

## EFFECTS OF SOIL FUMIGANTS AND BIOYIELD™ ON ROOT-KNOT NEMATODE INCIDENCE AND YIELD OF TOMATO

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Several formulations of 1,3-dichloropropene (Telone, Dow AgroSciences LLC, Indianapolis, IN) combined with biologically amended transplants were evaluated for effects on nematode galling and yield of tomato. Innovations in application methods for Telone products will reduce worker exposure and requirements for personal protective equipment (PPE) but require efficacy studies to determine optimum strategies for nematode control. Soil-less transplant media amended with BioYield™ (Gustafson LLC, Plano TX), a formulation of two Gram-positive plant growth-promoting rhizobacteria (PGPR) has shown potential to improve plant vigor, reduced disease severity and increased yield of tomato and pepper (Kokalis-Burelle *et al.*, 2002). BioYield contains two PGPR isolates, *Bacillus subtilis* strain GBO3 and *Bacillus amyloliquefaciens* strain GB99, in a formulation including chitin, shown to elicit low levels of resistance responses in tomato. The objective of this study was to evaluate the effects of several 1,3-D based soil treatments combined with BioYield amended transplants on disease and yield of tomato.

### Methods

A field study was conducted in spring 2003 at the University of Florida's Plant Science Research and Education Center in Citra, FL. Treatments were arranged in split-plots with main plots consisting of soil fumigant treatments and subplots comprised of two plant types; untreated transplants and transplants treated with BioYield. Fumigants were applied by a commercial applicator 21 days prior to planting and were; 1) untreated, 2) methyl bromide:chloropicrin 67:33 at 350 lbs/a injected in preformed beds, 3) 1,3-D and chloropicrin at 35 gal/a (Telone C-35) applied on flat soil before bedding, 4) 1,3-D (Telone II) at 18 gal/a applied on flat soil before bedding + chloropicrin at 126 lbs/a injected in beds, and 5) 1,3-D (Telone II) at 18 gal/a applied on flat soil before bedding. Prebedded treatments were applied using the Yetter Avenger coulter applicator with three chisels/bed, set 12" apart each at a 12" depth. Immediately after application of prebedded treatments the beds were formed (3-ft wide bed tops) on 6-ft centers using a power bedder. Methyl bromide and chloropicrin were applied in preformed beds using a mini-combo unit with three chisels/bed at approximately a 10-inch depth. The experimental design was a randomized complete block with five replications. All main plot soil treatments were applied under 30- $\mu$ m-thick low-density black polyethylene mulch with one central drip irrigation line per bed. 'Florida 47' tomato seed were planted into 128 cell speedling transplant flats filled with peat-based potting mix treated with BioYield at a rate of 1:40 BioYield:potting mix. Plants were routinely maintained in the greenhouse for four weeks at the U.S. Horticultural Research Lab, Ft. Pierce, FL. Tomato seedlings were transplanted

into split plots in a single row spaced 18" apart on 5 March 2003 with BioYield treated plants on the north and untreated plants on the south side of each plot.

## **Results and Discussion**

The marketable yield per plant and per plot was highest in the methyl bromide treatment compared to all other treatments, and lowest in the untreated control plots (Table 1). Of the Telone II treatments, prebed application of Telone II with an in-bed application of chloropicrin had significantly higher yields than prebed application of Telone II without an in-bed application of chloropicrin. C-35 and Telone II + chloropicrin had similar yield. There were no significant differences in yield with the addition of BioYield to transplants.

All treatments differed from each other in root-knot nematode control, with methyl bromide providing the highest level of protection, and the untreated control plots exhibiting extremely high levels of disease (Table 2). Of the three Telone treatments, prebedded application of Telone C-35 provided the highest level of nematode control, followed by prebedded application of Telone II with chloropicrin applied in the bed. Prebedded application of Telone II without chloropicrin in the bed provided the least nematode control of all the chemical treatments. It is noteworthy that additional nematode control was achieved in the treatment including chloropicrin and that among the Telone treatments, yield data are not correlated with data on nematode control. This may indicate that a threshold exists at moderate nematode infestation levels where disease is not highly correlated with yield. Unusually cool winter temperatures and wet conditions in March-April may have also contributed to nematode and fungal pathogen interactions and lower yields. There were significant interactions between the main and subplot treatments in this study. BioYield treated plants significantly reduced root-knot nematode galling in both the control and methyl bromide treatments, but either had no effect or increased galling in the Telone treatments (Table 2). The negative effect of 1,3-D on the BioYield treatment requires further investigation. Nematode control with the Telone and chloropicrin combinations and the prebedded application methods used in this study did not compare with the nematode control or yield achieved with methyl bromide.

## **References**

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- Kokalis-Burelle, N., Vavrina, C.S., Rossskopf, E.N., and Shelby, R.A. 2002. Field evaluation of plant growth-promoting rhizobacteria amended transplant mixes and soil solarization for tomato and pepper production in Florida. *Plant and Soil* 238:257-266.

Table 1. Spring 2003 Marketable Tomato Yield in Fumigant/BioYield Trial, Citra, FL.

Tomato Yield		
Treatment, rate per acre, and application method	lbs/plot	lbs/plant
Untreated	44.41 d <sup>1</sup>	3.73 d
Methyl bromide 67-33 350 lbs/a (in bed)	122.86 a	9.77 a
C-35 35 gal/a (prebedded)	88.44 bc	7.25 bc
Telone II 18 gal/a (prebedded) + Pic 126 lbs/a (in bed)	96.29 b	7.65 b
Telone II 18 gal/a (prebedded)	76.14 c	6.24 c
LSD <sub>0.05</sub>	16.89	1.28

<sup>1</sup> Letters indicate significant differences between treatments at LSD<sub>0.05</sub>

Table 2. Spring 2003 Tomato Gall Ratings in Fumigant/BioYield Trial, Citra, FL.

Gall Ratings <sup>1</sup>			
Treatment, rate per acre, and application method	BioYield	Control	LSD <sub>0.05</sub>
Untreated	84.11 a <sup>2</sup> a <sup>3</sup>	96.50 a b	5.57
Methyl bromide 67-33 350 lbs/a (in bed)	0.90 e a	3.18 d b	1.98
C-35 35 gal/a (prebedded)	20.53 d a	17.93 c b	1.32
Telone II 18 gal/a (prebedded) + Pic 126 lbs/a (in bed)	39.75 c a	34.73 b a	7.66
Telone II 18 gal/a (prebedded)	56.88 b a	43.68 b b	11.97
LSD <sub>0.05</sub>	11.61	10.47	

<sup>1</sup> Based on 0 – 100% rating scale with 0 = no galling, 10 = 10% of root system galled.....100 = 100% of root system galled.

<sup>2</sup> Letters indicate significant differences between chemical treatments in columns at LSD<sub>0.05</sub>

<sup>3</sup> Letters indicate significant differences between BioYield and control treatments in rows at LSD<sub>0.05</sub>