

## **Broccoli and Cabbage Weed Control Trials 2004**

Richard Smith, Vegetable Crop and Weed Science Farm Advisor  
University of California Cooperative Extension, Monterey County

**Objective:** To evaluate new preemergence and post emergence weed control strategies for broccoli and cabbage.

**Summary:** Several materials and rates were evaluated in these trials. Goal Tender 4F is a promising post emergence application material for cole crops. In these trials, on occasion, it appeared to cause slight stunting of broccoli and cabbage. However, stunting caused by Goal Tender at the 2 ounce/A rate was comparable to AN 20, a standard weed control practice used in the broccoli production, and both treatments yielded comparably. Goal Tender provided excellent control of Purslane, Nettle and Malva, but was weak on Shepherds Purse. Xpress Organic was safe for use over the top of broccoli in one trial but not in the other and these evaluations will need to be repeated to better understand the safety of this material for post emergence use on cole crops. Flumioxazin coated fertilizer provided acceptable weed control when applied at the first true leaf stage of broccoli, but was too phytotoxic to the crop. Pyraflufen was also unacceptably phytotoxic to broccoli at the rates used in this trial.

**Methods: *Broccoli Trial No. 1:*** Conducted in cooperation with Ed Mora of D'Arrigo Bros. on Ranch 19, Block 7. The preemergence applications were made on May 3 and postemergence applications were made on June 3 (all plots had been treated with 50 GPA of AN20 earlier that morning). The variety was Marathon and the soil type was Elkhorn Fine Sandy Loam.

***Broccoli Trial No. 2:*** Conducted in Soledad in cooperation with Ed Mora of D'Arrigo Bros. on Ranch 2, Block 26. The preemergence applications were made on May 24 and postemergence applications were made on June 11. 500 lbs/A of ammonium nitrate fertilizer were applied to the plots to even out the amount of nitrogen applied in the post emergence AN 20 and flumioxazin coated fertilizer treatments. The variety was Patron and the soil type was Chualar Loam. ***Details common to both trials:*** See table 1 for materials and rates. Each plot was 20 feet long by 40 inches wide and randomized in a complete block design with three replications.

The treatments were applied with two passes of a one-nozzle wand with an 8004E tip applying the equivalent of 37 GPA unless noted otherwise. ***Cabbage Trial No. 1:*** Conducted in cooperation with Galen Schmeidt of Tanimura and Antle on the Spreckles Ranch block 28. The trial was conducted on a direct seeded field of red cabbage. No preemergence herbicide was applied to the trial area. The postemergence applications were made on March 11. The treatments were applied at 72 GPA using two passes of an 8008E nozzle at 30 psi; 47 GPA using two passes of an 8005E nozzle at 30 psi; or 72 GPA as a directed spray to the base of the plants. Each plot was one 40-inch bed wide by 20 feet long. The variety was Ruby and the trial was conducted on Salinas Clay loam soil. ***Cabbage Trial No. 2:*** Conducted at the Hartnell East Campus Research Station. The trial was direct seeded on August 17 and the Dacthal preemergence application was made on the same day. The post emergence applications were made on September 16. The treatments were applied with two passes of a one-nozzle wand with an 8004E tip applying the equivalent of 37 GPA unless noted otherwise. All plots were one 40-inch bed wide by 20 feet long and arranged in a randomized complete block design with four replications. The variety was Headstart and the soil type was Chualar Sandy Loam. See tables for evaluation and harvest dates.

