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WEED CONTROL IN SEEPAGE IRRIGATED FALL TRANSPLANTED BROCCOLI AND CAULIFLOWER[1]

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Abstract. **Preplant incorporated applications of oxyfluorfen (0.5 lb. a.i./acre) and post transplant applications of DCPA (8 lb. a.i./acre), napropamide (2 lb. a.i./acre) and propachlor (5 and 10 lb. a.i./acre for each of 3 applications) were evaluated for efficacy and phytotoxicity in fall transplanted 'Atlantic' broccoli** (Brassica oleracea **L. Italica Group) and 'Early Snowball A' cauliflower** (Brassica oleracea **L. Botrytis Group). Crop plant vigor was acceptable with all herbicide treatments for both crops. Grass and broadleaf weed control was acceptable with all treatments except DCPA. Broccoli yields were decreased by DCPA relative to the hoed check, but cauliflower yields were not affected. Herbicide treatments did not influence broccoli head size; however, the size of cauliflower curds was decreased by DCPA compared to the hoed check, oxyfluorfen and 10 lb. a.i./acre propachlor treatments. The most acceptable herbicide treatments were napropamide, oxyfluorfen, and both rates of propachlor.**

Weed control is a major problem in vegetable production on sandy soils in Florida. The long growing season and production under different environmental conditions during spring and fall result in considerable diversity of weed species present and their severity of infestation. Lack of weed control increases harvest costs, while reducing yield and quality of marketable produce and effectiveness of other pesticides. Weed control practices in broccoli and cauliflower were further hindered by the loss of 2 of the 4 previously registered herbicides. Of the remaining materials, DCPA does not always perform well, while trifluralin offers erratic weed control on low organic matter content sands (3). Evaluations of herbicides in north Florida indicated highest yields of broccoli and cauliflower were obtained with DCPA in spring while metolachlor, napropamide and oxyfluorfen provided the highest yields in the fall (2). Napropamide and oxyfluorfen performed well in a spring herbicide trial in cauliflower at the Bradenton Agricultural Research and Education Center, but have not been evaluated on broccoli at this location (1). Therefore, evaluation of DCPA, napropamide, oxyfluorfen and propachlor was conducted on broccoli and cauliflower during the fall of 1982.

Materials and Methods

Six-week old container grown 'Atlantic' broccoli and 'Early Snowball A' cauliflower plants were transplanted September 30, 1982 into Myakka fine sand (pH 6.3) which had been fumigated with 6 gal/acre of ethylene dibromide. Plants were grown on raised, unmulched beds to facilitate evaluation of the compounds for weed control. Plants were fertilized with 6-6-6 containing micronutrients and 18-0-25 (with 2% MgO) as needed to supply a total of 150 lb. N, 120 lb. P_2O_5, and 190 lb. K_2O per acre. Treatment plots were arranged in a randomized complete block design with one-half of each plot being planted to broccoli and one-half to cauliflower. Plot size was 4.5 x 24 ft with 12 plants of each crop spaced 1 ft apart in a single row. Treatments were replicated 4 times.

Treatments were a weedy check, a hoed check, preplant incorporated application of oxyfluorfen (Goal®, 0.5 lb. a.i./acre), single post transplant applications of DCPA (Dacthal®, 8.0 lb. a.i./acre) and napropamide (Devrinol®, 2.0 lb. a.i./acre) and 3 post transplant applications of propachlor (Ramrod®, 5 and 10 lb. a.i./acre). Preplant incorporated (ppi, September 30) and post transplant (post-t, single application, September 30 and post-t, multiple applications, September 30, October 12, and November 10) herbicide treatments were applied with a CO_2 backpack sprayer operated at 3 mph and 22 psi pressure with 2 11004 unijet nozzles delivering 26.6 gal/acre. Oxyfluorfen was incorporated with a rototiller to a depth of 2 inches. Hoed checks were hoed weekly for the entire season.

Crop vigor was evaluated October 27 and weed control was evaluated October 27 and December 21. Predominant weed species were crabgrass (*Digitaria ciliaris* (Ratz.) Koel), goosegrass (*Eleusine indica* (L.) Gaertn.), pigweed (*Amaranthus viridis* L.) and rorippa (*Rorippa teres* L.). Marketable broccoli heads and cauliflower curds were harvested, counted and weighed November 24 (broccoli only) and 29 and December 2, 6 and 15. Data were analyzed by analyses of variance and treatment means were separated by Duncan's new multiple range test.

