

California Pepper Commission – Final Report, 2004

Title: Preemergence Weed Control Trials in Peppers

Principle Investigators:

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Timeline: April 30, 2004 to November 30, 2004

Summary: Trials were conducted in two pepper production districts: Coastal (Santa Clara County) and Central Valley (Fresno County). In both counties Goal Tender 4F and 2XL at the 0.50 lb a.i./A rate applied 15 to 25 days prior to transplanting provided good broadleaf and grass weed control for the first 30 to 35 days following pepper transplanting. The combination of Goal (applied pretransplant) + Dual Magnum (applied at layby) or Goal (applied pretransplant) + Outlook (applied at layby) looked promising as an extended season weed control system for peppers. Chateau appeared to be too phytotoxic as a pre-transplant application, although weed control might be as good as or better than Goal. However a granular formulation of Chateau (flumioxazin), Broadstar (0.25 or 1.0%), provided good weed control and acceptable safety to when applied over-the-top of the peppers post transplant, however the granular formulation creates problems for obtaining a uniform application. These data indicate that a viable pretransplant and post transplant system can be achieved in peppers which suffer from late season weed control issues. It is hoped that this data can be useful in securing label adjustments and/or registrations for these herbicides on peppers.

Background: Peppers are long-season vegetables that have limited effective weed control materials available for use. The preemergence herbicides registered for peppers have serious gaps in the spectrum of weeds that they control (Smith et al., 1999). As a result, many growers spend in the range of \$200 to 350/acre in weed control in direct seeded peppers early in the season (Livingston et al., 1997). Dual Magnum (s-metolachlor) received a five year 24C registration through the efforts of the Pepper Commission and was first used by growers in the 2002 growing season. It provided useful weed control on nightshade and yellow nutsedge. Goal 2XL (oxyfluorfen) is currently registered for use 30 days prior to transplanting at 1 to 2 pints per acre, but the soil must be worked to a depth of 2.5 inches prior to transplanting, thus destroying the layer of herbicide on the soil surface. A new formulation of oxyfluorfen, Goal Tender 4F, has been developed by Dow AgroSciences which has less risk of co-distillation. We have examined its use on shaped pepper beds 15 to 30 days prior to transplanting as is allowed by the current Goal label. However, we have not worked the beds prior to transplanting thereby leaving the layer of Goal on the soil surface as an at-transplanting herbicide application. This use is not currently allowed on the label and would require

working with Dow AgroSciences to adjust the label to allow this use pattern. Goal Tender is safer for this use pattern than Goal 2XL. In 2003 we examined Shark (FMC Corp.) and in 2003 and 2004 Chateau (Valent Corp.) for this same use. In 2004 we coupled the pretransplant application of Goal with layby application of Dual Magnum (S-metolachlor) and Outlook (dimethenamid). The concept was to develop a pre and post transplant herbicide combination that would provide growers with an extended season weed control option. The current Dual Magnum label does not specifically allow a layby application and Outlook is not currently registered for use on peppers. Our goal was to test this weed control system in two pepper growing regions that have different weed pressures: 1) the Coastal production district that has nightshade and malva, and 2) the Central Valley production district which has nightshade, nutsedge, fleabane, and spurge. These two areas would provide the best and most thorough evaluation of this proposed weed control strategy.

Objectives:

1. Examine applications of two formulations of oxyfluorfen (Goal 2XL, Goal 4F) and flumioxazin (Chateau 51 DG) to pepper beds prior to transplanting. The beds will not be disturbed prior to transplanting except by the transplanting shoe, thereby leaving over 90% of the bed with the herbicide barrier. Evaluate weed control, crop safety and yield.
2. Examine layby applications of Dual Magnum to the above treated beds to provide extended weed control and evaluate it as a potential weed control system for transplanted peppers.
3. Trials will be conducted in the Central Valley and Coastal production districts to provide a thorough evaluation of the applicability of the weed control techniques

Methods:

