Table 2. The effects selected bactericides had on bacterial spot control of pepper cv. Capistrano.

Treatment	Rate (G/378 L)	16 Sept.	28 Sept.	12 Oct.
Gentamycin	189	4.0[z] ab[y]	3.8 de	4.8 b
Gentamycin	284	3.8 a-d	3.9 cd	4.3 b-d
Gentamycin	378	2.8 f-h	3.7 d-f	4.0 de
Gentamycin	567	3.3 c-g	3.8 de	4.0 de
Gentamycin	756	3.3 c-g	3.5 d-g	3.8 ef
Gentamycin-plus[x]	189	3.6 b-e	4.3 bc	4.4 b-d
Gentamycin-plus	284	3.2 d-g	3.3 e-g	3.7 e-g
Gentamycin-plus	378	3.4 b-f	3.5 d-g	3.5 fg
Gentamycin-plus	567	2.8 gh	3.3 fg	3.3 gh
Gentamycin-plus	756	2.3 h	3.1 g	3.0 h
Copper hydroxide	909			
mancozeb +	681	2.9 b-d	4.9 b-e	3.7 e-g
Control	—	3.8 a	5.1 a-d	5.4 a

[z]Value represents percent defoliation using the Horsfall-Barratt Index where 1 = 0% defoliation and 12 = 100% defoliation.
[y]Values in the same column which have at least one letter in common are not significantly different at p=0.05 by Duncan's Multiple Range Test.
[x]Gentamycin-plus is a mixture of gentamycin and oxytetracycline.

mycin plus reduced disease severity significantly in all three ratings. The copper-mancozeb treatment and the three higher gentamycin rates provided significant control in two of the three ratings. No significant yield differences were observed in either of the experiments (data not shown).

Although gentamycin alone reduced bacterial spot severity, the mixture of gentamycin plus was more efficacious. It is surprising that oxytetracycline was beneficial to the spray mixture since, in a previous study, it did not reduce bacterial spot severity significantly (Jones and Jones, 1985). The bactericide market is quite limited and is responsible to some extent for the limited supply of effective bactericides. Furthermore, the bacterial spot pathogen has been able to develop resistance or tolerance to two of the major bactericidal compounds, copper and streptomycin (Jones et al, 1991; Marco and Stall, 1983; Stall and Thayer, 1962). Thus, the possibilities of other bactericides being effective against the bacterial spot pathogen for prolonged periods are encouraging. Further testing will need to be done to determine the future of these two antibiotics for bacterial spot control.

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MANAGEMENT OF DIAMOND BACK MOTH, *PLUTELLA XYLOSTELLA*, USING BIOLOGICAL INSECTICIDES

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Abstract. **Several studies were conducted to control diamondback moth (DBM), *Plutella xylostella* (L.), on cabbage (*Brassica oleracea* var. *capitata* L.) using conventional, biological, and botanical insecticides. Emamectin benzoate alone or in rotation with *Baccillus thuringiensis* var. *kurstaki* (Dipel 2x) or *B. thuringiensis* var. *aizawai* (Xentari) reduced *P. xylostella* populations significantly. In the second test, all formulations of *B. thuringiensis* significantly reduced *P. xylostella* populations. In the third test, the significantly lowest number of *P. xylostella* larvae was recorded on *B. thuringiensis* var. *aizawai* treated plants. Other *B. thuringiensis* formulations also reduced *P. xylostella* larvae when compared with thc untreated control. In the fourth test, *Anagrapha falcifera* virus (AfNPV) performance was comparable to the different *B. thuringiensis* formulations in controlling the diamondback moth. Also azadirachtin (Neemix) and fipronil significantly reduced this pest. In the fifth test, the various formulations of Azadirachtin significantly increased marketability of cabbage by controlling *P. xylostella* larvae.**

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Cabbage, *Brassica oleracea* var. *capitata* L., is an important vegetable crop in Florida. Almost 17,000 acres of cabbage are planted annually in Florida (Hochmuth, 1988). The diamondback moth (DBM), *Plutella xylostella* (L.), possesses extremely variable adaptive characters and is a serious pest of cabbage and other cruciferous crops. DBM has been reported in over 100 countries as an economic pest of various cole crops. It has a high reproductive potential (ca. 300 eggs/female), and short generation times (about 20 generations per year in topics).