Results and Discussion

Broccoli plant vigor was not reduced by any of the treatments, except napropamide (Table 1). Vigor of cauliflower plants, when compared with the hoed check, was not affected by treatment; however, plants in plots treated with

Table 1. Influence of herbicide treatment on vigor of transplanted broccoli and cauliflower. Bradenton, FL, Fall 1982.

Treatment	Rate (lb. a.i./acre)	Method of application[y]	Vigor[z] Broccoli	Vigor[z] Cauliflower
Weedy check	—	—	9.8 a[x]	9.4 abc
Hoed check	—	—	9.8 a	9.4 abc
Oxyfluorfen (Goal)	0.5	ppi	9.6 a	9.8 a
DCPA (Dacthal)	8.0	post-t	9.5 a	9.6 ab
Napropamide (Devrinol)	2.0	post-t	8.5 b	8.6 bc
Propachlor (Ramrod)[w]	5.0	post-t	9.0 ab	8.6 bc
Propachlor (Ramrod)[w]	10.0	post-t	9.1 ab	8.5 c

[z]Vigor was rated on a 0 to 10 scale where 0 = all plants dead and 10 = optimum growth, no phytotoxicity.
[y]ppi = preplant incorporated, post-t = post transplant.
[x]Mean separation within columns by Duncan's new multiple range test, 5% level.
[w]Two applications at indicated rate occurred prior to evaluation.

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napropamide and both rates of propachlor were less vigorous than those in the oxyfluorfen treatment. Repeat applications of propachlor produced some lesions on broccoli and cauliflower leaves, but they were not severe enough to reduce vigor.

Early season grass control was excellent (>97%) with oxyfluorfen, napropamide and the high rate of propachlor (Table 2). Although less grass control was obtained with the low rate of propachlor, it was still acceptable. Grass control with DCPA was marginal with a rating of 7.0 or less being considered unacceptable. By the end of harvest, the grass population was low and all herbicide treatments effected acceptable control, but only napropamide provided grass control comparable to the hoed check. Grass control with DCPA improved, but this may have been due to crop competition and a slight decrease in pigweed control which resulted in shading of the grass weeds. Control of pigweed and rorippa at the first evaluation was excellent (>96%) with all herbicides, except DCPA. By late season only napropamide and propachlor (10 lb. a.i./acre) provided pigweed control comparable to the hoed check. Pigweed control with oxyfluorfen and 5 lb. a.i./acre propachlor was acceptable, although it was significantly lower than that obtained with napropamide. DCPA no longer provided acceptable pigweed control. Late season rorippa control was not different from the hoed check in plots treated with both rates of propachlor. Control with the remaining treatments was acceptable and actually appeared to improve with the DCPA treatment but this may have been due to crop and pigweed competition as rorippa is not a particularly strong competitor.

Broccoli was harvested 5 times over a 21-day period.

Table 2. Influence of herbicide treatments on weed control in transplanted cauliflower and broccoli. Bradenton, FL, Fall 1982.

Treatment	Rate (lb. a.i./acre)	Method of application[y]	Weed control rating[z]					
			Grass		Pigweed		Rorippa	
			Oct. 27	Dec. 21	Oct. 27	Dec. 21	Oct. 27	Dec. 21
Weedy check	—	—	0.0 c[x]	0.0 d	0.0 c	0.0 d	0.0 c	0.0 d
Hoed check	—	—	10.0 a	10.0 a	10.0 a	10.0 a	10.0 a	10.0 a
Oxyfluorfen (Goal)	0.5	ppi	9.7 a	8.4 c	9.9 a	9.0 b	9.5 a	8.8 c
DCPA (Dacthal)	8.0	post-t	7.6 b	8.0 c	7.0 b	6.6 c	7.0 b	8.6 c
Napropamide (Devrinol)	2.0	post-t	10.0 a	9.4 ab	9.8 a	9.9 a	9.6 a	9.0 bc
Propachlor (Ramrod)[w]	5.0	post-t	8.6 b	8.1 c	9.6 a	8.5 b	9.9 a	9.6 ab
Propachlor (Ramrod)[w]	10.0	post-t	9.8 a	8.8 bc	9.9 a	9.4 ab	10.0 a	9.7 a

[z]Weed control was evaluated on a 0 to 10 visual scale where 0 = no control and 10 = 100% control.
[y]ppi = preplant incorporated, post-t = post transplant.
[x]Mean separation within columns by Duncan's new multiple range test, 5% level.
[w]Three applications at indicated rate.

