REDUCTION OF RHIZOCTONIA AND FUSARIUM ROOT ROT IN BROCCOLI BY BED SOLARIZATION AND METAM SODIUM IN BERMUDA.

R. J. McGovern[1]* and F. Harper[2]. [1]Plant Pathologist, University of Florida-IFAS, Gulf Coast Research & Education Center, Bradenton, FL, 34203 and [2]Former Agricultural Officer, Department of Agriculture, Fisheries & Parks, Hamilton, BDA

Cole crop production including broccoli, cabbage, cauliflower, and kale occurs during August through May in Bermuda and comprises about 20 ha annually. In recent years, local production has accounted for up to 25% of island consumption. Transplants of *Brassica oleracea* are currently produced in seed beds without preplant fumigation. Reported soilborne pathogens of *Brassica* spp. in Bermuda include *Rhizoctonia solani* and *Sclerotinia sclerotiorum* but disease incidence and crop loss data are unavailable (Waterston, 1947). Combined use of clear mulch (soil solarization) and metam sodium previously produced a synergistic reduction of Fusarium crown rot (*Fusarium oxysporum* f.sp. *radicis-lycopersici*) in tomato in southwest Florida (McGovern et al., 1995). The objective of the current research was to evaluate the effectiveness of soil solarization alone and in combination with metam sodium in managing soilborne disease in a commercial broccoli seed bed in Bermuda.

Materials and Methods

A field (loamy sand) in Warwick, Bermuda was used to evaluate the efficacy of soil solarization and metam sodium (MS) in reducing soilborne disease in broccoli (*Brassica oleracea* L. var. *botrytis* L.) 'Pirate' (Peto Seeds, Saticoy, CA) seedlings. Treatments consisted of clear, uv-stabilized, low density polyethylene (PE) mulch (25 µm, Atlantis Plastics, Atlanta, GA), white PE (25 µm) plus metam sodium [(MS),702 l/ha], and clear PE plus MS. Treatments and an untreated control (non-mulched soil) were replicated six times using 1.2 x 9.3 m, level seed beds arranged in a randomized complete block design. Mulches were applied, and MS was incorporated through rotovation about 20 cm deep on 28 June, 1995. Daily maximum soil temperatures were monitored at 5, 15 and 30 cm in mid afternoon (2:30-3:00 PM) by means of soil thermometers from 28 June through 15 Aug. at a second experimental site which utilized identical treatments in Devonshire, Bermuda.

Mulches remained intact until 26 Aug., after which time significant tearing occurred. On 6 Sept., mulches were completely removed, the soil was rotovated to a depth of about 20 cm, and broccoli was seeded. Damage resulting from the passage of two hurricanes near Bermuda necessitated total reseeding and reworking of beds on 5 Oct. Plant establishment was assessed in a randomly selected 1 m section of each bed, and biomass data were obtained from 10 transplants per bed on 16 Oct. Infection rate was evaluated on the same date by plating the crown and roots of five randomly selected transplants from each seed bed on acidified potato dextrose agar after surface disinfestation in 0.5% NaOCl. Culture plates were examined after 24, 48, and 72 hours to identify and enumerate fungal infection. Infection frequency was standardized by dividing the number of fungal colonies by the average root

weight of the corresponding treatment replicate. Plant root systems were also examined for symptoms of root knot nematode damage. Treatment means were separated by ANOVA/LSD ($P \leq 0.05$).

Results and Discussion

Precipitation for July and August was slightly elevated by 4% and 10%, respectively, in comparison to the 30 year average compiled by the Bermuda Department of Agriculture. Average maximum soil temperatures under clear PE at 5, 15 and 30 cm were 48.2, 36.9, and 33.6° C, respectively, and were higher than corresponding averages in non-mulched soil (33.6, 31.6, and 30.0° C) (Figure 1). Average maximum soil temperatures recorded under white mulch (42.0, 35.2, and 31.6° C were intermediate. Temperatures which have been reported to rapidly inactivate *Fusarium* spp. (55-65° C) and *Rhizoctonia* spp. (50-60° C) only occurred in the upper soil strata under clear PE (McGovern and McSorley, 1996). No evidence of root knot nematode damage was detected, but *Rhizoctonia solani* and *Fusarium* spp. were frequently isolated from discolored roots.

Infection rate by *Rhizoctonia solani* was significantly decreased by all treatments, while *Fusarium* infection was decreased by solarization and solarization plus MS in comparison to the untreated control (Table 1). All treatments also significantly increased plant establishment, while the fresh weight of both roots and shoots was significantly increased over the control by solarization plus MS. It is possible that some of the effectiveness of the treatments was negated by deep rotovation prior to seeding (necessitated by delayed seeding due to hurricanes), since it may have brought untreated soil into the root zone. Nevertheless, solarization, metam sodium, and especially a combination of the two were demonstrated to be effective preplant treatments for broccoli transplant production.