The DBM is difficult to control. Growers use cultural methods, biological controls and insecticides to manage this pest. The DBM has developed resistance to all major classes of insecticides. All conditions that foster the development of insecticide resistance are present in Florida including high temperatures, long growing seasons, multiple insect generations, intense insect pressure, and frequent insecticide applications (Yamada & Koshihara, 1978; Sun et al., 1978). Barroga (1974) reported the occurrence of resistance of the DBM to DDT and to some organophosphorus compounds, and resistance of DBM populations to various other chemicals was also reported (Sudderuddin and Kok, 1978; Sun et al., 1978; Liu et al., 1981; 1982; Georghiou, 1981; Miyata et al., 1982; Chen & Sun, 1986; Tabashnik et al., 1987). In the United States, studies on the resistance of DBM populations to labeled insecticides of various classes were conducted by several authors (Royer et al., 1985; Ghidiu, 1986; Linduska, 1986; Story et al., 1987).

Since conventional insecticides pose hazards to the environment and to people, and since insecticide resistance is widespread (National Research Council, 1986), sound alternative management tools for the DBM are needed urgently. Use of microbial insecticides and especially genetically improved strains of *Bacillus thuringiensis* var. *kurstaki*, are promising for controlling lepidopteran pests. In addition *B. thuringiensis* is neither toxic to humans, nor to most beneficial insects or other nontarget organisms (Flexner et al., 1986; Wilcox et al., 1986). A number of improved strains of *B. thuringiensis* have the potential to manage the DBM in Florida (Leibee et al., unpublished; Seal, 1995). However, Jansson and Lecrone (1990) reported the possible development of resistance of the DBM to *B. thuringiensis* in the Homestead, Florida area. At this site, this author has investigated the effectiveness of several formulations and strains of *B. thuringiensis* in the management of the DBM on cabbage.

Materials and Methods

Studies were conducted in the experimental fields of the Tropical Research and Education Center, Homestead, FL during the 1994 and 1995 vegetable growing seasons. Certified Rio Verde cabbage seeds were incorporated into Pro-Mix (Premier Brand, Inc., Stamford, CT06902) and seeded directly on 3 feet wide and 0.6 feet high raised beds of Rockdale soil. The spacing between the seeds was 0.3 m within the row and adjacent rows were separated by 0.9 m. The soil in each bed was fumigated with 75% methyl bromide and 25% chloropicrin, and the beds were covered with white mulch. The mulch was perforated 3 d before planting. All cultural practices (except preplant fertilizer) employed were those recommended for growing cabbage in Florida (Hochmuth, 1988). Beds were fertilized with 18-0-20 (N-P-K) placed in a shallow groove in the center of the bed at the rate of 1650 lb./acre. Plants were irrigated twice daily, two hours each time by means of drip tubes (T-Tape, T-Systems International, Inc.). The drip tube was placed at the center of each bed and 10 cm below the soil surface. The emitters on each tube were spaced at 8-in. intervals, and the tube delivered water with a flow rate of 0.4 gpm/100 feet.

Five studies were conducted using randomized complete block designs, each with four replications. Plots were 25 feet long and contained 2 beds; and each bed had one row of cabbage. An untreated zone 9 feet wide planted to cabbage separated the replicates.

The first study was conducted using six treatments. Treatments evaluated were: i) weekly application of Emamectin benzoate (0.0075 lb. [a.i.]/A); ii) weekly application of conventional *B. thuringiensis* var. *aizawai* (Xentari, 1.0 lb./A); iii) weekly application of conventional *B. thuringiensis* var. *kurstaki* (Dipel 2X, 1.0 lb./A); iv) two weekly applications of Treatment (i) followed by two weekly applications of Treatment ii; v) two weekly applications of Treatment (i) followed by two weekly applications of Treatment (iii); and vi) an untreated check. Treatments were applied with 100 gallons/A of water at 51 lb/in.^{2} by means of a tractor-mounted single bed sprayer with two disc cone nozzles at each side of the bed and one nozzle above the center. Applications were made on 6 dates, i.e. 2, 15, 22 and 29 March, and 7 and 14 April 1995. Treatments were evaluated by recording the number of larvae on 10 plants selected randomly from the center 20 feet in each of the two rows in each treatment plot. Foliar damage was recorded visually on 10 plants per treatment plot at harvest using a scale from 1 to 6, where 1 corresponds to no damage and 6 corresponds to the most extensive feeding damage to the cabbage head and outer leaves.

