Black Plastic Mulch and Spunbonded Polyester Row Cover as Method of Southern Blight Control in Bell Pepper

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ABSTRACT

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Incidence and severity of southern blight, caused by *Sclerotium rolfsii*, of bell pepper (*Capsicum annuum*) were determined on cv. Skipper plants grown with black plastic mulch (BPM), with BPM + spunbonded polyester (SPE) floating row cover, and in bare soil with or without PCNB. Disease incidence and severity were lower and yields were higher in plots with BPM and BPM + SPE than in plots with bare soil and no PCNB treatment. The use of BPM and row cover for the control of southern blight is an alternative to the use of expensive chemicals.

Southern blight, caused by *Sclerotium rolfsii* Sacc., is one of the most destructive diseases of vegetables in warm, humid regions of the world (1,7) and is a major pathogen of vegetable crops in Alabama. Disease buildup in monoculture is common because of massive production of sclerotia (1,7). Recommendations for control of southern blight emphasize the importance of good field sanitation and cultural practices (1,8), but fumigation with eradicant chemicals (e.g., methyl bromide) and soil solarization (8,10) are the most effective control measures. These recommendations are still valid but are not adequate (1,7).

The use of black plastic mulch (BPM), BPM + row cover, and other cultural practices involving mulch has improved several vegetable crop yields (3,4,6, 9,11,13-16). Trickle irrigation in conjunction with soil fumigation and plastic mulch has been used in the control of root-knot nematodes and soilborne fungi, resulting in increased yields of many crops (17). Little has been done, however, to develop information on the use of BPM and row cover to control southern blight of vegetable crops (5,12). The objective of this study was to determine the efficacy of BPM and BPM + row cover in controlling southern blight of bell peppers (*Capsicum annuum* L.).

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MATERIALS AND METHODS

The study was conducted on an Orangeburg sandy loam soil with a pH of 6.1. Before planting, P and K in the form of triple superphosphate and muriate of potash, respectively, were incorporated into the soil. At planting, 68 kg/ha of actual N was applied in the form of ammonium nitrate, and at flowering, an additional 24 kg/ha was applied. Trifluralin was applied preplant incorporated at 0.84 kg a.i./ha for weed control, and carbaryl was used as the insecticide. When appropriate, a 2% solution of PCNB (Terraclor 75WD) was applied at 0.28 L per plant at planting. Peppers were cultivated and irrigated as needed.

Treatments were arranged in a randomized complete block design with four replications as follows: 1) BPM, 2) BPM + spunbonded polyester (SPE) floating row cover, 3) bare soil, 4) BPM + PCNB, 5) BPM + SPE + PCNB, and 6) bare soil + PCNB.

On 6 April 1986 and 8 April 1987, BPM (3 mil thick, 0.9 m wide) was placed on rows 6.1 m long and 1.07 m apart. Bell peppers, cv. Skipper, were seeded in flats in the greenhouse on 3 March 1986 and 13 March 1987 and transplanted into all field plots 24 April 1986 and 23 April 1987. Plants were spaced 0.61 m apart within the row. Immediately after planting, SPE floating row cover (1.8 m wide, designed to rest loosely on the plants over the row) was placed over the rows by hand. The row cover remained in place for 25 days, then was removed; the BPM remained in place throughout the growing season.

RESULTS AND DISCUSSION

BPM and BPM + SPE reduced southern blight incidence in soils naturally infested with *S. rolfsii* (Table 1). This trend was similar in 1987 on treat-

Table 1. Disease incidence (DI) and disease severity (DS)[x] of bell pepper cv. Skipper plants as affected by black plastic mulch (BPM), spunbonded polyester (SPE) floating row cover, and PCNB (P)

Days after	BPM		BPM + SPE		Bare soil		BPM + P		BPM + SPE + P		Bare soil + P	
transplanting	DI (%)	DS	DI (%)	DS	DI (%)	DS	DI (%)	DS	DI (%)	DS	DI (%)	DS
1986												
75	32.5 b[y]	1.7 b	21.3 b	1.1 b	68.8 a	3.8 a	...[z]	...	...	...	...	...
98	68.8 ab	2.2 b	47.5 b	1.6 b	83.8 a	3.8 a	...	...	...	...	...	...
108	70.0 ab	3.4 b	68.0 b	2.5 c	88.0 a	4.3 a	...	...	...	...	...	...
1987												
92	5.7 b	0.2 a	5.6 b	0.2 a	15.0 a	0.7 b	0.0 c	0.0 a	0.0 c	0.0 a	0.0 c	0.0 a
124	10.4 b	0.4 b	11.0 b	0.4 b	49.5 a	2.1 a	4.7 c	0.1 b	9.5 b	0.3 b	0.0 d	0.0 b
133	28.0 b	0.9 b	22.7 b	1.0 b	61.0 a	2.5 a	4.8 d	0.2 c	14.0 c	0.6 b	11.1 c	0.5 b
140	58.6 b	2.0 b	52.3 b	1.8 b	83.0 a	3.6 a	23.6 c	0.8 c	26.6 c	0.5 b	30.0 c	1.2 b

[x] Based on a rating of 0 = no disease symptom to 5 = 100% of plant killed.

[y] Mean separation across columns within years by Duncan's multiple range test, $P = 0.05$.

[z] No data collected.