Table 3. Influence of herbicide treatment on yield of marketable broccoli heads at each harvest and season total and average head size for the season. Bradenton, FL, Fall 1982.

Treatment	Rate (lb. a.i./acre)	Method of application[z]	Number of 23-lb. crates/acre						Avg. head wt (lb.)
			Nov. 24	Nov. 29	Dec. 2	Dec. 6	Dec. 15	Total	
Weedy check	—	—	2.6 a[y]	30.7 c	46.5 a	24.6 b	23.7 a	128.0 c	.34 b
Hoed check	—	—	22.8 a	109.6 ab	75.4 a	42.1 ab	25.4 a	275.3 a	.48 ab
Oxyfluorfen (Goal)	0.5	ppi	23.7 a	96.4 b	74.5 a	15.8 b	41.2 a	251.6 ab	.42 ab
DCPA (Dacthal)	8.0	post-t	19.3 a	71.9 bc	82.4 a	33.3 b	20.2 a	227.1 b	.45 ab
Napropamide (Devrinol)	2.0	post-t	0.0 a	71.9 bc	75.4 a	63.1 a	43.8 a	254.3 ab	.45 ab
Propachlor (Ramrod)[w]	5.0	post-t	24.6 a	59.6 c	96.4 a	18.9 b	43.0 a	252.5 ab	.47 a
Propachlor (Ramrod)[w]	10.0	post-t	0.0 a	136.8 a	97.3 a	35.9 ab	8.8 a	278.8 a	.37 ab

[z]ppi = preplant incorporated, post-t = post transplant.
[y]Mean separation within columns by Duncan's new multiple range test, 5% level.
[w]Three applications at indicated rate.

Table 4. Influence of herbicide treatment on yield of marketable[z] cauliflower curds at each harvest and season total and average curd size for the season. Bradenton, FL, Fall 1982.

Treatment	Rate (lb. a.i./acre)	Method of application[y]	Number of 23-lb. crates/acre					Avg. curd wt (lb.)
			Nov. 29	Dec. 2	Dec. 6	Dec. 15	Season total	
Weedy check	—	—	16 a	30 c	57 b	117 a	219 b	0.8 c
Hoed check	—	—	34 a	324 ab	210 a	182 a	751 a	1.7 a
Oxyfluorfen (Goal)	0.5	ppi	24 a	450 a	96 ab	167 a	736 a	1.7 a
DCPA (Dacthal)	8.0	post-t	50 a	282 ab	153 ab	102 a	587 a	1.4 b
Napropamide (Devrinol)	2.0	post-t	0 a	247 b	168 ab	266 a	681 a	1.6 ab
Propachlor (Ramrod)[w]	5.0	post-t	40 a	380 ab	146 ab	164 a	730 a	1.5 ab
Propachlor (Ramrod)[w]	10.0	post-t	19 a	249 b	133 ab	253 a	655 a	1.7 a

[z]Marketable yield is defined as curds weighing greater than 0.8 lb.
[y]ppi = preplant incorporated, post-t = post transplant.
[x]Mean separation within columns by Duncan's new multiple range test, 5% level.
[w]Three applications at indicated rate.

Yield of marketable stalks was not significantly influenced by treatment relative to the hoed check for the first, third, fourth or fifth harvests (Table 3). Broccoli yield at the second harvest was not decreased by any herbicide treatment except 5 lb. a.i./acre propachlor which yielded significantly less than the hoed check, oxyfluorfen and 10 lb. a.i./acre propachlor. Season total yield was not significantly different from the hoed check with all herbicide treatments, except DCPA. Average head weight was not affected by treatment. Marketable cauliflower curds were harvested 4 times over a 16-day period. Yield was not affected by herbicide treatment relative to the hoed check at any harvest date or for the season total (Table 4). At the second harvest, yield was greater with oxyfluorfen than with napropamide or 10 lb. a.i./acre propachlor, but there were no differences among herbicide treatments at any other harvest date or for season total. Cauliflower curd size for the season was greater in the hoed check and plots treated with oxyfluorfen and 10 lb. a.i./acre propachlor than was obtained with *DCPA*.