In the second study, effectiveness of various conventional *B. thuringiensis* var. *Kurstaki* were determined in controlling the diamondback moth. Treatments evaluated were: i) *B. thuringiensis* (ABG 6347; 1.0 lb./A); ii) *B. thuringiensis* var. *kurstaki* (Dipel 2X; 1.0 lb./A); iii) *B. thuringiensis* (San 415; 1.0 lb./A); iv) *B. thuringiensis* (Agree; 1.0 lb./A); v) *B. thuringiensis* (Able; 1.0 lb./A); vi) Treatment (iv)in rotation with Treatment (v); and vii) an untreated control. Plot size, plot design, insecticide application method and sampling method were as above.

In the third study, the effectiveness of different conventional *B. thuringiensis* was evaluated again in controlling the diamondback moth. Treatments evaluated were: i) *B. thuringiensis* (Crymax WDG1; 1.0 and 0.50 lb./A); ii) *B. thuringiensis* (Crymax WDG2; 1.0 and 0.50 lb./A); iii) *B. thuringiensis* (Agree; 1.0 lb./A); iv) *B. thuringiensis* var. *aizawai* (Xentari; 1.0 lb./A); v) *B. thuringiensis* var. *kurstaki* (Dipel 2X; 1.0 lb./A); vi) *B. thuringiensis* (LoCh 159-94B (0.53 and 0.40 gallons/A); vii) *B. thuringiensis* (Biobit XL; 0.25 gallons/A): viii) *B. thuringiensis* (Biobit HP; 1.0 lb./A); and ix) an untreated check. Plot size plot design, insecticide application method and sampling method were as above.

In the fourth study 'Gourmet' cabbage was planted on 7 April 1995. All cultural practices were as above. Ten different treatments of biological and botanical insecticides were tested to manage the diamondback moth. Treatments evaluated were: i) azadirachtin (Neemix 0.25%; 2 lb. [product]/A); ii) *B. thuringiensis* (Able; 1.0 lb./A); iii) *B. thuringiensis* (Agree; 1.0 lb./A) in weekly rotation with another *B. thuringiensis* (Able; 1.0 lb./A); iv) *B. thuringiensis* var. *aizawai* (Xentari; 1.0 lb./A); v) *B. thuringiensis* (Crymax WDG2; 1.0 lb./A); vi) *B. thuringiensis* (Biobit HP; 1.0 lb./A); vii) Two rates of *Anagrapha falcifera* virus (AfNPV, 2 2×10^{11} PIBsw $\times$ 10^{11} PIBs/A & 8 $\times$ 10^{10} PIBs/A); viii) fipronil (Regent; 0.09 lb. [a.i.]/A); ix) a nontreated check. Treatment plots each consisted of two rows 25 ft long, and the plots were arranged in a randomized complete block design with four replications per treatment. The materials were applied by means of a backpack sprayer fitted with two nozzles per row that delivered 50 GPA at 40 psi. Applications were made on six dates 9, 14, 19, 22 and 26 May, and 1 June. The methods used for sampling were the same as above.

Table 1. Mean numbers of diamondback moth (DBM) per cabbage plant treated with different insecticides in study #1.

Insecticides	Rates (lb./A)	Mean[z] numbers of DBM							
		2 March	15 March	22 March	29 March	7 April	14 April	Average	Damage[y] grading
Emamectin benzoate	0.0075	0.5b	0.5b	0.1b	0.0b	0.0b	0.0b	0.2b	1.3b
B. thuringiensis var. *Aizawai*	1.0	0.8b	0.2b	0.0b	0.03b	0.0b	0.02b	0.2b	1.2b
B. thuringiensis var. *kurstaki*	1.0	0.6b	0.3b	0.3b	0.1b	0.1b	0.1b	0.1b	1.3b
Emamectin benzoate +	0.0075								
B. thuringiensis var. *Aizawai*	1.0	1.1ab	0.2b	0.0b	0.0b	0.0b	0.0b	0.2b	1.1b
Emamectin benzoate +	0.0075								
B. thuringiensis var. *kurstaki*	1.0	0.6b	0.02b	0.0b	0.1b	0.0b	0.0b	0.2b	1.1b
Control		1.8a	6.5a	3.5a	2.9a	0.7b	0.5a	2.6a	3.1a

[z]Means within a column followed by the same letter are not significantly different (P > 0.05; Ryan-Einot-Gabriel-Welsh multiple F test (SAS Institute 1986]).
[y]Damage grading: 1 corresponds to no damage and 6 corresponds to the most extensive feeding damage to the cabbage head and outer leaves.