Literature Cited

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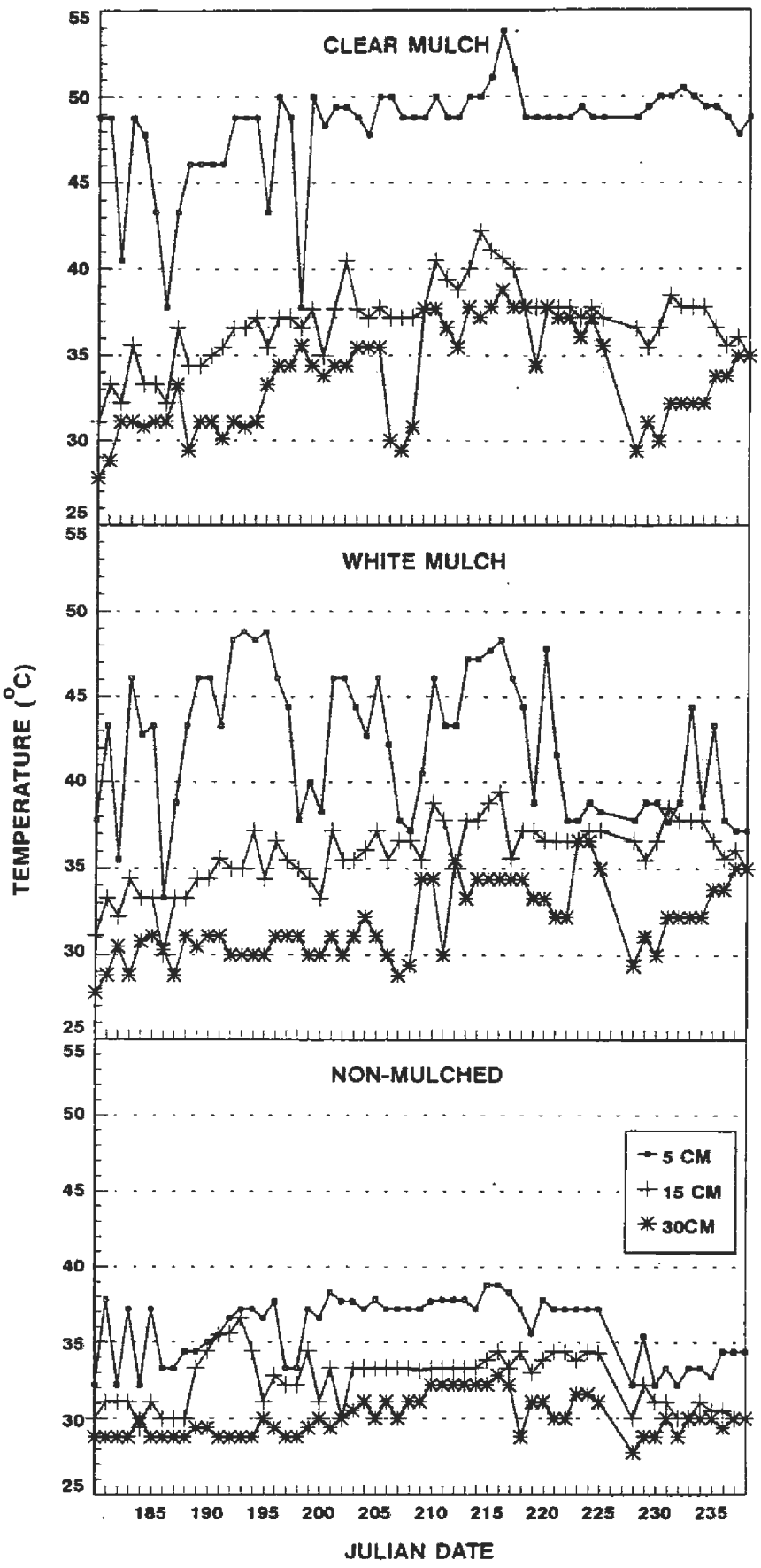

FIGURE 1. AVERAGE DAILY MAXIMUM SOIL TEMPERATURES IN DEVONSHIRE BERMUDA, 2:30-3:00 PM

TABLE 1. EFFECT OF SOLARIZATION AND METAM SODIUM ON FUNGAL INFECTION AND PLANT GROWTH IN BROCCOLI 'PIRATE' IN A COMMERCIAL SEED BED IN WARWICK, BERMUDA.

Treatment	*Rhizoctonia solani* (Colonies/g Root)	*Fusarium* spp. (Colonies/g Root)	Plant Establishment (Number of Plants/m)	Root Weight (g/Plant)	Shoot Weight (g/Plant)
Control	8.3 a[1]	4.4 a	127.3 c	0.35 b	5.9 b
Solarization (2 months)	3.3 b	1.8 b	170.6 ab	0.46 ab	6.3 b
Metam Sodium (702 l/ha)	3.1 b	2.1 ab	187.6 a	0.46 ab	7.2 ab
Solarization + Metam Sodium	1.5 b	0.9 b	160.0 b	0.58 a	8.4 a

[1]Means followed by different letters are significantly different by LSD ($P \leq 0.05$)