**Results: *Broccoli Trial No. 1:*** No weed evaluations were made of this trial due to low weed pressure. All treatments were over sprayed with 50 GPA of AN20. In addition, the trial was harvested by the crew before the second harvest evaluation could be conducted, but we were able to count the stumps of the harvested heads and therefore only total heads are shown. In spite of these issues, the trial did provide a good measure of relative

yield between treatments. Pyraflufen was too phytotoxic at the rates used in this trial (table 2). There was no significant reduction in yield from the post emergence application of Goal 4F except for the Dacthal + Goal 4F combination. It is unclear why the combination yielded less as this has not been seen in the past. Xpress Organic did not significantly reduce the yield in this trial when applied post emergence. Flumioxazin (the active ingredient in Chateau) coated fertilizer did reduce yield at the 125 lbs rate and appeared to have spotty toxicity on the broccoli plants presumably due to the uneven application of the granular material. **Broccoli Trial No. 2:** There was good weed pressure in this trial. All Goal treatments provided excellent weed control. AN 20 was weak on Lambsquarter and provided intermediate control of Hairy Nightshade (table 3). Xpress Organic was weak on Malva and provided intermediate overall weed control. Flumioxazin coated fertilizer provided good weed control. Pyraflufen provided excellent weed control but was too phytotoxic to the broccoli. Goal 4F did not reduce the stand of broccoli and dramatically reduced the hours per acre to weed. In addition, it had intermediate phytotoxicity ratings except for Goal 2XL which was relatively high. Xpress Organic appears to have reduced the stand of broccoli and had significant phytotoxicity. All Goal Tender treatments yielded comparably to the untreated and AN 20 treatment (table 4). Flumioxazin and Xpress Organic reduced the yield of broccoli in this trial. **Cabbage Trial No.1:** All treatments had acceptable phytotoxicity ratings except for Goal 2XL at 4 ounces/A (table 5). All weed control materials provided comparable control of Shepherds Purse and Nettle. The AN 20 treatment had significantly greater yield than several treatments presumably because of the additional nitrogen that was added to the crop. All of the Goal treatments yielded comparably, but there was a weak trend suggesting indicating lower yield at the 4 ounce vs the 2 ounce rate. **Cabbage Trial No.2:** Goal Tender provided excellent control of nettle and purslane, but only partial control of Shepherds Purse (table 6). Goal Tender at the 2 ounce/A rate and AN 20 treatments caused noticeable but slight stunting of the cabbage on the first evaluation date. The plants were not taken to full marketable yield, but rather were harvested at an immature stage (biomass evaluation). There were fewer plants in the AN 20 treatment, but no differences in yield as measured by total weight per plot and mean head weight (table 7).

Table 1. Rates and application techniques for the broccoli trials

No.	Treatment	Rate lb ai/A	Material/A	Application Technique
1	Untreated	----	----	----
2	Ammonium Nitrate	72 gallons	72 gallons	Post over top
3	Dacthal 75WP <sup>1</sup>	7.5	10.0 lbs	Preemergence
	Goal Tender 4F	0.0625	2.0 fl. oz	Post over top
4	Goal Tender 4F	0.0625	2.0 fl. oz	Post over top
5	Goal Tender 4F	0.125	4.0 fl. oz	Post over top
6	Goal Tender 4F <sup>2</sup>	0.125	4.0 fl. oz	Post high volume <sup>1</sup>
7	Goal 2XL	0.063	4.0 fl. oz	Post over top
8	Flumioxazin on fertilizer <sup>3</sup> 0.25 lbs a.i./ 250 lbs fertilizer	0.063	125 lbs	Post broadcast (21 days)
9	Flumioxazin on fertilizer <sup>3</sup> 0.25 lbs a.i./ 250 lbs fertilizer	0.094	188 lbs	Post broadcast (21 days)
10	Xpress Organic	10% v/v	10%	Post over top
11	Xpress Organic	20% v/v	20%	Post over top
12	Pyraflufen 25 g/l	0.10	0.48 gallon	Preemergence
13	Pyraflufen 25 g/l	0.005	3.1 fl. oz	Post over top
14	Pyraflufen 25 g/l	0.01	6.2 fl. oz	Post over top

1 – preemergence; 2 – postemergence high volume (72 GPA); 3 post emergence broadcast 21 days following seeding

