the mancozeb treatment did not reduce disease severity compared to the control.

It was apparent from this study that epiphytic populations do play a significant role in disease development. It was also evident that choosing the correct Cu formulation was important when developing control strategies. Finally, suspensions composed of mancozeb copper can greatly improve disease control capabilities.

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Proc. Fla. State Hort. Soc. 106:163-165. 1993.

IMPROVING YIELD OF CUCUMBERS IN NEMATODE-INFESTED SOIL BY DOUBLE-CROPPING WITH A RESISTANT TOMATO CULTIVAR, USING TRANSPLANTS AND NEMATICIDES

H. Y. HANNA, P. D. COLYER, T. L. KIRKPATRICK[1], D. J. ROMAINE, AND P. R. VERNON

Louisiana State University Agricultural Center
Louisiana Agriculture Experiment Station
Red River Research Station
Bossier City, LA 71113

Additional index words. root-knot nematode, *Meloidogyne incognita*, ethoprop.

Abstract. **A study was conducted in 1992 at the Red River Research Station in northwestern Louisiana in a field infested with *Meloidogyne incognita* (Kofoid & White) Chitwood. The influence of a nematode-resistant tomato (*Lycopersicon esculentum* Mill.) cultivar, use of cucumber (*Cucumis sativus* L.) transplants, and pre-plant application of nematicides on growth and yield of trellised cucumbers double-cropped with tomatoes was studied. Plant fresh and dry weight, stem length, number of female flowers, and yield of 'Dasher II' cucumbers planted after the nematode-resistant tomato cultivar 'Celebrity' were significantly higher than after the susceptible tomato cultivar 'Heatwave'. Using cucumber transplants significantly increased cucumber growth and yield in comparison to direct seeded cucumbers. Pre-plant application of the nematicide ethoprop at 2.8 lb/acre through drip irrigation significantly increased the yield and growth of cucumbers. Preceding cucumbers with a nematode-resistant tomato cultivar significantly reduced the number of nematodes in soil samples taken after the last harvest of cucumbers.**

Root-knot nematodes, *Meloidogyne incognita* (Kofoid & White) Chitwood, cause significant losses in yields of many economic crops throughout the world including tomatoes and cucumbers. Development of tomato cultivars resistant to root-knot nematodes has proven to be an effective, economical, and environmentally safe means of reducing losses from this pest. However, attempts to produce commercial cucumber cultivars that are resistant to root-knot nematodes have not been successful (Deakin et al., 1971).

Trellising cucumbers can increase yield and enhance fruit quality (Baker, 1977; Hanna et al., 1987; Konsler and Strider, 1973; Russo et al., 1991). Recent studies have shown that trellised cucumbers double-cropped with tomatoes is feasible (Hanna, 1993) and can minimize the cost of trellising cucumbers (Hanna et al., 1989). This study was undertaken to determine the influence of nematode-resistant and susceptible tomato cultivars, direct seeding or transplanting cucumbers, and pre-plant application of ethoprop nematicide on nematode population, growth, flowering, and yield of trellised cucumbers double-cropped with tomatoes.

Materials and Methods

Six-week old transplants of 'Celebrity' (nematode-resistant) and 'Heatwave' (nematode-susceptible) tomatoes were

Approved for publication by the Director of the Louisiana Agricultural Experiment Station as manuscript No. 93-84-7341. The authors gratefully acknowledge the donation of tomato and cucumber seeds by Petoseed Co., Inc., Saticoy, CA.

[1]Southwest Research and Extension Center, University of Arkansas, Hope, Arkansas 71801.

planted during the first week of Apr. 1992, in 4 (75×5 feet) rows each. After the last harvest, tomato plants were killed with glyphosate. On 31 July 'Dasher II' cucumber seeds and transplants were planted into the same polyethylene-mulched tomato beds with drip irrigation lines left in place. One-half of the direct-seeded and transplanted cucumber plots were injected with ethoprop (Mocap EC) at 2.8 lb/acre in 102 gallons of water prior to planting. The other one-half received plain water. The experimental design was 2×2×2 factorial arrangement of treatments in a randomized complete block with 4 replications. Treatments were tomato cultivar (nematode resistant vs. nematode susceptible) preceding cucumbers, planting method (transplanted vs. direct seeded cucumbers), and nematicide (treated vs. untreated plots). The drip irrigation system, trellising structure, and tomato skeletons were left in place to irrigate and support climbing cucumber plants. Other cultural practices were the same as described by Hanna et al., (1993). Nematode counts were made from each plot at the termination of cucumber harvest. Plant fresh and dry weight, main stem length, and number of female flower data were taken on a sample of 5 plants prior to the first harvest and the average per plant was calculated. Cucumbers were harvested 3 times a week for 5 weeks. Fruit were graded according to U.S Department of Agriculture standards (USDA, 1958) for U.S. Fancy, No. 1, and No. 2. Premium yield was determined by combining fruit graded Fancy and No. 1. Total yield was the sum of fruit graded Fancy, No. 1, and No. 2. Data from 2 replications were subjected to analyses of variance using SAS-ANOVA (SAS Institute, 1988).

Results and Discussion

Population density of root-knot nematodes from cucumber plots previously planted with the resistant tomato cultivar 'Celebrity' was significantly lower than from plots planted with the susceptible cultivar 'Heatwave' (Table 1). Plant fresh and dry weight, stem length, and number of female flowers were significantly greater in cucumber samples taken from plots previously planted with the resistant tomato cultivar. Premium and marketable yields of cucumber following the nematode resistant cultivar 'Celebrity' were also greater (Table 1).