Fresno County Trial: A field trial investigating several herbicides in peppers was conducted on a Panoche clay loam soil at the UC West Side Research and Extension Center (WSREC) in Fresno County near Five Points. On May 18, 2004 the bell pepper variety "Jupiter" was transplanted into 40" beds with two rows per bed. Within row plant spacing was 10". Preplant applications of Goal Tender 4F and Goal 2XL (oxyfluorfen) were made on April 23, which was 25 days prior to transplanting the peppers. No water was applied following these pre-transplant applications. Chateau (flumioxazin) was applied pre-transplant and Dual Magnum was applied post-transplant on May 18. The field was sprinkler irrigated immediately after planting and again as needed for a few weeks before it was switched to furrow irrigation. Plot size was two 40-inch beds x 70 feet of row length. The plots were split in half (2 beds x 35 feet) and a layby application of Dual Magnum, Outlook (dimethenamid) or Broadstar (granular flumioxazin) was made on June 28, 2004. The untreated checks were also split in half at layby and one half was hand weeded the one time, while the other half was allowed to continue to grow weedy.

Herbicides were applied in a 30 gal/A water volume with a 2 nozzle boom with 8003evs tips and a CO₂ backpack sprayer @30 psi with the exception of Broadstar, which was

hand broadcast over the top of the peppers. Layby applications were not shielded sprays but were directed away from the plants. Weeds were vigorous and abundant throughout the season and included: prostrate and redroot pigweeds (*Amaranthus blitoides* and *A. retroflexus*); several solanaceous species- black nightshade (*Solanum nigrum*), hairy nightshade (*S. sarrachoides*), and lanceleaf groundcherry (*Physalis lanceifolia*); common lambsquarters (*Chenopodium album*); and jungle rice (*Echinochloa colonum*).

Plots were evaluated for phytotoxicity to the peppers and weed control. Ratings and weed counts were made prior to layby applications and prior to harvest. Peppers were hand harvested on August 5, 2004 from a subsection of the plot measuring 15 feet long and one bed wide. See tables for treatments and evaluation dates.

Monterey County Trials:

Trial No. 1: The trial was conducted in cooperation with Paul Mirasou and Dirk Buchser of B&T Farms on Furlong Road in Gilroy. The trial site was transplanted on April 30. The 30 day pretransplant treatments were applied on April 2 and the 15 day pretransplant treatments were applied on April 15. No water was applied following these pretransplant applications. Chateau was applied pretransplant on April 27 and Broadstar and Dual Magnum were applied post transplant on April 30. Each of the above mentioned plots were split in half and a layby application of Dual Magnum was applied to half of each plot and none to the other half at 30 days following transplanting (post directed application) on May 26. Few weeds emerged after the layby application and no further weed evaluations were conducted, and the data does not show the split. Each plot was one 40-inch bed wide by 40 feet long and replicated three times in a randomized complete block design. All 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. The soil type was Pacheco Silt Loam and the variety was Baron.

Trial No. 2: The trial was established at the Hartnell East Campus Research Facility in Salinas. The trial site was transplanted on May 4. The 15 day pretransplant treatments were applied on April 22. Chateau was applied immediately prior to transplanting on May 4 and Broadstar was applied immediately post-transplanting on May 4 as well. Dual Magnum was applied 37 days following transplanting (post directed application) on June 10. Each plot was one 40-inch bed wide by 25 feet long and replicated four times in a randomized complete block design. All 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. Weeds were evaluated on June 10 and the plot was hand weed and the time to weed each plot was recorded. An additional flush of weeds was allowed to emerge and these were evaluated to test the longevity of the original pretransplant applications and the layby application of Dual Magnum on July 21. The soil type was Chualar Loam and the variety was Cal Wonder 300. See tables for treatments and evaluation dates.

Results:

Fresno County Trial:

Pre and Transplant Herbicide Treatments

Table 1 – All herbicide treatments had significantly fewer weeds and better weed control ratings than the untreated check. Pepper stand counts were not affected by either formulation of Goal. Slight phytotoxicity and better weed control, especially with respect to nightshade control, was noted with the higher application rate of both Goal formulations. Chateau (a liquid formulation of flumioxazin) caused significantly more injury and phytotoxicity to the peppers than Goal or Dual Magnum, yet weed control was not significantly different. Virtually no significant phytotoxicity was observed with the use of Dual Magnum.

Table 2 - Phytotoxicity ratings diminished over time for the Goal Tender 4F at the higher rate compared to Goal 2XL, but even the 2XL was not really problematic by the end of the season. A pre-transplant application of Goal (either formulation at either rate) was insufficient at providing season long weed control, although weeds were significantly less than in the untreated check. Phytotoxicity caused by Chateau continued to be apparent.