Table 2. Trial No. 1. Yield evaluation of broccoli

<b>Treatment</b>	<b>Material/A</b>	<b>Number per plot July 29</b>	<b>lbs. per plot July 29</b>	<b>Mean head wt. July 29</b>	<b>Heads per plot August 3</b>	<b>Total Heads Per plot</b>
Untreated	----	32.3	15.3	0.47	11.0	43.3
Ammonium Nitrate	72 gallons	27.7	13.1	0.47	14.7	42.3
Dacthal 75WP <sup>1</sup> Goal Tender 4F	10.0 lbs 2.0 fl. oz	21.7	11.1	0.51	9.7	31.3
Goal Tender 4F	2.0 fl. oz	26.3	12.6	0.47	10.7	37.0
Goal Tender 4F	4.0 fl. oz	30.7	14.6	0.48	9.3	40.0
Goal Tender 4F <sup>2</sup>	4.0 fl. oz	26.7	13.0	0.50	11.7	38.3
Goal 2XL	4.0 fl. oz	25.0	12.8	0.50	15.0	40.0
Flumioxazin on fertilizer <sup>3</sup> 0.25 lbs a.i./ 250 lbs fertilizer	125 lbs	22.7	11.2	0.49	9.7	32.3
Flumioxazin on fertilizer <sup>3</sup> 0.25 lbs a.i./ 250 lbs fertilizer	188 lbs	28.7	14.8	0.52	7.0	35.7
Xpress Organic	10% v/v	28.3	13.5	0.50	12.3	40.7
Xpress Organic	20% v/v	31.0	15.9	0.51	7.7	38.7
Pyraflufen 25 g/l <sup>1</sup>	0.48 gallon	0.0	0.0	0.0	0.0	0.0
Pyraflufen 25 g/l	3.1 fl. oz	12.7	7.3	0.51	7.0	19.7
Pyraflufen 25 g/l	6.2 fl. oz	0.0	0.0	0.0	0.0	0.0
LSD (0.05)	----	8.4	4.8	0.08	6.0	10.5

1 – preemergence; 2 – postemergence high volume (72 GPA); 3 post emergence broadcast 21 days following seeding

Table 3. Trial No. 2. Weeds per 2-4" uncultivated bands x 20 feet (13.3 ft<sup>2</sup>) and time to weed evaluations on June 24, and phytotoxicity rating on two dates

<b>Treatment</b>	<b>Material per Acre</b>	<b>Hairy Night-shade</b>	<b>Malva</b>	<b>Lambs-quarter</b>	<b>Total Weeds</b>	<b>Stand Count</b>	<b>Hrs/A to weed</b>	<b>Phyto rating<sup>1</sup> June 17</b>	<b>Phyto rating<sup>1</sup> June 24</b>
Untreated	----	40.3	9.3	5.3	56.6	71.0	16.5	0.0	0.3
Ammonium Nitrate	72 gals.	26.0	3.3	6.7	37.0	77.3	12.8	0.0	0.7
Dacthal 75WP <sup>1</sup> Goal Tender 4F	10.0 lbs 2.0 fl. oz	1.3	2.0	0.3	4.0	76.6	4.1	1.3	1.7
Goal Tender 4F	2.0 fl. oz	2.3	0.7	0.7	4.3	73.3	3.7	1.3	2.2
Goal Tender 4F	4.0 fl. oz	2.3	0.0	0.0	3.7	82.0	3.7	2.0	3.3
Goal Tender 4F <sup>2</sup>	4.0 fl. oz	0.7	0.3	0.0	1.0	80.0	3.1	1.7	2.3
Goal 2XL	4.0 fl. oz	3.0	0.0	0.7	4.3	78.6	3.7	4.0	5.3
Flumioxazin on fertilizer <sup>3</sup> 0.25 lbs a.i./ 250 lbs fertilizer	125 lbs	1.3	5.0	1.3	8.3	71.0	5.8	1.7	6.7
Flumioxazin on fertilizer <sup>3</sup> 0.25 lbs a.i./ 250 lbs fertilizer	188 lbs	2.0	7.3	0.3	10.3	61.6	5.6	2.0	7.3
Xpress Organic	10%	12.0	13.3	3.3	28.7	64.0	9.0	1.7	7.6
Xpress Organic	20%	11.7	14.3	0.0	26.0	53.3	8.9	3.0	9.0
Pyraflufen 25 g/l <sup>1</sup>	0.48 gallon	0.0	1.7	0.5	1.7	1.3	2.5	10.0	10.0
Pyraflufen 25 g/l	3.1 fl. oz	0.0	2.0	0.0	2.0	37.3	3.0	7.3	9.0
Pyraflufen 25 g/l	6.2 fl. oz	0.0	0.0	0.0	0.0	2.3	2.5	9.0	10.0
LSD (0.05)	----	15.1	8.5	3.4	21.6	23.4	4.8	1.2	1.6

