2009 Weed Control Trials in Peppers

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Summary: Peppers is a long-season crop that is subject to early and late season weed issues. These trials focused on layby applied herbicides to reduce late season weeds. Dual Magnum, Prowl H2O and a combination of these treatments are registered for use on peppers and were included as standard treatments. Outlook, Chateau and Broadstar were tested and non-registered alternatives. The Chateau treatments were tested at 3 and 6 ounces, and Broadstar was tested at 37.6 lbs/A which is the same amount of flumioxazin as 3 ounces of Chateau (0.093 lbs a.i./A). Chateau was applied as a directed spray towards the base of the plant (some did contact the bottom leaves), as a shielded spray (to avoid contact with bottom leaves, although some did) and as a directed spray with the water repellent adjuvant DC-6184 (to reduce phytotoxicity of leaves that come into contact with the spray). The trials indicated that directed or shielded sprays of Chateau gave excellent control of little mallow, but currently registered herbicides, Dual Magnum and Prowl H2O, did not. Continued efforts need to be researched to keep the spray of Chateau off of pepper leaves during application to improve crop safety. A granular formulation of flumioxazin, such as Broadstar, has the potential to deliver the chemical to the soil surface with little to no phytotoxicity to the crop.

Methods: ***Trial No. 1.*** Trial was established in cooperation with Jim Guidotti and Kevin Vaughn west of Soledad. Peppers were direct seeded in mid-April; the variety was a proprietary dehydrating chili type. The peppers were hand weeded and cultivated on June 25. Layby weed control applications were made on June 27; sprinkler irrigation was used to set the herbicides and was applied on June 30 (weather was in the low 80's on June 27, but cooled to the mid-70's the subsequent days prior to first irrigation). Each plot was one 80-inch bed wide by 10 feet long and replicated three times in a randomized complete block design. Two application methods were assessed: 1) a spray directed to the base of the plant and 2) a spray applied with shields to avoid contact with the base of the plant. There were 5 seedlines on each bed and 6 passes of a single nozzle spray tip (8008E Teejet at 30 psi) were made to cover the area between the seedlines and both sides of the bed. All materials were applied in the equivalent of 103 gallons of water per acre. The granular material, Broadstar, was applied by shaking the material from a container over the surface of the soil. Yield was evaluated by harvesting all fruit from 15 plants; there were few culls or green fruits (the field had been treated with etheral) and only marketable yield was measured. Soil type at the site was Metz fine sandy loam. ***Trial No. 2.*** Trial was established in cooperation with Paul Mirassou east of Gilroy. The pepper variety Baron was transplanted on June 18. Peppers were grown in double rows (1 foot apart) on 40 inch beds. Layby weed control applications were made on July 7; the herbicide was set with water from drip irrigation that was applied to the middle of the bed between the two seedlines (no sprinkler irrigation was applied). Each plot was one 40-inch bed wide by 20 feet long and replicated three times in a randomized complete block design. Applications were applied as either directed or shielded sprays to the area between plant rows. Three passes were made to cover the area between the seedlines and both sides of the bed with a one nozzle wand with an 8008E teejet nozzle at 30 psi. All materials were applied in the equivalent of 103 gallons of water per acre. Yield was evaluated by harvesting all fruit from 15 plants and sorting reds, greens, breakers and culls. Soil type at the site was Campbell silty clay loam. See table for treatments and evaluation dates.

Results: ***Trial No. 1:*** There was no to slight phytotoxicity observed on the Prowl H2O, Dual Magnum, Prowl H2O+Dual Magnum and Outlook treatments on the five evaluation dates (Table 1). The Chateau treatments had varying levels of phytotoxicity, but generally there was higher phytotoxicity at the 6 ounce rate than at the 3 ounce rate. On the first evaluation date there was lower phytotoxicity with the shielded application over the directed application and the directed application plus DC-6184; however, that trend did not persist over the other evaluation dates.

Shepherd's purse, hairy nightshade, malva and lambsquarters were the primary weeds at this site. All of the weed control materials reduced total weeds significantly on the July 14 evaluation date (Table 2). The Chateau treatments were effective against all weed species in the trial. Prowl H2O was weak on nightshade. The same pattern was observed on the July 24 evaluation date. On the August 11 evaluation date the level of weed control began to decline in the Dual Magnum, Prowl H2O and Outlook treatments (Table 3). The Chateau and Broadstar treatments continue to have low numbers of weeds. There was more malva emerged on the August 11 and September 2 evaluation dates and all Chateau and Broadstar treatments provided good control of this weed.