Layby Herbicide Treatments

Table 2 - Layby applications of Outlook and Dual Magnum improved weed control following Goal applications. Weed control was better in the treatments with higher rates of Goal. Both layby applications were effective on broadleaf weeds, especially nightshades and pigweed, and junglerice, a grass weed that is closely related to barnyardgrass.

A layby application of Broadstar (granular formulation of flumioxazin) resulted in slight phytotoxicity to the peppers and exhibited poor weed control. This is no doubt due to poor uniformity of application. There simply were not enough granules to spread over the entire area so application and weed control was extremely spotty. Dual Magnum provided very good weed control and crop safety in this trial.

Yield Evaluation

Table 3 – In plots where weeds were allowed to grow with absolutely no weed control effort there was absolutely no bell pepper yield. Weed heights at harvest were estimated (in feet) to be lambsquarters (5.5), pigweed (3.5-4.5), nightshades and groundcherry (3.5) and junglerice (2.5). Pepper plants were estimated to be two feet tall.

In plots where weeds were hand cultivated at layby, yield was only slightly less than the best herbicide treatments, however harvesting was more difficult due to the presence of weeds. The phytotoxicity caused by Chateau on the peppers did have a negative impact on pepper yield. Plots treated with Goal formulations (pre-transplant) yielded higher than Dual Magnum (at transplant).

Monterey County Trials:

Trial No. 1: Goal Tender 4F and Goal 2XL at 0.25 lb and 0.50 lb a.i./A at 30 days pretransplant provided moderate weed control of Hairy Nightshade, the main weed at this plot (table 4). Goal Tender and Goal 2XL provided improved weed control at the 0.50 lb a.i./A rate, as well as improved weed control at the 15 day pretransplant application date.

All Goal treatments had acceptable phytotoxicity ratings on both evaluation dates, except for Goal 2XL at 0.50 lb a.i./A applied 15 days pretransplant. However, the phytotoxicity ratings improved with each subsequent evaluation date (tables 4 & 5). Chateau provided excellent weed control but reduced the stand and had significant phytotoxicity ratings into June (tables 4 & 5). Broadstar (a granular formulation of flumioxazin, same chemical as Chateau) applied over-the-top at transplanting provided moderate weed control and good safety on peppers. Dual Magnum provided excellent weed control of all weeds in this trial and excellent safety. All materials significantly reduced hours per acre to hand weed, however Chateau and Dual Magnum were most effective at this site (table 5). Yield evaluations are on a per plant basis, and no reduction in yield were observed (table 6). However, it may be assumed that given the reduction in stand in the Chateau treatment that some reduction in yield must have occurred on a per acre basis.

Trial No. 2: Purslane, Nettle and Hairy Nightshade were the main weeds at this site. All treatments reduced total weeds over the untreated control on the first evaluation date (table 7). The granular material Broadstar was challenging to apply uniformly at the lower rates and, as a result, the weed control tended to be spotty (due to lack of uniformity) at the lower rates of this material. At higher rates of Broadstar weed control was greatly improved. This trial examined lower rates of Chateau than the previous trial and the 0.023 and 0.047 lb a.i. rates also provided good weed control. However, Chateau had significant phytotoxicity ratings at all evaluation dates. All treatments dramatically reduced the number of hours per acre to hand weed. The second evaluation date, July 21 was a measure of the long-term weed control provided by each treatment (table 8). Nettle was the principle weed that germinated following the hand weeding on June 10. The combination of Goal Tender 4F + Dual Magnum, all Goal 2XL treatments, and the higher rates of Chateau and Broadstar provided the most long-term weed control. Goal 2XL had intermediate phytotoxicity ratings and Goal Tender 4F and Broadstar had the lowest phytotoxicity ratings. No yield evaluations were conducted of this trial.