1 – preemergence; 2 – postemergence high volume (72 GPA); 3 post emergence broadcast 19 days following seeding  
4 – scale: 0 = no crop damage to 10 crop dead.

Table 4. Trial No. 2. Yield evaluation of broccoli

Treatment	Material/A	Number per plot Aug. 18	lbs. per plot Aug. 18	Number per plot Aug. 23	lbs. per plot Aug. 23	Total Heads Per plot	Total lbs. per plot	Mean Head Wt. lbs
Untreated	----	6.7	3.1	11.3	5.6	18.0	8.6	0.48
Ammonium Nitrate	72 gallons	4.3	2.1	13.7	6.9	18.0	9.0	0.50
Dacthal 75WP <sup>1</sup>	10.0 lbs	8.3	4.5	9.3	4.0	17.7	8.5	0.48
Goal Tender 4F	2.0 fl. oz	6.0	3.7	10.7	5.3	16.7	9.0	0.54
Goal Tender 4F	4.0 fl. oz	5.3	2.7	11.3	5.3	16.7	7.9	0.47
Goal Tender 4F <sup>2</sup>	4.0 fl. oz	5.3	2.6	15.3	8.3	20.7	10.9	0.53
Goal 2XL	4.0 fl. oz	7.0	3.8	7.7	3.9	14.6	7.7	0.54
Flumioxazin on fertilizer <sup>3</sup>	125 lbs	4.7	3.5	7.0	4.2	11.7	7.7	0.68
0.25 lbs a.i./ 250 lbs fertilizer	188 lbs	5.3	4.6	6.3	2.4	11.7	7.0	0.63
Flumioxazin on fertilizer <sup>3</sup>	0.25 lbs a.i./ 250 lbs fertilizer							
Xpress	10%	4.0	2.6	8.3	4.2	12.3	6.8	0.56
Xpress	20%	0.7	0.3	4.7	2.1	5.3	2.4	0.45
Pyraflufen 25 g/l <sup>1</sup>	0.48 gallon	0.0	0.0	0.0	0.0	0.0	0.0	0.67
Pyraflufen 25 g/l	3.1 fl. oz	3.3	2.3	4.0	2.7	7.3	5.0	0.81
Pyraflufen 25 g/l	6.2 fl. oz	0.0	0.0	0.3	0.2	0.3	0.2	0.87
LSD (0.05)	----	3.8	2.4	6.0	2.7	6.7	3.5	0.34

1 – preemergence; 2 – postemergence high volume; 3 post emergence broadcast 19 days following seeding

Table 5. Cabbage trial No. 1. Phytotoxicity, weed and yield evaluations.