Total weeding time was reduced in all herbicide treatments (Table 4). Dual Magnum, Prowl H2O and Outlook were significantly lower than the untreated. All Chateau and Broadstar treatments had the lowest weeding time. In general, the 6 ounce rates had lower weeding time than the 3 ounce rate. There were no significant differences in yield among the treatments. Fruit yield per plant varied from 0.927 to 1.136 lbs of fruit per plant with individual fruit weight between 0.102 to 0.119 lbs/fruit.

Trial No. 2: All Chateau treatments had greater phytotoxicity ratings on July 15 than Dual Magnum or the untreated check (Table 5). There was a trend indicating that the 3 ounce rate had less phytotoxicity than the 6 ounce rate. All Chateau treatments had fewer weeds on the August 19 evaluation date. This was largely due to better malva control. The same trend was observed on the October 1 evaluation. There were no differences in yield among the treatments (Table 6).

Chateau burns leaves if contacted by spray

Weed control by Chateau

Gilroy plot free of malva, but surrounded by malva

Table 1. Trial No. 1. Phytotoxicity ratings on five dates

Treatment	Application	Lbs a.i./A	Material/ A	Phyto[1] July 9	Phyto July 14	Phyto July 24	Phyto Aug 11	Phyto Sept 2
Untreated	---	---	---	0.0	0.0	0.0	0.0	0.0
Dual Magnum 7.62	Directed	1.43	1.5 pints	0.0	0.3	0.0	0.0	0.0
Prowl H2O 3.8EC	Directed	0.95	2.0 pints	0.0	0.3	0.0	0.0	0.0
Dual Magnum 7.62 +Prowl H2O 3.8EC	Directed	1.43 0.95	1.5 pints 2.0 pints	0.0	0.7	0.0	0.0	0.0
Chateau 51WG	Directed	0.093	3.0 oz	1.7	1.3	2.0	1.0	0.7
Chateau 51WG	Directed	0.188	6.0 oz	3.0	2.7	2.3	1.0	2.0
Chateau 51WG	Shielded	0.093	3.0 oz	1.3	1.3	1.7	0.7	0.7
Chateau 51WG	Shielded	0.188	6.0 oz	2.0	2.0	2.0	1.3	1.3
Chateau 51WG +DC 1–6184	Directed 0.5% v/v	0.093	3.0 oz	1.2	1.7	1.8	1.0	1.3
Chateau 51WG +DC 1–6184	Directed 0.5% v/v	0.188	6.0 oz	1.7	2.0	1.7	1.3	0.7
Outlook 6.0	Directed	0.65	14.0 oz	0.0	0.5	0.3	0.0	0.0
Broadstar 0.25%G	Broadcast	0.094	37.6 lbs	0.3	0.3	0.3	0.0	0.0
Pr>Treat				<0.001	0.003	<0.001	0.119	0.050
Pr>Block				0.461	0.298	0.035	0.236	0.080
$LSD_{0.05}$				0.9	1.2	1.3	NS	1.3

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

Table 2. Trial No. 1. Weed counts (weeds per 6 sq. ft) on two dates[1].

