Table 3. Injury to bell peppers treated with various spray tank mixtures, Groveland, FL, 6 June 1985.[z]

Treatment	Rate (formation/acre)	Sun scald or chemical burn/plot		Worm-injured peppers/plot[y]	
		Number	Weight (lb.)	Number	Weight (lb.)
Maneb +	1.6 qt.				
copper hydroxide +	3.0 lb.				
soluble fertilizer +	10.0 lb.				
spreader-sticker	0.5 pt.	14.00 b[x]	2.82 b	3.00 a	0.58 a
Chlorpyrifos +	1.0 qt.				
spreader-sticker	0.5 pt.	20.50 ab	3.55 ab	0.50 b	0.15 b
Soluble fertilizer +	10.0 lb.				
chlorpyrifos +	1.0 qt.				
spreader-sticker	0.5 pt.	26.50 a	4.90 a	0.25 b	0.08 b
Maneb +	1.6 qt.				
copper hydroxide +	3.0 lb.				
chlorpyrifos +	1.0 qt.				
spreader-sticker	0.5 pt.	21.25 ab	4.02 ab	0.00 b	0.00 b

[z]Materials were added to the spray tank with flowing water in the order given in the table.
[y]Data were tranformed by $\sqrt{x}$ + 0.05 before analysis. Actual values are presented in the table.
[x]Mean separation in columns by Duncan's multiple range test, 5% level.

sticker treatment. Further work is needed to determine the cause for this injury and the relationship between materials used in this trial.

Yields of peppers per plot were significantly reduced in the chlorpyrifos + maneb + copper hydroxide + spreader-sticker treatment although weights of peppers per plot were statistically equivalent (Table 2). Some of this difference may be attributable to reduced plant stands in plots treated with the above mixture, but adjusting the data on a peppers per plant basis did not alter the statistical groupings. Number of marketable fruit per plot were lower with all chlorpyrifos schedules, primarily due to increased incidence of sun scald or chemical burn. Weights of marketable peppers per plot were not statistically different, however.

Disease control was uniformly excellent among all treatments, thus indicating no antagonism between chlorpyrifos and maneb or copper hydroxide. Pressure from noctuid larvae, primarily corn earworm (*Heliothis zea* (Boddie)) was very low; however, all 3 chlorpyrifos schedules provided significant protection of the fruit (Table 3). Schuster and Everett (1) also demonstrated good control of a noctuid, the beet armyworm (*Spodoptera exigua* Hubner)), and of the pepper weevil (*Anthonomous eugenii* Cano) with chlorpyrifos on peppers.

Realistically, this was an exaggerated pepper spray program which few commercial growers would utilize. A more normal practice would be to alternate spray materials and use less than maximum label rates. The plants were stressed early and never achieved full size despite good fertilization, cultural, and irrigation practices. Additionally, the emulsifiable concentrate formulation of chlorpyrifos was used instead of the wettable powder. The latter formulation has been shown to be less phytotoxic to many vegetable plants. Further research with other formulations and spray tank mixtures is suggested.

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SUSCEPTIBILITY OF PEPPER CULTIVARS TO BLACK SPOT FRUIT DISORDER

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Additional Index Words. Capsicum annuum, pod spot, physiological disorder, brown stage.

Abstract. **Fruits of the pepper (*Capsicum annuum,* L.) cv. Early Calwonder produced fewer symptoms of the black spot fruit disorder in some bell pepper trials than many tobacco mosaic virus tolerant cultivars and breeding lines. 'Cubanelle' was tolerant to the disorder in the fruit trials but FLBG-1 was susceptible.**

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Description of the 2- to 7-mm subcutaneous black spot disorder has been published (4). Locally the disorder has been called pod spot (1). The black spot disorder is also referred to as green pitting of red fruits in Queensland, Australia, (2). There, the fruits of 'California Wonder' showed relatively less green pitting than 'Yolo Wonder'; the green pitting was associated with high Ca levels (2). However, in our trials pitting was not observed. In Florida the B/Ca ratio was thought to be a factor in the disorder (Dr. T. L. Carpenter, former technical director, South Bay Grower Inc., personal communication). The black spot disorder has been observed on both limed-sandy and indigenous calcareous soils in South Florida. Black spot or pitting was not reported on immature fruits grown with normal or low Ca levels in sand cultures (3). The black spot disor-

der on red mature fruits was found in commercial fields of American Food Farms in south Florida in the 1972-73 seasons near Lantana, Fla. It was confined to fruits at the ends of the fields. The largest known fruit loss in Florida due to black spot disorder was that of the crown set (fruits from the first flowers) in a 40-acre field in south Florida in 1977 (Dr. T. L. Carpenter, former technical director, South Bay Growers, personal communication.)

The purpose of this paper is to present black spot data obtained from cultivars and breeding lines in trials from 1972-82 on sandy soils of the lower east coast of Florida.