Table 2. Mean numbers of diamondback moth (DBM) per cabbage plant treated with different insecticides in study #2.

Insecticides	Rates (lb./A)	Mean[z] numbers of DBM							
		13 March	20 March	27 March	3 Apr.	9 Apr.	14 Apr.	Average	Damage[y] Grading
B. thuringiensis; ABG 6347	1.0	0.9b	0.2b	0.1b	0.1b	0.02b	0.0b	0.2b	1.0b
B. thuringiensis; Dipel 2X	1.0	0.9b	0.4b	0.3b	0.1b	0.1b	0.1b	0.3b	1.1b
B. thuringiensis; San 415	1.0	0.5b	0.4b	0.3b	0.1b	0.1b	0.0b	0.2b	1.2b
B. thuringiensis; San 420	0.5	0.5b	0.2b	0.2b	0.2b	0.1b	0.0b	0.2b	1.2b
B. thuringiensis; Agree	1.0	0.4b	0.2b	0.1b	0.0b	0.0b	0.0b	0.1b	1.2b
B. thuringiensis; Able	1.0	0.8b	0.4b	0.2b	0.1b	0.02b	0.0b	0.2b	1.0b
B. thuringiensis; Agree +	0.5								
B. thuringiensis; Able	0.3	0.5b	0.1b	0.1b	0.1b	0.02b	0.1b	0.1b	1.2b
Control	0.0	3.8a	7.3a	5.8a	3.7a	1.3a	0.2a	3.7a	3.7a

[z]Means within a column followed by the same letter are not significantly different (P > 0.05; Ryan-Einot-Gabriel-Welsh multiple F test [SAS Institute 1986]).
[y]Damage grading: 1 corresponds to no damage and 6 corresponds to the most extensive feeding damage to the cabbage head and outer leaves.

In the fifth study; Rio Verde cabbage was planted on 21 Dec. 1994, and grown with all cultural practices as above. Each plot consisted of 4 rows each 30 ft long, and plots were arranged in a randomized complete block design with four replications per treatment. Treatments evaluated were: i) two rates of azadirachtin (LDF; 0.12 and 0.24 oz. [a.i.]/A); two rates of azadirachtin (Align; 0.12 and 0.24 oz. [a.i.]/A); and one rate of another formulation of azadirachtin (Neemix 0.25% (0.006 lb. [a.i.]/A). All treatments were applied at two intervals, 7 days and 14 days, between 3 March and 17 April; and they were compared to an untreated control. Insecticide applications and sampling methods were as discussed in the previous tests.

Data from all studies were transformed to square root x + 1 prior to performing the analysis of variance (SAS Institute, 1989), and the means were separated using the Ryab-Einot-Gabriel-Welsch multiple F-test (REGWF) at the $P = 0.05$ level of significance. The means were detransformed to the original scale for the ease of interpretation.

Results and Discussion

During the first study the abundance of diamondback moth larvae was low, i.e. 2 to 5 larvae/plant. All of the treatments reduced significantly the larval population on cabbage (Table 1). Emamectin benzoate alone or in rotation with *B. thuringiensis* var *aizawai* (Xentari) and *B. thuringiensis* var. *kurstaki* (Dipel 2X) reduced significantly the larval populations at all sampling dates. Emamectin benzoate alone or in rotation with *Bacillus thuringiensis* increased significantly the quality of harvestable heads.

In the second study, all treatments with the various *B. thuringiensis* entities successfully reduced diamondback moth larvae at all sampling dates (Table 2). Application of these *B. thuringiensis* entities also improved quality of cabbage heads.

In the third study, diamondback population level was low at the beginning, but medium to high in the later part of the test. On the first sampling date treatments with the various formulations of *B. thuringiensis* (Crymax) did not in reduce diamondback moth larval populations to levels below those in the untreated control (Table 3). However at subsequent sampling dates, the diamondback moth populations were significantly controlled by the various treatments of *B. thuringiensis* (Crymax). However the lowest numbers of diamondback moth larvae were recorded on *B. thuringiensis* var. *aizawai* (Xentari) treated plants. Moreover when the means of different sampling dates are averaged, all treatments with *B. thuringiensis* entities reduced significantly the diamondback moth larval populations.