Table 1. Phytotoxicity and weed ratings and weed counts prior to layby application - FRESNO County

Code	Herbicide	Rate lb ai/A	Material per Acre	23-JUN-04			23-JUN-04				
				Peppers #/plot	Phyto*	Weed Control**	Weed Counts/6 sq ft (6 tosses of 1'x1' square)				
							PIG	NIGHT	LAMB	JUNGLE	TOTAL
1	Goal Tender 4F	0.25	0.5 pint	217	1.3 bcd	3.0 c	5.3 b	5.0 a	1.5 ab	1.8 b	13.6 b
3	Goal Tender 4F	0.50	1.0 pint	230	3.0 b	7.0 a	2.3 b	1.8 b	1.3 b	1.3 b	6.7 c
5	Goal 2XL	0.25	1.0 pint	250	0.5 d	5.1 b	4.8 b	2.0 ab	1.3 b	1.8 b	9.9 bc
7	Goal 2XL	0.50	2.0 pint	224	2.5 bc	6.0 ab	4.0 b	1.3 b	1.8 ab	1.8 b	8.9 bc
9	Untreated			205	0.0 d	0.0 d	10.3 a	8.0 a	2.5 ab	4.8 a	25.5 a
2	Goal Tender 4F	0.25	0.5 pint		1.0 cd	3.5 c					
4	Goal Tender 4F	0.50	1.0 pint		2.5 bc	4.5 bc					
6	Goal 2XL	0.25	1.0 pint		1.5 bcd	3.5 c					
8	Goal 2XL	0.50	2.0 pint		2.5 bc	5.8 ab					
10	Chateau	0.09	3.0 ozs		5.0 a	5.8 ab					
12	Untreated				0.0 d	0.8 d					
14	Dual Magnum	1.43	1.5 pint		1.0 cd	5.3 b					
16	Untreated				0.0 d	0.0 d					
LSD .05				N.S.	1.9	1.6	3.7	3.1	1.2	2.4	6.1

* rating scale: 0 = no crop damage to 10 = crop dead

Bell Pepper Variety: Jupiter

** rating scale: 0 = no weed control to 10 = 100% control

Transplanted May 18, 2004

Table 2. Phytotoxicity ratings and weed counts per plot just prior to harvest - FRESNO County