Table 2. Effects of black plastic mulch (BPM), spunbonded polyester (SPE) floating row cover, and PCNB (P) on the production of bell pepper cv. Skipper

	Yield (t/ha)		
Treatment	**Market-able**	**Cull**	**Total**
1986			
BPM	4.02 a[z]	2.44 a	6.46 a
BPM + SPE	2.87 b	2.30 a	5.17 a
Bare soil	1.49 c	0.28 b	2.31 b
1987			
BPM	2.93 a	1.05 b	3.98 a
BPM + SPE	2.41 a	1.46 a	3.87 a
Bare soil	1.01 c	1.08 b	2.09 c
BPM + P	2.69 a	1.99 a	4.68 a
BPM + SPE + P	2.86 a	1.49 a	4.39 a
Bare soil + P	1.92 b	1.04 b	2.96 b

[z] Mean separation in columns within years by Duncan's multiple range test, $P = 0.05$.

ments where PCNB was not used. The disease severity rating (Table 1) was higher on bell peppers grown in the bare soil than on those grown in soil mulched with BPM + SPE. The disease increased during the growing season with all treatments but was significantly less with the plastic mulch treatments than with the bare soil without PCNB treatment.

Bell pepper plants grown with either BPM or BPM + SPE produced higher yields (Table 2). Other investigators attributed improved yields of mulched vegetable crops to increased temperature, conservation of soil moisture, weed control, maintenance of good soil physical condition, increased nitrogen, and increased CO_2 in the microclimate surrounding the plant roots (4,6,10,12,14,15,17).

Boyle, cited by Aycock (1), found that saprophytic media supplied to the infected plant area resulted in rapid growth of the fungus. The common practices of applying soil to the base of plants are often detrimental because soil covering lower leaves may form a "bridge" of dead tissue that furnishes an ideal medium for initiating pathogenesis (1).

Mulching with black plastic may reduce disease incidence by preventing or reducing the formation of a bridge of dead tissues between the soil and the plants. *S. rolfsii* is generally considered to be strongly aerobic because of its prevalence in well-aerated soil (1,12). Previous reports on mulching showed that CO_2 concentration in the atmosphere of soil mulched with plastic increased (13,15), whereas the O_2 concentration decreased (13). The changes in CO_2 and O_2 levels in soil atmosphere may indicate a change in the activity of *S. rolfsii.* Various researchers cited by Aycock (1) suggested that starving the fungus by elimination of weed hosts was recommended as a cultural method of controlling this disease. Since mulching soil reduces the weed population, this could be an important factor in explaining the reduced disease incidence. BPM alone or BPM + SPE can be used to reduce the severity of southern blight of bell pepper and provides an alternative to use of expensive chemicals.

LITERATURE CITED

1. Aycock, R. 1966. Stem rot and other diseases caused by *Sclerotium rolfsii.* N.C. Agric. Exp. Stn. Tech. Bull. 174. 202 pp.
2. Baker, A., and Kahn, A. A. 1981. Effect of nitrogenous amendments on the incidence of Sclerotium wilt on potato. Potato Res. 24:363-365.
3. Brown, J. E., and Wilson, M. A. 1984. Evaluation of tomato performance using black plastic mulch, wooden stakes and wire cages. Pages 24-27 in: Proc. Natl. Agric. Plast. Congr. 17th.
4. Courter, J. W., and Oebker, N. F. 1964. Comparisons of paper and polyethylene mulching on yields of certain vegetable crops. Proc. Am. Soc. Hortic. Sci. 85:526-531.
5. Geraldson, C. M., Overman, A. J., and Jones, J. P. 1965. Combination of high analysis fertilizer, plastic mulch and fumigation for tomato production on old agricultural land. Proc. Soil Crop Sci. Soc. Fla. 25:18-24.
6. Hopen, H. J. 1964. Effects of black and transparent polyethylene mulches on soil temperature, sweet corn growth and maturity in a cool growing season. Proc. Am. Soc. Hortic. Sci. 86:415-420.
7. Jenkins, S. F., and Averre, C. W. 1986. Problems and progress in integrated control of southern blight of vegetables. Plant Dis. 70:614-619.
8. Katan, J. 1981. Solar heating (solarization) of soil for control of soilborne pests. Annu. Rev. Phytophathol. 19:211-236.
9. Magruder, R. 1930. Paper mulch for the vegetable garden: Its effect on plant growth and on soil moisture, nitrates, and temperatures. Ohio Agric. Exp. Stn. Bull. 447.
10. McCarter, S. M., Jaworski, C. A., Johnson, A. W., and Williamson, R. E. 1976. Efficacy of soil fumigants and methods of application for controlling southern blight of tomatoes grown in transplants. Phytopathology 66:910-913.
11. Punja, I. K., and Jenkins, S. F. 1984. Efficacy of selected fungicides, calcium and nitrogenous fertilizers, and deep plowing for control of *Sclerotium rolfsii* on processing carrots. (Abstr.) Phytopathology 74:631.
12. Reynolds, S. G. 1970. The effects of mulches on southern blight (*Sclerotium rolfsii*) in dwarf bean (*Phaseolus vulqaris*). Trop. Agric. 47:137-144.
13. Rubin, B., and Benjamin, A. 1984. Solar heating of soil: Involvement of environmental factors in the weed control process. Weed Sci. 32:138-142.
14. Shaw, C. F. 1926. The effect of a paper mulch on soil temperature. Hilgardia 1:341-364.
15. Sheldrake, R., Jr. 1963. Carbon dioxide levels in the microclimate as influenced by the permeability of mulches. Pages 93-96 in: Proc. Natl. Agric. Plast. Conf. 4th.
16. Smith, A. 1931. Effect of paper mulches on soil temperature, soil moisture and yields of certain crops. Hilgardia 6:159-201.
17. Sumner, D. R., Johnson, A. W., Jaworski, C. A., and Chalfant, R. B. 1978. Influence of film mulches and soil pesticides on root diseases and population of soil-borne fungi in vegetables. Plant Soil 49:267-283.