Considering weed control and yield, the best herbicide treatments for broccoli and cauliflower were oxyfluorfen, napropamide and both rates of propachlor.

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PEPPER PRODUCTION AS INFLUENCED BY PLANT SPACING AND NITROGEN-POTASSIUM RATES[1]

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Abstract. **Three within-row plant spacings and 3 N-K_2O rates were evaluated for their effects on yield, fruit size and plant height of 2 bell pepper** (Capsicum annuum **L.) cultivars. Within-row spacings were 4, 8 or 12 inches between plants and N-K_2O rates were either 150-210, 205-290 or 294-415 lb./acre, respectively. The 2 cultivars tested were 'Early Calwonder' (ECW) and IFAS breeding line No. 811 (BL). This study was conducted during the spring and fall seasons of 1982 and the spring season of 1983. For 2 of the 3 seasons marketable yield per acre increased as the within-row spacing decreased from 12 to 8 to 4 inches. For the other season, yields at 4 and 8 inch spacings were equal and higher than yields at the 12 inch spacing. In all 3 tests, yield/plant was lowest at the 4-inch, intermediate at the 8-inch and highest at the 12-inch in-row spacing. However, the higher yield/plant at the wider spacings was not sufficient to compensate for the reduced plant population. Marketable yields/acre were higher with ECW than with the BL during all 3 tests. Average fruit weight was higher at the 12-inch spacing in 1 of the 3 tests. In all 3 tests, plant height of ECW and BL was greater at the 4-inch, intermediate at the 8-inch and less at the 12-inch in-row spacing. There was no significant response in yield or fruit size during any of the 3 seasons to increased rates of N-K_2O. However, plant height was increased with the medium and high rates of N-K_2O during 2 of the seasons.**

Florida's annual production of pepper on 20,400 acres accounts for approximately one-third of the total U.S. production and during the November to June period this increases to almost 50% (1). Maximum production per unit area at economical costs is necessary to maintain the state's competitive position. High density plantings with proper management could accomplish this goal. Peppers produced in south Florida, the major production area, are commonly grown using within-row spacings of 8 to 10 inches, plastic mulched plant beds spaced 6 ft on center, seep irrigation and nitrogen rates of 250 to 300 and potassium (K_2O) rates of 375-450 lb./acre (1). Locascio and Stall (6) using overhead irrigation reported increased pepper yields with beds spaced 4 ft as compared to 6 ft on center, but obtained no yield difference between within-row spacings of 9 to 12 inches. Stoffella (personal communication) obtained about a 40% increase in yields at 11-inch as compared to a 22-inch within-row spacing. Yields of non-mulched peppers have also been increased with higher plant densities (2). Plant density has been shown to influence the yield of a number of other crops (3, 4, 8). There are also numerous reports (5, 6, 7) concerning the effect of fertilizer rates on pepper production.

These studies were conducted to determine the influence of within-row plant spacing and N-K_2O rates on the production of two bell pepper cultivars having different growth characteristics.

Materials and Methods

Experiments were conducted on an Immokalee fine sand (Arenic Haplaquod) during the spring seasons (February-May) 1982 and 1983, and the fall season (September-December) 1982 to evaluate the effect of 3 within-row plant spacings and 3 N-K_2O rates on the production of 2 bell pepper cultivars. Within-row plant spacings were 4, 8 and 12 inches, and the N-K_2O rates (lb./acre) were 150-210, 204-290, and 295-415, respectively, for the low, medium and high rates. The 2 pepper cultivars were 'Early Calwonder', a standard for commercial use in south Florida, and IFAS breeding line No. 811, which has a short to medium plant type and concentrated fruit set. Treatments were arranged in factorial combinations in a randomized complete block design with 4 replications.

Different plot areas were used for each of the 3 experiments, but all were located in a field which had been in bahiagrass for approximately 15 yr. Soil samples taken from

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