Treatment	Application	Lbs a.i./A	July 14						July 24					
			Shep. Purse	Night shade	Malva	Purslane	Lambs quarter	Total weeds	Shep. Purse	Night shade	Malva	Purslane	Lambs quarter	Total weeds
Untreated	---	---	3.3	13.0	1.3	1.3	4.0	23.0	0.3	6.3	2.7	1.7	2.0	13.3
Dual Magnum	Directed	1.43	0.3	0.7	0.7	0.3	0.3	2.3	0.0	0.7	1.3	0.0	0.3	2.3
Prowl H2O	Directed	0.95	0.0	5.7	1.3	0.0	0.0	7.0	0.0	3.0	1.3	0.0	0.3	4.7
Dual Magnum + Prowl H2O	Directed	1.43 0.95	0.3	0.3	0.0	0.3	0.3	1.3	0.0	0.0	0.7	0.0	0.0	0.7
Chateau	Directed	0.093	0.0	0.0	0.7	0.0	0.0	0.7	0.0	0.3	0.0	0.0	0.0	0.3
Chateau	Directed	0.188	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chateau	Shielded	0.093	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chateau	Shielded	0.188	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chateau +DC 1–6184	Directed	0.093 0.5% v/v	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Chateau 51WG +DC 1–6184	Directed	0.188 0.5% v/v	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outlook 6.0	Directed	0.65	0.0	0.3	1.3	0.0	0.7	2.3	0.0	0.3	0.3	0.0	0.0	1.0
Broadstar	Broadcast	0.094	0.0	0.3	0.3	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Pr>Treat			0.107	0.075	0.152	<0.001	<0.001	0.007	0.477	<0.001	0.020	0.005	0.180	<0.001
Pr>Block			0.325	0.504	0.864	0.384	0.126	0.337	0.384	0.531	0.234	0.384	0.352	0.289
$LSD_{0.05}$			NS	NS	NS	0.5	1.0	10.4	NS	2.3	1.5	0.8	NS	2.3

1 – Other weeds not included in this analysis, but that are included in total weeds are wood sorrel, sow thistle and Mexican lovegrass.

Table 3. Trial No. 1. Weed counts (weeds per 6 sq. ft) on two dates[1].

Treatment	Application	Lbs a.i./A	August 11						September 2					
			Shep. Purse	Night shade	Malva	Purslane	Lambs quarter	Total weeds	Night shade	Malva	Purslane	Lambs quarter	Chick weed	Total weeds
Untreated	---	---	2.3	6.3	8.0	1.3	3.0	28.7	5.7	5.0	1.0	1.7	12.7	39.0
Dual Magnum	Directed	1.43	0.0	3.0	7.0	0.0	0.3	16.7	2.0	4.3	0.0	0.0	11.0	24.0
Prowl H2O	Directed	0.95	0.0	2.3	8.3	0.0	0.0	12.0	2.7	5.0	0.0	0.0	1.3	11.0
Dual Magnum + Prowl H2O	Directed	1.43 0.95	0.3	0.7	7.7	0.0	0.0	9.0	1.3	5.3	0.0	0.0	4.0	12.0
Chateau	Directed	0.093	0.0	0.7	0.0	0.3	0.0	1.0	1.7	1.0	0.3	0.0	1.0	9.0
Chateau	Directed	0.188	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	2.7
Chateau	Shielded	0.093	0.0	0.0	0.7	0.0	0.0	0.7	0.3	1.7	0.0	0.0	1.3	6.0
Chateau	Shielded	0.188	0.0	0.3	0.0	0.0	0.0	0.7	0.3	0.7	0.0	0.0	2.0	8.7
Chateau +DC 1–6184	Directed	0.093 0.5% v/v	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	7.7
Chateau 51WG +DC 1–6184	Directed	0.188 0.5% v/v	0.0	1.0	0.7	0.0	0.0	2.0	0.3	0.7	0.0	0.0	0.3	3.3
Outlook 6.0	Directed	0.65	0.3	2.3	8.3	0.0	1.7	21.0	2.3	4.3	0.0	0.0	8.3	29.7
Broadstar	Broadcast	0.094	0.0	0.0	1.0	0.0	0.0	1.7	0.0	0.7	0.0	0.0	0.3	3.7
Pr>Treat			<0.001	0.003	<0.001	<0.001	<0.001	<0.001	0.515	0.030	<0.001	0.092	<0.001	<0.001
Pr>Block			0.042	0.931	0.056	0.626	0.365	0.079	0.428	0.924	0.384	0.384	0.006	0.013
$LSD_{0.05}$			0.4	2.8	4.1	0.4	1.3	6.8	NS	4.0	0.3	NS	3.8	10.8

1 – Other weeds not included in this analysis, but that are included in total weeds are wood sorrel, sow thistle and Mexican lovegrass.

Table 4. Trial No. 1. Weeding time evaluations (hours/Acre) on two dates and harvest Evaluation on October 20, 2009.