				29-JUL-04							
Code	Herbicide	Rate lb ai/A	Material per Acre	Phyto	Weed counts per plot			ALL			ALL WEEDS
					PIG	NIGHT	CHERRY	LAMB	Broadleaves	JUNGLE	
1	Goal Tender 4F	0.25	0.5 pint	0.5 ef	3.8 cdefg	4.5 defgh	4.5 bcd	2.0 bc	14.8 defg	3.5 cdefgh	18.3 defg
3	Goal Tender 4F	0.50	1.0 pint	0.5 ef	4.0 cdef	3.3 efghij	1.8 def	0.3 c	9.4 ghij	1.8 ghi	11.0 ghijk
5	Goal 2XL	0.25	1.0 pint	0.5 ef	3.5 cdefgh	4.0 defghij	3.8 bcde	0.0 c	11.3 fghij	3.5 cdefgh	14.8 fghijk
7	Goal 2XL	0.50	2.0 pint	2.0 bcde	2.5 defghi	6.0 cdef	3.0 cdef	0.8 c	12.3 fghij	3.8 cdefg	16.0 fghijk
9	Untreated			0.0 f	10.0 a	10.0 ab	10.0 a	10.0 a	40.0 a	10.0 a	50.0 a
1-L	Goal 4F + Outlook @ Layby	0.25 + 0.75	0.5 + 1.0 pint	0.8 def	3.0 cdefghi	3.0 fghij	3.5 bcdef	0.5 c	10.0 ghij	3.3 defgh	13.3 ghijk
3-L	Goal 4F + Outlook @ Layby	0.50 + .75	1.0 + 1.0 pint	0.5 ef	1.5 efghi	1.0 j	1.0 ef	0.8 c	4.3 j	2.0 fghi	6.3 k
5-L	Goal 2XL + Outlook @ Layby	0.25 +.75	1.0 + 1.0 pint	1.0 cdef	2.3 efghi	3.3 efghij	3.0 cdef	0.0 c	8.6 ghij	0.8 i	9.3 hijk
7-L	Goal 2XL + Outlook @ Layby	0.50 + 0.75	2.0 + 1.0 pint	2.3 abcd	4.0 cdef	1.8 hij	1.8 def	0.5 c	8.1 ghij	1.3 hi	9.3 hijk
9-L	Untreated & Weeded@ Layby			0.0 f	4.3 cde	12.0 ab	3.0 cdef	0.3 c	19.6 cde	3.0 defghi	22.5 cdef
2	Goal Tender 4F	0.25	0.5 pint	0.8 def	2.3 efghi	4.3 defghi	5.3 bc	0.8 c	12.5 efghij	5.0 bcd	17.5 efgh
4	Goal Tender 4F	0.50	1.0 pint	1.0 cdef	3.3 cdefgh	6.8 cd	1.8 def	3.0 bc	14.9 defg	4.8 bcd	19.5 cdefg
6	Goal 2XL	0.25	1.0 pint	0.8 def	3.0 cdefghi	7.0 bcd	5.0 bc	3.0 bc	18.0 cdef	4.5 bcde	22.5 cdefg
8	Goal 2XL	0.50	2.0 pint	1.3 cdef	2.3 efghi	4.0 defghij	1.5 def	2.3 bc	10.1 ghij	4.3 cdef	14.3 fghijk
10	Chateau	0.09	3.0 ozs	3.8 abcd	1.5 efghi	2.5 ghij	2.8 cdef	0.8 c	7.6 hij	5.0 bcd	12.5 ghijk
12	Untreated & Weeded			0.0 f	2.8 defghi	12.0 a	4.5 bcd	1.5 c	20.8 cd	6.8 b	27.5 bc
14	Dual Magnum	1.43	1.5 pint	0.5 ef	2.0 efghi	6.3 cde	3.8 bcde	2.8 bc	14.9 defg	3.3 defgh	18.0 efgh
16	Untreated			0.0 f	7.8 ab	9.0 abc	6.3 b	5.0 b	28.1 b	5.8 bc	33.8 bc
2-L	Goal 4F + Dual M @ Layby	0.25 + 1.20	0.5 + 1.25 pt	0.9 cdef	0.8 ghi	7.0 bcd	2.5 cdef	3.3 bc	13.6 efghij	2.3 efghi	15.8 fghijk
4-L	Goal 4F + Dual M @ Layby	0.50 + 1.20	1.0 + 1.25 pt	1.3 cdef	0.5 hi	2.8 ghij	0.5 f	2.0 bc	5.8 ij	1.5 ghi	7.3 ijk
6-L	Goal 2XL + Dual M @ Layby	0.25 + 1.20	1.0 + 1.25 pt	1.8 bcde	1.3 efghi	5.0 defg	3.3 bcdef	1.3 c	10.9 ghij	2.8 defghi	13.5 ghijk
8-L	Goal 2XL + Dual M @ Layby	0.50 + 1.20	2.0 + 1.25 pt	2.5 abcd	2.0 efghi	1.3 ij	1.3 ef	1.5 c	6.1 ij	1.3 hi	7.3 ijk
10-L	Chateau + Dual M @ Layby	0.09 + 1.20	3.0 ozs + 1.25 pt	3.3 abcd	1.0 fghi	2.0 ghij	0.8 ef	1.0 c	4.8 j	2.3 efghi	7.0 jk
12-L	Broadstar 1% G @ Layby	0.06	6.25 lb	1.5 cdef	6.0 bc	10.3 a	3.5 bcdef	2.5 bc	22.3 bc	4.8 bcd	27.0 bcd
14-L	Dual M + Dual M @ Layby	1.50 + 1.20	1.5 + 1.25 pt	0.5 ef	0.0 i	4.5 defgh	3.8 bcde	1.5 c	9.8 ghij	1.5 ghi	11.3 ghijk
16-L	Untreated & Weeded @ Layby			0.0 f	5.5 bcd	9.0 abc	5.3 bc	3.0 bc	22.8 bc	3.5 cdefgh	26.3 bcde
LSD 0.05				1.6	3.1	3.1	3.0	3.3	7.2	2.5	9.0