Transplanting or direct-seeding cucumbers had no significant effect on the number of root-knot nematodes (Table 2). However, transplanted cucumbers produced significantly greater fresh and dry weight per plant, longer stems, higher number of female flowers, and larger premium yields than direct-seeded cucumber. Significant differences were not detected between the marketable yield of transplanted and direct seeded-cucumbers (Table 2).

Treating cucumber plots with ethoprop before planting did not significantly reduce the number of root-knot nematodes (Table 3), but it significantly increased the cucumber fresh and dry weight, stem length, number of female flowers, and premium and marketable yields (Table 3).

Northwestern Louisiana farms have been under cotton cultivation for many years. A soil sample collected from the test site before conducting this test indicated a population density of *M. incognita* of 4,951 juveniles/500 cm³. Attempts to produce an economic crop of cucumbers in these infested soils without pesticide treatment had failed. Presently, there is wide spread use of methyl bromide among vegetable growers in many areas to control nematodes and soilborne fungi. However, efforts are underway to find environmentally safe alternatives to the use of methyl bromide. Nematode-resistant tomato cultivars are available commercially, and double-cropping cucumbers and tomatoes has been shown to be feasible (Hanna, 1993). This study indicates that planting a nematode-resistant tomato cultivar before cucumbers had a significant effect on

Table 1. Effects of nematode-resistant and susceptible tomato cultivars on nematode population, growth, and yield of 'Dasher II' cucumbers double-cropped with tomatoes.

		Plant					
		Fresh	Dry	Stem		Yield (bu/acre)	
Tomato cultivar	Nematodes (no./500 cm³)	wt (oz)	wt (oz)	length (inch)	Flower (no.)	Prem.	Mark.
Celebrity (resist)	408	17.5	1.8	67.9	25.3	538.5	961.5
Heatwave (susc)	2077	10.0	1.1	50.0	14.3	186.2	393.0
Signif.	*[z]	**	**	**	**	**	**

[z]T test was significant at the 5% (*) or the 1% (**) level.

Table 2. Effects of planting method on nematode population, growth, and yield of 'Dasher II' cucumbers double-cropped with tomatoes.

		Plant					
		Fresh	Dry	Stem		Yield (bu/acre)	
Planting method	Nematodes (no./500 cm³)	wt (oz)	wt (oz)	length (inch)	No. flowers	Prem.	Mark.
Transplanted	1743	17.0	1.8	69.7	26.8	474.2	807.7
Direct seeded	743	10.4	1.1	48.2	12.9	250.5	546.8
Signif.	NS[z]	**	**	**	**	**	NS

[z]T test was significant at the 1% level (**) or not significant (NS).

Table 3. Effects of ethoprop nematicide on nematode population, growth, and yield of 'Dasher II' cucumbers double-cropped with tomatoes.

Nematicide	Nematodes (no./500 cm³)	Plant: Fresh wt (oz)	Plant: Dry wt (oz)	Plant: Stem length (inch)	Plant: Flowers (no.)	Yield (bu/acre): Prem.	Yield (bu/acre): Mark.
Treated	625	17.1	1.8	66.8	25.2	508.8	913.1
Untreated	1860	10.4	1.1	51.1	14.4	215.9	441.5
Signif.	NS[z]	**	**	**	**	**	**

[z]T test was significant at the 1% level (**) or not significant (NS).

reducing nematode population and increasing cucumber yields. It also indicates that pre-plant treatment of cucumber plots with ethoprop was effective in producing vigorous plants and increasing yield.

The application of the ethoprop did not result in lower nematode populations in the cucumbers at harvest. However, application of ethoprop did significantly improve the plant growth and development of parameters measured and resulted in higher yields. It was apparent that ethoprop did not lower final nematode populations, but it was possible that use of the nematicide resulted in lower numbers of *M. incognita* juveniles infecting roots during the seedling and young plant stage and improved plant establishment and growth. Similarly, the use of transplants where roots had already developed prior to exposure to nematodes may have allowed plants to withstand nematode infection during the early season to a greater degree than direct-seeded plants.

It appears from these preliminary studies that cultural practices such as double-cropping cucumbers with nematode-resistant tomatoes and using transplants instead of direct seeding can be viable alternatives to pesticide treatment to reduce losses from root-knot nematodes.

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Proc. Fla. State Hort. Soc. 106:165-168. 1993.

MANAGEMENT OF INSECT PESTS OF SQUASH

SUSAN E. WEBB
Central Florida Research and Education Center
University of Florida
Leesburg, FL 34748

Additional index words. sweetpotato whitefly, *Bemisia tabaci*, pickleworm, *Diaphania nitidalis*, melonworm, *Diaphania hyalinata*, *Aphis gossypii*.

Abstract. **Aphids (*Aphis gossypii* Glover), sweetpotato whitefly [*Bemisia tabaci* (Gennadius)], pickleworm [*Diaphania nitidalis* (Stoll)], and melonworm [*Diaphania hyalinata* (L.)] can cause serious damage to squash (*Cucurbita pepo* L.) and other cucurbits in Florida. In 1991 and 1992, various control measures were evaluated for management of these insect pests. Standard chemical insecticides, detergent, *Bacillus thuringiensis*, and mineral oil were tested either alone or in combination. In 1991, a combination of detergent and *Bacillus thuringiensis* was more effective than endosulfan for control of pickleworms and melonworms. Detergent did not effectively control aphids or whiteflies. Mineral oil in combination with a pyrethroid was highly effective against the entire pest complex in 1992 and also controlled powdery mildew.**

Yellow summer squash and zucchini (*Cucurbita pepo* L.), winter squashes (*C. pepo* and *C. moschata* L.), and cucumbers (*Cucumis sativis* L.) are a significant part of Florida vegetable production, with a total value of $128.7 million in 1991-92 (Anonymous, 1993). Development of a sound insect pest management program for these crops could result in less insecticide use and possibly lower production costs. Since

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