In the fourth study, various Bt products were compared with AfNPV, botanical and conventional insecticides. The conventional insecticide, fipronil (Regent) and the conventional *B. thuringiensis* (Able and Xentari) significantly reduced DBM on the first sampling dates (Table 4). Both formulations of AfNPV and *B. thuringiensis* (Biobit HP) controlled DBM larvae from the second sampling date onward. When the means of all sampling dates are averaged, all treatments differed significantly from the untreated control.

In the fifth study, the efficacy of various derivatives of Azadirachtin in controlling the DBM were compared. The population abundance was medium at the beginning and low at

Table 3. Mean numbers of diamondback moth (DBM) per cabbage plant treated with different insecticides in study #3.

Insecticides[y]	Rates (lb./A)	Mean[z] numbers of DBM 28 March	4 April	10 April	17 April	26 April	3 May	Average
Crymax WDG1	0.5	7.5ab	0.3de	0.1d	1.9ab	1.6bc	0.3b	1.8c-e
Crymax WDG1	1.0	6.3a-c	1.2de	0.0d	1.3b	0.5b-d	0.13b	1.4d-g
Crymax WDG2	0.5	5.0bc	0.1e	0.0d	1.6ab	1.3b-d	0.3b	1.3d-g
Crymax WDG2	1.0	6.7a-c	0.0e	0.0d	1.0b	0.5cd	0.2b	1.3e-g
Agree	1.5	4.5c	0.1e	0.1cd	1.9ab	0.4bd	0.2b	1.1e-g
Xentari	1.0	—[x]	0.0e	0.1cd	0.9b	1.4b-d	0.1b	0.6g
Dipel 2X	1.0	7.1ab	1.2de	0.6cd	3.9a	1.6b	0.3b	2.2cd
LoCh 159-94B	4.2	0.8	0.4de	0.1cd	1.4ab	0.8b-d	0.1b	0.6fg
LoCh 159-94B	3.2	—[x]	1.3d	0.1cd	1.9ab	1.8ab	0.3b	1.1d-g
Biobit XL	2.0	—[x]	7.6b	0.7bc	2.9ab	2.1b	0.1b	2.4c
Biobit HP	1.0	—[x]	4.5c	0.2cd	2.0ab	2.0b	0.3b	1.6c-f
Control		8.6a	16.0a	8.9a	2.1ab	4.5a	1.7a	6.17a

[z]Means within a column followed by the same letter are not significantly different (P > 0.05; Ryan-Einot-Gabriel-Welsh multiple F test [SAS Institute 1986]).
[y]*B. thuringiensis* based insecticides.
[x]Samples were not collected.

Table 4. Mean numbers of diamondback moth (DBM) larvae per plant of cabbage treated with different insecticides in study #4.

Treatments	Rates product/A	Mean[z] no. of DBM on 9 May	14 May	19 May	22 May	26 May	1 June	Average
Neemix[y]	2.0 lb.	3.5a	1.3b	0.8b	0.6bc	0.0c	0.1c	1.3b
Able[x]	1.0 lb.	0.9c	0.3c	0.0d	0.1cd	0.0c	0.5b	0.5c
Agree-Able[x]	1.0-1.0	2.3ab	0.3c	0.2cd	0.2cd	0.0c	0.1c	0.6c
Xentari[x]	1.0 lb.	1.5bc	0.2c	0.3b-d	0.3cd	0.1bc	0.1c	0.6c
Crymax[x]	1.0 lb.	2.4ab	0.0c	0.1d	0.3b-d	0.3b	0.3bc	0.6c
Biobit Hp[x]	1.0 lb.	2.9ab	0.2c	0.2cd	0.1d	0.1bc	0.0c	0.7c
AfNPV	2×10^{11} PIBs[w]	2.3ab	1.1b	0.3b-d	0.9b	0.2bc	0.6b	1.1b
AFNPV	2×10^{10} PIBs	3.7a	1.5b	0.7bc	0.4b-d	0.3bc	0.1c	1.2b
Fipronil	0.1 lb. a.i.	1.1c	0.1c	0.1d	0.2cd	0.2bc	0.1c	0.5c
Control		3.2a	2.3a	3.2a	2.5a	1.7a	2.5a	2.5a

[z]Means within a column followed by the same letter are not significantly different (P > 0.05; Ryan-Einot-Gabriel-Welsh multiple F test [SAS Institute, 1985]).
[y]Azadirachtin.
[x]*B. thuringiensis* based insecticides.
[w]Polyhedral inclusion bodies of *Anagrapha falcifera* virus.

Table 5. Mean numbers of Diamondback moth (DBM) per cabbage plant treated with different insecticides in study #5.