* rating scale: 0 = no crop damage to 10 = crop dead

** rating scale: 0 = no weed control to 10 = 100% control

Bell Pepper Variety: Jupiter

Transplanted MAY 18, 2004

Layby June 28, 2004

Harvest AUG 5, 2004

Table 3. Yield evaluation of peppers - FRESNO County

Code	Herbicide	Rate lb ai/A	Material per Acre	----- Harvested Fruit 05-AUG-04 -----			
				small fruit	sunburn & rotten fruit	Market Yield lbs/plot	Total Yield lbs/plot
1	Goal Tender 4F	0.25	0.5 pint	3.7 fg	3.6 cdef	33.9 efg	41.2 fgh
3	Goal Tender 4F	0.50	1.0 pint	6.3 bcde	2.7 efg	34.7 efg	43.7 efgh
5	Goal 2XL	0.25	1.0 pint	5.0 ef	3.7 cdef	40.1 bcdef	48.8 cdefg
7	Goal 2XL	0.50	2.0 pint	5.2 def	4.2 cdef	43.3 abcd	52.6 abcde
9	Untreated			0.0 h	0.0 g	0.0 h	0.0 i
1-L	Goal 4F + Outlook @ Layby	0.25 + 0.75	0.5 + 1.0 pint	4.8 efg	5.6 bcde	34.9 defg	45.3 defgh
3-L	Goal 4F + Outlook @ Layby	0.50 + .75	1.0 + 1.0 pint	5.7 cde	3.1 defg	42.2 abcde	51.0 bcdef
5-L	Goal 2XL + Outlook @ Layby	0.25 +.75	1.0 + 1.0 pint	6.3 bcde	3.8 cdef	44.2 abc	54.2 abcde
7-L	Goal 2XL + Outlook @ Layby	0.50 + 0.75	2.0 + 1.0 pint	5.9 cde	4.2 cdef	40.2 bcdef	50.3 bcdef
9-L	Untreated & Weeded@ Layby			3.0 g	3.6 def	36.1 cdefg	42.6 fgh
2	Goal Tender 4F	0.25	0.5 pint	5.2 def	7.5 ab	43.4 abcd	56.1 abc
4	Goal Tender 4F	0.50	1.0 pint	5.2 def	7.5 ab	41.6 abcde	54.4 abcd
6	Goal 2XL	0.25	1.0 pint	4.9 erg	9.0 a	43.6 abc	57.5 abc
8	Goal 2XL	0.50	2.0 pint	7.0 bcde	6.2 abcd	44.9 ab	58.1 abc
10	Chateau	0.09	3.0 ozs	9.8 a	3.3 def	31.8 fg	44.9 defgh
12	Untreated & weeded			5.4 def	8.1 ab	39.5 bcdef	53.0 abcde
14	Dual Magnum	1.43	1.5 pint	6.7 bcde	2.7 efg	30.3 g	39.7 gh
16	Untreated			0.0 h	0.0 g	0.0 h	0.0 i
2-L	Goal 4F + Dual M @ Layby	0.25 + 1.20	0.5 + 1.25 pint	5.4 def	7.6 ab	41.5 abcde	54.4 abcd
4-L	Goal 4F + Dual M @ Layby	0.50 + 1.20	1.0 + 1.25 pint	7.1 bcde	5.4 bcde	49.1 a	61.6 a
6-L	Goal 2XL + Dual M @ Layby	0.25 + 1.20	1.0 + 1.25 pint	6.2 bcde	8.0 ab	44.9 ab	59.1 ab
8-L	Goal 2XL + Dual M @ Layby	0.50 + 1.20	2.0 + 1.25 pint	6.4 bcde	8.6 ab	40.1 bcdef	55.1 abcd
10-L	Chateau + Dual M @ Layby	0.09 + 1.20	3.0 ozs + 1.25 pint	7.6 bc	1.8 fg	30.8 g	40.2 gh
12-L	Broadstar 1% G @ Layby	0.06	6.25 lb	6.0 cde	8.0 ab	36.8 bcdefg	50.8 bcdef
14-L	Dual M + Dual M @ Layby	1.50 + 1.20	1.5 + 1.25 pint	8.0 ab	3.9 cdef	37.9 bcdefg	49.8 bcdefg
16-L	Untreated & Weeded @ Layby			5.2 def	6.8 abc	38.3 bcdefg	50.3 bcdef
LSD 0.05				2.0	3.2	8.5	10.3

Table 4. Monterey County, Trial No. 1. Weed counts (6 ft²) on May 13, 2004 and phytotoxicity ratings

