.0	2.0	0.0
Dual Magnum 7.62	1.50 pts	----	----	0.3	1.0	0.0	1.5	0.8
Outlook 6.	0.80 pt	----	----	0.8	0.5	0.0	2.5	0.3
Spartan 4F	0.13 lb	----	----	0.8	0.0	0.3	1.8	0.0
Matrix SG25	0.12 lb	----	----	0.5	0.0	0.3	1.8	3.0
Dual Magnum 7.62	1.50 pts	Dacthal 6F	1.17 gal	0.0	0.5	0.0	0.8	0.5
Dual Magnum 7.62	1.50 pts	Dual Magnum 7.62	1.50 pts	0.0	1.3	0.0	1.8	0.3
Outlook 6.0	0.80 pt	Dacthal 75W	9.3 lbs	0.3	0.0	0.0	0.5	0.8
Outlook 6.0	0.80 pt	Dual Magnum 7.62	1.50 pts	0.5	0.8	0.0	1.5	0.8
----	----	Sandea 75WG NIS	1.0 oz	0.8	0.3	0.0	1.0	0.0
----	----	V-10142 75WG Kinetic	0.26 lb	0.5	0.3	0.0	0.8	0.0
----	----	V-10142 75WG Kinetic	0.52 lb	0.0	0.0	0.0	0.5	0.0
----	----	V-10142 75WG Kinetic V-10142 75WG Kinetic	0.52 lb 0.52 lb	0.0	0.0	0.0	0.0	0.0
LSD (0.05)				1.0	1.2	0.2	2.2	0.8

1- Scale: 0=no crop injury to 10=crop dead

Table 4. Weed count (no. weeds per 20 ft<sup>2</sup>) and phytotoxicity ratings on September 5 (95 days after pretransplant treatments and 58 days after layby treatment)

Treatment At transplanting	Material/A	Layby/ Postemergence	Material/A	Night-shade	Shepherd's Purse	Purslane	Sow Thistle	Total weeds	Phyto <sup>1</sup>
Untreated	----	Untreated	----	1.0	5.5	0.3	2.3	10.3	0.0
Dual Magnum 7.62	1.50 pts	----	----	0.8	4.8	1.3	0.5	8.3	1.0
Outlook 6.0	0.80 pt	----	----	2.7	7.0	0.3	1.8	13.3	1.0
Spartan 4F	0.13 lb	----	----	1.7	4.5	1.5	1.3	11.8	0.0
Matrix SG25	0.12 lb	----	----	2.2	8.0	1.0	2.3	18.5	3.3
Dual Magnum 7.62	1.50 pts	Dacthal 6F	1.17 gal	0.	4.8	0.3	0.3	7.5	0.3
Dual Magnum 7.62	1.50 pts	Dual Magnum 7.62	1.50 pts	0.8	2.5	0.3	1.5	6.8	0.0
Outlook 6.0	0.80 pt	Dacthal 75W	9.3 lbs	0.8	7.0	0.0	1.0	10.3	0.0
Outlook 6.0	0.80 pt	Dual Magnum 7.62	1.50 pts	0.8	4.0	0.5	2.5	9.8	0.0
----	----	Sandea 75WG NIS	1.0 oz	2.3	8.0	1.3	2.0	14.0	1.3
----	----	V-10142 75WG Kinetic	0.26 lb	1.8	0.8	0.0	1.5	5.0	0.8
----	----	V-10142 75WG Kinetic	0.52 lb	0.8	1.5	0.3	0.8	5.0	0.0
----	----	V-10142 75WG Kinetic V-10142 75WG <sup>2</sup> Kinetic	0.52 lb  0.52 lb	0.0	0.0	0.0	2.3	3.3	0.0
LSD (0.05)				2.1	4.2	1.0	2.2	6.4	1.7

1- Scale: 0=no crop injury to 10=crop dead



Table 5. Yield of peppers on October 22

Transplant Application Material a.i./A	Layby/Post directed Application Material a.i./A	Reds			Green		Turning		Total Marketable		
		Tons/A	Fruit/A <sup>1</sup>	% red	Tons/A	Fruit/A	Tons/A	Fruit/A	Tons/A	Fruit/A	Mean (gr)
Untreated	Untreated	13.30	84.10	48.43	5.62	56.73	8.25	63.70	27.17	204.63	121.4
Dual Magnum 1.43	----	13.25	69.03	55.05	3.30	36.35	7.87	49.40	24.45	154.78	146.3
Outlook 0.60	----	11.10	69.40	44.98	5.32	50.23	7.30	60.45	23.70	180.13	119.8
Spartan 0.10	----	13.48	81.65	57.03	3.92	43.68	5.75	51.05	23.12	176.43	119.7
Matrix 0.03	----	9.20	50.63	52.70	4.00	43.70	3.15	23.70	16.37	118.03	126.8
Dual Magnum 1.43	Dacthal 7.0	11.65	72.68	52.05	3.20	30.63	6.85	50.23	21.72	153.53	128.4
Dual Magnum 1.43	Dual Magnum 1.43	12.70	83.33	54.13	3.62	40.03	6.37	49.00	22.70	172.35	119.9
Outlook 0.60	Dacthal 7.0	10.88	65.35	47.03	4.62	45.73	6.75	51.43	22.20	162.55	124.5
Outlook 0.60	Dual Magnum 1.43	12.03	76.35	54.08	3.37	34.70	6.27	50.23	21.70	161.30	122.0
----	Sandea 0.047 NIS 0.25%	9.70	61.25	53.68	2.90	31.03	4.60	37.58	17.20	129.85	120.0
----	V-10142 0.20 Kinetic 0.125%	13.35	75.95	57.83	3.07	36.78	5.85	58.60	22.30	161.30	128.5
----	V-10142 0.30 Kinetic 0.125%	14.95	94.33	66.78	2.52	28.58	4.07	35.10	21.52	158.03	123.6
----	V-10142 0.30 Kinetic V-10142 0.30 Kinetic 0.125%	9.23	61.65	42.30	4.85	57.58	7.15	61.65	21.22	180.93	106.6
LSD (0.05)		2.54	15.11	10.55	1.56	16.88	2.74	17.34	3.02	25.90	16.4