Materials and Methods

The 1972-73 trials were grown with open bed culture with split fertilizer applications on the Winsberg field on the Lee Brothers Farm, Lantana and on the University of Florida Morikami Farm, Delray Beach. The later trials were grown with polyethylene mulched beds with all the fertilizer applied prior to the laying of the mulch. On the Morikami Farm plots, 0.6 pound of B was applied in the N-P-K broadcast fertilizer applied prior to bedding. In the first test one mature fruit (red) was selected randomly from each plant for rating of the absence or presence of the disorder. Five to 8 plants per plot were checked. The 194 breeding lines were classified into 4 groups according to sib-relationship, with 25 to 400 plants per sib-line. In the later cultivar trials, the number of fruits with the brown stage of the disorder on immature pods was recorded for plants in each plot. No cultivar trial was conducted in 1974.

Results and Discussion

In Jan. and Feb. of the 1972-73 test, 'Early Calwonder' plants produced a significantly lower percentage of black spot on red fruits than the percentages for 3 breeding lines (Table 1). The data for plants bearing spotted pods show similar results (Table 1). The crosses of 'Avelar' with susceptible breeding lines resulted in lines that produced mostly plants with fewer spotted fruits when compared to crosses involving only susceptible lines. The disorder was not observed in the trial when breeding selections were made on plants bearing brown colored pods (botanically immature stage). In the 1975 trial harvested from Jan. to early Apr., 'Yolo Wonder' (tobacco mosaic virus tolerant [TMV]) and 'Resistant Florida Giant' (TMV) plants produced significantly more black spot fruits compared to 'Avelar' or 'Early Calwonder' (Table 2). The incidence of the disorder was very low in the 1976 and 1977 trials with less than 0.8% of the total number of fruits affected. 'Hybelle Hybrid' (TMV) was very susceptible in the Dec.-Jan. 1977-78 trial (Table 2). 'PSR 9275' was susceptible in the 1978-79 trial harvested in December and January (Table 2).

'Tambel 1' (TMV) produced the highest percentage (3%) of disorder in the brown spot stage in the 1980 trial harvested 5 times for immature pods (Table 3). The percentage was less than 50% recorded for the first experiment, sampled one time for mature red pods. 'Tambel 1' produced the highest average number of black spot fruits per plant (0.4 black spot fruit per plant) in the 1980 trial (Table 3). Breeding lines 79-III3-12-3 and 80-1-3-20 were susceptible in May-June, 1981 harvests (Table 3). 'Tambel 1' and Valley Giant (TMV) produced the highest number of spotted fruits in the May 1982 bell pepper trials (Table 4).

In the 1982 long yellow waxy fruit type trials, black spot disorder was more pronounced in the line FLBG-1 (Table 4). Similar visual observations were made in a 1983 trial.

Table 1. Percentage of pepper plants producing fruit with black spots and percentage of red fruits with the disorder, 1973, Florida.

Breeding lines cultivars	Plants with black spot (%)	Fruits with disorder (%)
71-25	67 a[z]	53 a
71-23	55 a	55 a
71-18	30 b	30 b
71-24	18 bc	18 bc
Avelar crosses[y]	10 c	12 c
Avelar	9 c	18 bc
Early Calwonder	8 c	5 c

[z]Mean separation by Duncan's multiple range test, 5% level.
[y]Crossed with breeding lines listed in table.

Table 2. Means of black spot fruit disorder in pepper cultivar trials from 1975-1979.

	Black spot					
	Number of fruit					Spotted fruit per plant
	(1000 per acre)			Percent		
Cultivar	1975	1978	1979	1975	1979	1975
Yolo Wonder	4.7 a[z]			1.4 a		0.17 a
Res. Florida Giant	3.2 ab			1.2 ab		0.13 ab
Florida VR-2	2.0 bc	0 c	0.0 b	0.7 abc	0.0 b	0.08 ab
Early Calwonder	0.3 c	0 c	0.0 b	0.1 c	0.0 b	0.01 b
Avelar	0.3 c			0.0 c		
Hybelle Hybrid		14 a				
Grande Rio 66		8 b				
Pip		8 b				
6C-X80		8 b				
Starr		5 bc				
Hybrid OS		2 bc				
Delray Bell		1 c	1.3 ab		1.8 ab	
6C-X234			0.0 b		0.0 b	
#6700			1.1 ab		1.6 ab	
PSR 9275			2.9 a		3.4 a	
PSR 175			0.2 b		0.3 ab	
PSR 10275			0.0 b			

[z]Mean separation by Duncan's multiple range test, 5% level.

Table 3. Means of black spot disorder in pepper cultivar trials in 1980 and 1981.