Herbicide	Rate lb ai/A	Material/A	Timing ¹	Night shade	Malva	Lambs Quarter	Total Weeds	Phyto ¹ May 13	Phyto ¹ May 19
Goal Tender 4F	0.25	0.5 pint	30	25.0	1.0	1.3	27.3	0.0	0.0
Goal Tender 4F	0.25	0.5 pint	15	22.0	2.7	2.7	27.3	0.0	0.0
Goal Tender 4F	0.50	1.0 pint	30	26.0	0.0	0.0	26.0	0.7	0.7
Goal Tender 4F	0.50	1.0 pint	15	8.3	0.3	0.0	8.7	1.0	0.8
Goal 2XL	0.25	1.0 pint	30	35.7	1.7	0.0	37.3	0.3	0.0
Goal 2XL	0.25	1.0 pint	15	37.3	0.0	0.0	37.3	0.6	0.0
Goal 2XL	0.50	2.0 pint	30	24.7	0.0	0.3	25.0	1.3	1.3
Goal 2XL	0.50	2.0 pint	15	14.7	0.0	0.0	14.7	2.3	2.0
Chateau 51WG	0.094	3.0 ounces	pretransplant	0.6	0.0	0.0	0.7	5.0	3.3
Broadstar 0.25% G	0.094	37.6 lbs	Post transplant	13.3	0.3	0.3	14.0	0.7	1.0
Dual Magnum 7.63	1.43	1.50 pint	Post transplant	2.3	1.3	1.0	4.7	0.0	0.0
Untreated	----	----	----	112.3	6.7	15.7	134.7	0.0	0.0
LSD (0.05)				37.3	1.5	4.4	39.6	0.8	1.0

1 – application days prior to transplanting; 2 – Scale: 0 = no crop damage to 10 = crop dead

Table 5. Monterey County, Trial No. 1. Stand count, phytotoxicity rating and time of weeding evaluations

Herbicide	Rate lb ai/A	Material/A	Timing ¹	Stand ²	Phyto ³	Hours/A To weed May 26
				June 10	June 10	
Goal Tender 4F	0.25	0.5 pint	30	61.7	0.0	12.2
Goal Tender 4F	0.25	0.5 pint	15	62.3	0.3	15.3
Goal Tender 4F	0.50	1.0 pint	30	61.3	0.0	8.8
Goal Tender 4F	0.50	1.0 pint	15	64.0	0.3	8.2
Goal 2XL	0.25	1.0 pint	30	62.7	0.0	15.7
Goal 2XL	0.25	1.0 pint	15	61.3	0.3	17.8
Goal 2XL	0.50	2.0 pint	30	61.3	0.3	10.7
Goal 2XL	0.50	2.0 pint	15	63.7	0.7	8.5
Chateau 51WG	0.094	3.0 ounces	pretransplant	55.0	4.7	3.2
Broadstar 0.25% G	0.094	37.6 lbs	Post transplant	61.3	0.7	12.0
Dual Magnum 7.63	1.43	1.50 pint	Post transplant	61.7	0.3	5.4
Untreated	----	----	----	63.0	0.7	28.6
LSD (0.05)				4.9	1.2	10.0

1 – application days prior to transplanting; 2 – number of plants per forty feet of row;

3 – Scale: 0 = no crop damage to 10 = crop dead

Table 6. Monterey County, Trial No. 1. Yield evaluation of peppers (15 plants per plot) on September 14

Treatment, rate (a.i./A) and Application Time ¹	Total Marketable		Mean Fruit Weight	Red		Green		Sunburned		Immature or Cull
	Number	lbs	lbs	Number	lbs	Number	lbs	Number	lbs	Number
Goal Tender 4F 0.25; 30 days	129.0	72.0	0.56	106.5	62.7	22.4	9.3	12.3	6.5	1.7
Goal Tender 4F 0.25; 15 days	112.0	63.3	0.57	91.2	56.4	20.7	7.0	14.4	6.9	1.9
Goal Tender 4F 0.50; 30 days	122.0	71.0	0.58	104.9	64.6	17.1	6.3	12.2	4.9	0.0
Goal Tender 4F 0.50; 15 days	119.3	72.7	0.61	100.4	65.1	19.0	7.6	10.6	5.8	1.2
Goal 2XL 0.25; 30 days	130.0	67.1	0.52	102.0	58.0	28.0	9.1	14.0	6.4	5.5
Goal 2XL 0.25; 15 days	115.0	66.8	0.58	95.0	60.1	20.0	6.6	12.0	5.7	2.0
Goal 2XL 0.50; 30 days	132.3	75.9	0.58	115.3	70.0	17.0	5.8	10.0	4.7	1.3
Goal 2XL 0.50; 15 days	114.3	66.9	0.59	97.3	61.5	17.0	5.5	9.3	4.4	2.3
Chateau 51 WG 0.094; pre-trans	132.3	76.8	0.58	108.0	68.3	24.3	8.5	14.3	5.7	2.3
Broadstar 1% G 0.094; post-trans	128.7	73.1	0.57	104.3	64.9	24.3	8.2	13.0	6.7	1.3
Dual Magnum 7.63 1.43; post-trans	123.7	68.9	0.55	103.0	61.5	20.7	7.4	12.0	5.8	1.7
Untreated	123.3	71.8	0.58	104.7	65.1	18.7	6.7	12.7	5.4	0.7
LSD (0.05)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