Treatment	Application	Lbs a.i./A	Weed time Aug 11	Weed time Sept 2	Total weed time	Fruit wt (lbs/fruit)	Fruit yield (lbs fruit/plant)
Untreated	----	----	15.1	8.4	23.5 a	0.102	1.051
Dual Magnum	Directed	1.43	7.8	7.5	15.3 b	0.106	1.073
Prowl H2O	Directed	0.95	6.3	3.4	9.7 bc	0.116	0.947
Dual Magnum + Prowl H2O	Directed	1.43 0.95	5.6	4.3	9.9 b	0.120	1.136
Chateau	Directed	0.093	4.4	3.7	8.1 c	0.109	0.927
Chateau	Directed	0.188	3.3	2.3	5.6 c	0.105	0.898
Chateau	Shielded	0.093	4.0	5.0	9.0 c	0.114	0.982
Chateau	Shielded	0.188	3.7	2.2	5.9 c	0.103	0.959
Chateau +DC 1–6184	Directed	0.093 0.5% v/v	3.3	3.3	6.6 c	0.111	0.975
Chateau 51WG +DC 1–6184	Directed	0.188 0.5% v/v	3.5	2.3	5.8 c	0.119	0.958
Outlook 6.0	Directed	0.65	10.4	9.1	19.5 b	0.115	1.089
Broadstar	Broadcast	0.094	4.2	2.8	7.0 c	0.102	0.982
Pr>Treat			<0.001	0.011	<0.001	0.192	0.882
Pr>Block			0.137	0.900	0.457	<0.001	<0.001
$LSD_{0.05}$			2.9	4.1	5.6	NS	NS

Table 5. Trial No. 2. Phytotoxicity rating on July 15 and weed counts on two dates.

Treatment	Application	Lbs a.i./A	July 15	August 19					October 1			
			Phyto[1]	Malva	Scarlet Pimpernel	Night shade	Total Weeds	Phyto[1]	Malva	Sow Thistle	Other Weeds[2]	Total Weeds
Untreated			0.0	5.7	1.7	1.0	8.3	0.0	7.0	0.7	6.3	14.0
Dual Magnum	Directed	1.43	0.3	4.3	1.0	0.0	5.3	0.0	3.7	0.0	3.0	6.7
Chateau	Directed	0.093	2.3	1.0	0.0	0.0	1.0	1.0	0.7	0.0	1.7	2.3
Chateau	Directed	0.188	3.0	1.0	0.0	0.0	1.0	1.3	0.7	0.3	1.3	2.3
Chateau	Shielded	0.093	1.7	1.7	0.3	0.0	2.0	1.3	1.7	0.7	1.0	3.3
Chateau	Shielded	0.188	2.7	0.7	0.3	0.0	1.0	1.3	1.3	0.0	2.3	3.7
Pr>Treat			<0.001	0.017	0.137	0.066	0.018	<0.001	0.002	0.221	0.066	0.002
Pr>Block			0.513	0.772	0.911	0.402	0.756	0.031	0.391	0.751	0.312	0.204
$LSD_{0.05}$			0.9	3.0	NS	NS	4.5	0.6	2.6	NS	NS	3.6

1 – Scale: 0 = no crop damage to 10 = crop dead; 2 – other weeds = bristly ox tong and sow thistle

Table 6. Trial No. 2. Yield evaluation (per 15 plants per plot) on October 1, 2009.

Treatment	Application	Lbs a.i./A	Total fruits (lbs)	Marketable fruit (lbs)	Total fruits	Mean fruit wt (lbs)	% red fruits	% green fruits	% breaker fruits	% sunburned fruits
Untreated	----	----	45.8	36.9	105	0.505	70	19	3	9
Dual Magnum	Directed	1.43	41.2	30.6	92	0.513	65	23	1	11
Chateau	Directed	0.093	48.4	33.1	113	0.524	57	29	3	11
Chateau	Directed	0.188	45.4	33.4	106	0.533	59	34	1	6
Chateau	Shielded	0.093	47.3	34.7	108	0.506	63	23	5	8
Chateau	Shielded	0.188	42.7	30.2	101	0.513	59	25	6	10
Pr>Treat			0.532	0.543	0.416	0.313	0.437	0.340	0.353	0.333
Pr>Block			0.365	0.342	0.184	0.207	0.700	0.761	0.538	0.349
$LSD_{0.05}$			NS	NS	NS	NS	NS	NS	NS	NS