	Black spot				
	Fruit No. 1000/acre			Fruit %	Fruit per plant
Cultivar	1980	1981 I	1981 II	1980	1980
Tambel 1	12.0 a[z]		0.0 b	3.1 a	0.38 a
F1 VR-2	5.3 b			2.9 ab	0.11 ab
Grande Rio 66	3.0 b			1.7 ab	0.06 bc
VRDB-2	2.2 b			1.0 ab	0.06 bd
Yolo Wonder	1.2 b			0.4 b	0.04 bd
Delray Bell	0.6 b	0.0 b	0.2 ab	0.2 b	0.02 c
Early Calwonder	0.2 b	0.3 b	0.0 b	0.1 b	0.01 c
79III3-12-3		3.9 a			
79II3-19-4		0.3 b	0.0 b		
80-1-3-20			1.2 a		

[z]Mean separation by Duncan's multiple range test, 5% level.

Table 4. Means of black spot fruit disorder in both bell and yellow pepper cultivars in 1982.

	Black spot					
	Bell fruit no.		Yellow fruit			
	1000/Acre		1000/Acre		%	
Cultivar	1982	1982	1982	1982	1982	1982
Tambel 1	9.0 a[z]	8.5 a				
Sharina	2.6 b					
Delray Bell	1.0 b	0.2 b				
Early Calwonder	0.2 b	0.0 b				
Valley Giant		5.4 ab				
P 7118		0.0 b				
Bell Tower		0.0 b				
80-1793		0.0 b				
FLBG-1			90 a	33.5[y]	30 a	22.2[y]
Cubanelle			0 b	0.0	0 b	0.0
Hungarian Yellow Wax				9.0		3.2
Sweet Banana				0.5		0.4

[z]Mean separation by Duncan's multiple range test, 5% level.
[y]Mean of 2 replications.

In summary 'Early Calwonder', a popular commercial cultivar in Florida, produced fewer black spot fruits than those counted from the tobacco mosaic virus-tolerant cultivars: 'Tambel 1', 'Hybelle Hybrid', 'Yolo Wonder', 'Grande Rio 66', 'Resistant Florida Giant', 'Pip', and 'Valley Giant'. Cubanelle tolerated the disorder in the yellow fruit trials.

The black spot disorder is not usually seen early in the fruit development. Therefore, in order to avoid or reduce losses, the fruits can be harvested at the mature green stage or earlier in the susceptible cultivars, a practice often followed by some growers including Mr. W. A. DuBois, Sr., Dubois Farms, Inc., Delray Beach.

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WEED CONTROL IN THE STRAWBERRY SUMMER NURSERY

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Abstract. **Herbicides and soil fumigants were evaluated for weed control and daughter plant production in a strawberry (*Fragaria* x *ananassa* Dutch.) summer nursery in 1981, 1982, and 1984. In 1981, napropamide (2-(naphthoxy)-N,N-diethylpropionamide) and DCPA (dimethyl tetrachloroterephthalate) were not injurious to 'Dover' strawberry plants, while they severely reduced plant vigor in 1982. Postemergence applications of acifluorfen (sodium 5-[2-chloro-4-(trifluoromethyl) phenoxy]-2-nitrobenzoate), fluazifop-butyl (butyl 2-[4-[(5-(trifluoromethyl)-2-pyridinyl)oxy]phenoxy]propanoate) and sethoxydim (2-[1-(ethoxyimino)butyl]-5-[2-ethylthio) propyl]-3-hydroxy-2-cyclohexen-1-one) did not reduce plant vigor in 1982, while application of bentazon (3-isopropyl-1H-2,1,3-benzothiadiazin-4(3H)-one2,2-dioxide) resulted in almost complete death.**

Multi-chemical weed management systems were evaluated in 1984 with 'Dover' and 'Florida Belle' strawberry plants. Two applications of napropamide and alachlor (2-chloro-2' ,6'-diethyl-N-(methoxymethyl)acetanilide) reduced strawberry plant vigor. After 3 applications of each preemergence herbicide, 1 application of fluazifop-butyl and 1 application of glyphosate, (N-(phosphonomethyl)glycine), plant vigor was reduced significantly. Four applications of napropamide, DCPA or alachlor, in conjunction with 2 applications of fluazifop-butyl and 3 wiper applications of glyphosate controlled beggarweed (*Desmodium tortuosum* (Sw.) DC.) and goosegrass (*Eleusine indica* (L.) Gaertn.) as well as hand weeding. Acceptable control of hairy indigo (*Indigofera hirsuta* Harvery) was obtained with napropamide + fluazifop-butyl + glyphosate. Total number of 'Florida Belle' daughter plants was reduced by treatments containing napropamide and alachlor, while all of the herbicide treatments reduced the number of 'Dover' plants produced.

Weed control is a major factor limiting strawberry daughter plant production in Florida. Due to the general sensitivity of the crop to herbicides with variations between cultivars, the frequent presence of weeds which are difficult to control, and the season of plant production with its associated weed problems, most growers rely on cultivation and hand weeding. Locascio (3) reported good weed control with diphenamid and DCPA in the summer nursery; however, DCPA was observed to produce some injury on plants. Napropamide and DCPA are labelled for use in fruiting strawberries, yet growers have reported injury oc-

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