1 – Number of fruit in 1,000's

## South San Joaquin Valley Evaluations

Table 6: 2007 Fresno Preemergent Herbicide Trial: Weed Control, Phytotoxicity, and Yield of Transplanted Bell Peppers

Transplant	Lb a.i.		Layby	Lb a.i.		Weed Control & Phytotoxicity Ratings*						Yield lbs/plot							
	per A	Amt/A		Application	per A	Amt/A	May 17 2007			July 30 2007			Good	Small	TOTAL	Culls			
Application			Application			BRDLF	GRASS	PHYTO	BRDLF	PIG	NIGHT	LAMB	PURS	SOW					
Untreated	--		Untreated			0.0	0.0	0.0	4.3	6.8	4.5	5.3	2.0	8.3	78.1	2.1	<b>80.2</b>	d	3.1
<b>Dual Magnum 7.62</b>	1.4	1.5 pt	Untreated			9.6	9.9	0.0	8.5	9.3	9.5	9.8	6.5	10.0	111.8	2.2	<b>113.9</b>	ab	6.8
<b>Outlook 6.0</b>	0.5	.6 pt	Untreated			9.9	9.9	0.4	7.8	9.5	8.8	8.0	7.8	10.0	114.2	2.3	<b>116.4</b>	ab	3.5
<b>Matrix</b>	0.03	.125 lb	Untreated			10.0	10.0	<b>5.0</b>	5.3	9.0	5.3	7.5	4.3	8.5	58.4	2.3	<b>60.8</b>	e	1.5
<b>Dual Magnum 7.62</b>	1.4	1.5 pt	<b>Dacthal 75 W</b>	7.0	9.5 lb	9.7	9.9	0.3	10.0	10.0	10.0	10.0	10.0	10.0	116.6	3.8	<b>120.4</b>	ab	2.6
<b>Dual Magnum 7.62</b>	1.4	1.5 pt	<b>Dual Magnum</b>	1.4	1.5 pt	9.5	9.9	0.3	9.8	10.0	10.0	9.5	9.5	10.0	112.9	3.1	<b>116.0</b>	ab	2.8
<b>Dual Magnum 7.62</b>	1.4	1.5 pt	<b>Prowl H2O</b>	1.4	3 pts	9.8	9.5	0.8	10.0	10.0	7.5	10.0	10.0	10.0	107.8	3.6	<b>111.3</b>	ab	2.9
<b>Outlook 6.0</b>	0.5	.6 pt	<b>Dacthal 75 W</b>	7.0	9.5 lb	9.7	9.8	0.9	9.7	10.0	9.4	10.0	9.8	10.0	103.3	3.7	<b>107.0</b>	ab	0.8
<b>Outlook 6.0</b>	0.5	.6 pt	<b>Dual Magnum</b>	1.4	1.5 pt	9.8	10.0	0.3	9.6	10.0	10.0	9.0	9.0	10.0	100.9	1.4	<b>102.3</b>	bc	3.8
Untreated	--		<b>Dacthal 75 W</b>	7.0	9.5 lb	0.0	0.0	0.0	8.4	10.0	7.8	10.0	8.8	10.0	72.1	5.0	<b>77.1</b>	d	2.1
Untreated	--		<b>Spartan 4F</b>	0.1	3.2 ozs	0.0	0.0	0.0	5.3	9.3	5.8	7.0	3.5	8.5	73.0	3.7	<b>76.7</b>	d	1.5
Untreated	--		<b>V-10142 FL +COC</b>	0.15+1%	6 ozs	0.0	0.0	0.0	8.0	10.0	6.3	10.0	9.3	10.0	74.0	3.5	<b>77.6</b>	d	5.3
Untreated	--		<b>V-10142 FL +COC</b>	0.30+1%	12 ozs	0.0	0.0	0.0	7.9	10.0	6.3	10.0	9.5	9.8	85.4	2.7	<b>90.1</b>	cd	5.0
Untreated	--		Untreated			0.0	0.0	0.0	4.3	8.3	3.0	7.0	5.3	8.3	79.3	2.6	<b>81.9</b>	d	0.7

\* Weed Control: 1 = None, 10 = Excellent  
Phytotoxicity: 1 = None, 10 = Severe

**LSD** 15.8  
**CV%** 11.6



Fig.1: Pepper Trial - PRE- Layby, WSREC,



Fig. 2: Pepper Trial - After Layby, WSREC, 2007