Treatment	Material per Acre	Application Technique	Phyto <sup>4</sup>	S. purse <sup>5</sup>	Nettle <sup>5</sup>	Wt of 16 heads (lbs)	Mean head Wt (lbs)	Yield T/A	Percent harvested
Untreated	----	----	0.0	0.0	0.0	40.4	2.53	29.14	87.8
Ammonium Nitrate	72 gallons	Over top <sup>1</sup>	1.5	8.0	8.2	44.4	2.77	31.84	87.3
Goal Tender 4F	2.0 fl. oz	Over top <sup>1</sup>	0.8	7.0	9.0	40.8	2.55	29.29	88.3
Goal Tender 4F	4.0 fl. oz	Over top <sup>1</sup>	1.9	8.1	9.5	36.2	2.26	25.36	85.8
Goal Tender 4F	2.0 fl. oz	Low volume <sup>2</sup>	0.5	7.9	9.1	39.8	2.49	27.51	84.6
Goal Tender 4F	4.0 fl. oz	Low volume <sup>2</sup>	1.8	8.0	9.1	41.3	2.58	28.26	83.4
Goal Tender 4F	2.0 fl. oz	Directed <sup>3</sup>	0.8	7.0	8.9	43.5	2.71	31.22	87.9
Goal Tender 4F	4.0 fl. oz	Directed <sup>3</sup>	1.1	8.1	9.0	37.9	2.37	26.56	85.4
Goal 2XL	2.0 fl. oz	Over top <sup>1</sup>	0.8	8.0	9.0	39.2	2.45	27.69	86.7
Goal 2XL	4.0 fl. oz	Over top <sup>1</sup>	2.5	6.9	8.9	38.9	2.43	26.88	85.0
LSD (0.05)			0.5	0.9	0.4	6.8	0.42	5.42	ns

1 – 72 GPA using two passes of an 8008E nozzle at 30 psi; 2 – 47 GPA using two passes of an 8005E nozzle at 30 psi; 3 – 72 GPA directed to the base of the plants; 4 – Scale: 0 = no crop damage to 10 crop dead; 5 – Scale: 0 = no weed control to 10 complete weed control.

Table 6. Cabbage trial No. 2. Phytotoxicity and weed evaluations (2 ft<sup>2</sup>) on September 27.

Treatment	Rate lb ai/A	Material/A	Application Technique	Nettle	Shepherds Purse	Purslane	Total Weeds	Phyto <sup>3</sup>
Untreated	----	----	----	23.9	36.8	10.5	80.3	0.0
Ammonium Nitrate	72 gallons	72 gallons	Post over top	2.3	2.0	15.5	23.8	2.3
Dacthal 75WP <sup>1</sup>	7.5	10.0 lbs	Preemergence	0.0	3.3	0.0	4.5	2.5
Goal Tender 4F	0.0625	2.0 fl. oz	Post over top					
Goal Tender 4F	0.0625	2.0 fl. oz	Post over top	0.0	24.0	0.0	25.0	2.5
Goal Tender 4F	0.125	4.0 fl. oz	Post over top	0.0	16.8	0.0	18.5	2.8
Goal Tender 4F	0.125	4.0 fl. oz	Post high volume <sup>2</sup>	0.0	21.5	0.0	21.8	3.0
Goal 2XL	0.063	4.0 fl. oz	Post over top	0.0	26.5	0.0	26.8	4.0
LSD (0.05)				8.0	23.8	5.6	24.6	0.8

1 – preemergence; 2 – postemergence high volume (72 GPA); 3 – Scale: 0 = no crop damage to 10 crop dead

Table 7. Cabbage trial No. 2. Biomass evaluations on October 25

Treatment	Rate lb ai/A	Material/A	Application Technique	Number Per plot	Wt (lbs) Per plot	Mean plant wt (lbs)
Untreated	----	----	----	55.0	21.7	0.39
Ammonium Nitrate	72 gallons	72 gallons	Post over top	49.3	14.4	0.28
Dacthal 75WP <sup>1</sup>	7.5	10.0 lbs	Preemergence	53.3	14.6	0.27
Goal Tender 4F	0.0625	2.0 fl. oz	Post over top			
Goal Tender 4F	0.0625	2.0 fl. oz	Post over top	53.8	18.2	0.34
Goal Tender 4F	0.125	4.0 fl. oz	Post over top	48.3	17.2	0.36
Goal Tender 4F	0.125	4.0 fl. oz	Post high volume <sup>2</sup>	60.3	17.6	0.29
Goal 2XL	0.063	4.0 fl. oz	Post over top	51.3	17.3	0.34
LSD (0.05)				5.5	n.s.	n.s.

1 – preemergence; 2 – postemergence high volume (72 GPA)