Insecticides[x]	Rates (lb. -[a.i.]/A)	Mean[z] numbers of DBM 3 March	21 March	26 March	3 April	10 April	17 April	Average	Damage[y] Grading
LDF (7 d)	0.01	2.7bc	3.0bc	1.7bc	0.4cd	0.1c	0.0	1.3bc	1.8e-g
LDF (14 d)	0.01	1.9c	2.8bc	2.2bc	1.0bc	0.4a-c	0.1	1.4bc	2.4c-e
LDF (7 d)	0.02	1.5bc	1.9c	0.6d	0.1d	0.02c	0.0	0.7d	1.3g
LDF (14 d)	0.02	1.7c	2.2bc	1.8bc	0.6bc	0.1bc	0.1	1.1c	1.6fg
Align (7 d)	0.01	3.5b	3.1bc	1.9bc	1.2bc	0.3a-c	0.02	1.7bc	2.7bc
Align (14 d)	0.01	2.0c	2.8bc	2.1bc	1.6b	0.7a	0.1	1.5bc	2.9bc
Align (7 d)	0.02	2.7bc	3.1bc	1.5cd	0.4cd	0.2a-c	0.0	1.3bc	2.0d-f
Align (14 d)	0.02	2.1bc	3.7bc	2.3b	1.0bc	0.4a-c	0.02	1.6bc	2.6bc
Neemex (7 d)	0.01	2.5bc	2.6bc	1.7bc	0.9b-d	0.3a-c	0.1	1.3bc	3.1ab
Neemex (14 d)	0.01	1.9c	4.1b	2.2bc	1.9b	0.8ab	0.0	1.8b	2.6b-d
Control		6.0a	8.5a	7.3a	4.5a	0.5a-c	0.1	4.7a	3.6a

[z]Means within a column followed by the same letter are not significantly different (P > 0.05; Ryan-Einot-Gabriel-Welsh multiple F test [SAS Institute 1986]).
[y]Damage grading: 1 corresponds to no damage and 6 corresponds to the most extensive feeding damage to the cabbage head and outer leaves.
[x]Azadirachtin based insecticides.

the end of the study. Numbers of DBM larvae on cabbage plants treated with the various treatments differed significantly from the control on the first sampling date (Table 5). Reductions of diamondback moth larvae in all treatment plots were consistent at the different sampling dates. Foliage damage was also significantly less in the treated plants than in the untreated plants.

The above studies showed that *B. thuringiensis* based products were effective in controlling *P. xylostella* larvae on cabbage. The nonconventional insecticide, Emamectin benzoate, was highly effective against *P. xylostella*. Performance of fipronil in controlling *P. xylostella* was comparable with that of the *B. thuringiensis* based products. Azadirachtin-based products were also promising in managing *P. xylostella*. The integration of *B. thuringiensis*-based products with conventional, nonconventional insecticides and with azadirachtin-based products will provide improved management of *P. xylostella*. It is likely that the development of resistance by *P. xylostella* to any specific insecticide can be deterred either by rotation or by combined use of two or more products of different origin.

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CONTROL OF SOIL-BORNE DISEASES OF MULCHED TOMATO BY FUMIGATION

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Abstract. **Methyl bromide/chloropicrin (MB-C 67), chloropicrin, metam-sodium, dazomet, and dichloropropene/chloropicrin (C-17) soil fumigants were compared for control of soil-borne pathogens of tomato (*Lycopersicon esculentum* Mill.) in the spring of 1995. The latter four fumigants were combined with pebulate for nutsedge control. Marketable yields were increased with all fumigants compared to a nonfumigated treatment. The incidence of bacterial wilt, caused by *Pseudomonas solanacearum* (Smith) Smith, was 92% on plants grown in nonfumigated plots. This was reduced to 48, 26, 20, 37, and 44% for MB-C 67, chloropicrin, metam-sodium, dazomet, and C-17, respectively. Forty-five percent of the surviving control plants had root knot (*Meloidogyne* spp.), whereas only 4% of the plants grown in MB-C 67-treated soil had galled roots. The other fumigants did not reduce root knot incidence or severity. Crown rot (*Fusarium oxysporum* Schlecht. f. sp. *radicis-lycopersici* Jarvis & Shoemaker) incidence was reduced by all fumigants compared to the nonfumigated control. Late season development of southern blight (*Sclerotium rolfsii* Sacc.) was reduced by chloropicrin and dazomet.**