1 – application days prior to transplanting

Table 7. Monterey County, Trial No. 2. Weed counts (4 ft²) on June 10

Herbicide	Rate lb ai/A	Material/A	Timing ¹	Night-shade	Groundsel	Purslane	Nettle	Total Weeds	Hours/A to weed
Goal Tender 4F	0.25	0.5 pint	15	9.1	2.6	2.3	8.5	20.0	8.4
Goal Tender 4F S-Metolachlor 7.63	0.25 1.43	0.5 pint 1.50 pint	15 30 days post	2.3	1.5	0.8	10.0	21.3	15.3
Goal 2XL	0.25	1.0 pint	15	0.8	1.8	1.3	1.3	9.5	7.4
Goal 2XL S-Metolachlor 7.63	0.25 1.43	1.0 pint 1.50 pint	15 30 days post	3.3	1.5	0.5	6.3	15.8	13.3
Chateau 51WG	0.023	0.75 ounces	pretransplant	0.5	0.5	1.0	8.5	11.3	10.2
Chateau 51WG	0.047	1.5 ounces	pretransplant	0.8	1.3	0.5	0.8	3.5	7.5
Chateau 51WG	0.094	3.0 ounces	pretransplant	0.5	1.3	0.0	0.3	3.3	3.6
Broadstar 0.25% G	0.023	9.2 lbs	post transplant	5.5	7.3	7.3	7.5	32.0	41.1
Broadstar 0.25% G	0.047	18.4 lbs	post transplant	4.0	3.3	2.8	4.3	18.3	19.6
Broadstar 0.25% G	0.094	36.8 lbs	post transplant	0.0	1.3	1.3	1.3	6.5	9.8
Dual Magnum 7.63	1.43	1.50 pint	post transplant	0.3	0.3	0.0	3.3	5.5	3.7
Untreated	----	----	----	15.3	8.5	10.0	21.0	61.3	92.2
LSD (0.05)				7.5	5.1	3.8	8.9	15.3	18.1

1 – application days prior to transplanting; 2 – Scale: 0 = no crop damage to 10 = crop dead

Table 8. Monterey County, Trial No. 2. Weed counts (4 ft²) on July 21

Herbicide	Rate lb ai/A	Material/A	Timing¹	Night-shade	Purslane	Nettle	Total Weeds	Phyto¹
Goal Tender 4F	0.25	0.5 pint	15	4.7	4.1	114.9	135.4	0.0
Goal Tender 4F Dual Magnum 7.63	0.25 1.43	0.5 pint 1.50 pint	15 30 days post	0.3	2.0	21.0	35.3	1.2
Goal 2XL	0.25	1.0 pint	15	0.3	1.8	22.3	40.3	1.5
Goal 2XL Dual Magnum 7.63	0.25 1.43	1.0 pint 1.50 pint	15 30 days post	1.0	1.0	38.5	44.0	1.8
Chateau 51WG	0.023	0.75 ounces	pretransplant	0.3	3.8	68.8	91.5	2.8
Chateau 51WG	0.047	1.5 ounces	pretransplant	1.0	5.3	29.0	46.0	3.5
Chateau 51WG	0.094	3.0 ounces	pretransplant	1.3	1.8	26.5	35.3	5.1
Broadstar 0.25% G	0.023	9.2 lbs	post transplant	0.8	4.0	55.5	80.0	1.0
Broadstar 0.25% G	0.047	18.4 lbs	post transplant	0.8	1.8	27.8	35.5	0.5
Broadstar 0.25% G	0.094	36.8 lbs	post transplant	0.3	1.5	20.0	28.8	0.8
Dual Magnum 7.63	1.43	1.50 pint	post transplant	0.8	2.5	120.3	148.0	0.0
Untreated	----	----	----	4.8	10.3	142.3	168.0	0.0
LSD (0.05)				3.1	3.3	69.7	76.7	1.3

1 – Scale: 0 = no crop damage to 10 = crop dead