

# EVALUATION OF BRASSICA COVER CROPS FOR CONTROL OF SOILBORNE PEST AND DISEASES ON EGGPLANT

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## **Introduction**

Many plants in the *Brassicaceae* family produce glucosinolates naturally. Glucosinolates degrade into compounds such as methyl isothiocyanates (MITC) and allyl isothiocyanates (AITC).

Both MITC and AITC are lethal to soilborne pests such as nematodes and fungi. In fact, the common fumigant metham sodium degrades to MITC and then accounts for its activity as a soil fumigant. Since the Brassica species have been demonstrated to produce glucosinolates which degrade into MITC and AITC there is interest in determining if the growing a Brassica crop prior to another crop susceptible to soilborne pests would benefit from the rotation. This test evaluates the effect of Brassica species grown prior to eggplant. The Brassica cover crop was planted during the winter 2004 followed by a planting of eggplant in spring 2005. A second crop of squash is planned for fall 2005.

## **Materials and Methods**

The study was located at the Blackshank Farm, CPES, Tifton, GA. The area has a history of assorted vegetables. The area was prepared using all current University of Georgia Extension Service recommendations. The plot design was a split plot design with fumigants as main treatments and a Brassica cover crop and fallow plots as sub-treatments. Plots were arranged in randomized complete blocks consisting of single bed plots replicated four times. Each plot was 45 feet long and 6 feet wide with 10 foot alleys.

Brassica crops were turnip (Purple Top White Globe) and mustard (Florida Broadleaf). Two more treatments consisted of rye with and without a methyl bromide (67-33) (300 lbs/A) application prior to laying plastic. Brassicas were planted 4 November, 2004 with a monosem vacuum planter. On 15 March, Brassica covers were cut with a flail mower, fertilizer (10-10-10) at a rate of 500 lb/A, and the plots were rototilled. The biomass from certain Brassica and rye beds were removed prior to

rototilling. Beds were shaped and all beds were covered with 1 mil black polyethylene with drip tape in the center of the bed approximately 1 in. deep. The following day, metam sodium was drip-applied at 37.5 gal/A on certain beds. Plastic covered plots were 45 feet long and 30 inches wide. Pathogen/pest sachets were buried in the plots immediately following plastic laying by making a small cut in the plastic, burying the sachets, and then taping up the plastic.

Eggplant cv. Nightshade seedlings were purchased from Lewis Taylor Farms in Tifton. A single plant was transplanted using a mechanical type transplanter, which cuts holes in the plastic just ahead of the planters in the center of the plastic bed adjacent to the drip tape on 29 April, 2005. Plant spacing was 12 inches. All plots were sprayed with Manex (Maneb) (2 qt/A on 9 May) and Kocide (Copper Hydroxide) (2.6 pt/A on 20 and 27 May, 10, 17, 24, and 30 June, and 8 July) for foliar diseases and Lannate (Methomyl) (1 pt/A on 9 May and 10, 17, 24, and 30 June), Phaser (Endosulfan) (1 qt/A on 20 May), Pounce (Permethrin) (6 oz/A on 27 May), and Spintor (Spinosad) (6 oz/A on 8 July).

Stand counts and vigor ratings were conducted on 23 May. Plant vigor was rated on a scale of 1 to 10, 10 representing live and healthy plants and 1 representing dead plants.

Twelve soil cores, 2.5-cm-diam × 25-cm-deep, were collected from the center of each plot before planting Brassica's, at harvest of Brassica's (14 March), and at planting (27 April) and harvest (25 July) of eggplant. Nematodes were extracted from a 150-cm<sup>3</sup> soil sub-sample using a centrifugal sugar flotation technique. The extracted nematodes were then counted. On 9 June an early root gall evaluation was conducted on three plants per plot using a 0 to 10 scale, whereby, 0 = no galls, 1 = very few small galls, 2 = numerous small galls, 3 = numerous small galls of which some are grown together, 4 = numerous small and some big galls, 5 = 25 % of roots severely galled, 6 = 50 % of roots severely galled, 7 = 75 % of roots severely galled, 8 = no healthy roots but plant is still green, 9 = roots rotting and plant dying, 10 = plant and roots dead. Again following final harvest on 22 July five plants per plot were evaluated for root galls using that same scale.

All eggplant fruits were hand harvested from the 15 foot center area of each bed (15 plants per plot). Each harvest was separated into marketable and cull fruits, counted and weighed. There were a total of three harvests, 28 June and 7 and 18 July, 2005.

### **Summary**

Vigor ratings ranged from a low of 6.8 following rye to a high of 9.5 following rye plus methyl bromide (Table 1). Stand counts ranged from 25.8 to 23.0, with the lowest following rye. Root gall ratings were low on 9 June and 23 July and ranged from 1.3 to 0.3 and from 2.2 to 0.7 respectively.

Marketable yield both numbers of fruits and weight were highest in plots treated with methyl bromide (Table 2). Cull numbers and weights were about 10% of the total number and yield differed little from treatment to treatment. Total yield both number of fruit and weight mirrored results found under marketable yield, with highest numbers occurring in plots treated with methyl bromide the season prior to establishment of

eggplant.

Populations of *Pythium irregulare* and *Fusarium solani* both at planting and harvest are presented in Table 3. The level of fungi were lowest in plots treated with methyl bromide the season prior to establishment of eggplant. Sachets containing *Rhizoctonia solani* infested beet seed indicated a relatively low rate of survival. Although some differences were noted among treatments, no trends were noted.

Root knot nematodes ranged from a low of 0 in the rye + methyl bromide (no biomass) to a high of 12.5 nematodes/150 cc soil in the rye + Vapam (no biomass). Lesion nematode increased dramatically at harvest (Table 5). The root knot nematode numbers at harvest ranged from a low of 5 in rye to a high of 55 in mustard plots. The relationship between root knot nematode numbers and root gall index (Table 1) was not apparent.

**Table 1. Effect of Brassica Spp. and Other Cover Crops on Root Knot Nematode and Plant Vigor and Stand Counts of ‘Nightshade’ Eggplant, Spring 2005 Tifton, GA.**

Treatment <sup>a</sup>	Application Rate (gal/A)	Vigor Rating (0-10) <sup>b</sup>	Stand Counts <sup>c</sup>	Gall Ratings (1-10) <sup>d</sup>	
		May 23	May 23	June 9	July 22
1 Turnip		7.6de	24.3ab	1.1ab	0.9a
2 Mustard		7.6de	24.3ab	1.0ab	1.8a
3 Rye		8.0bcd	24.3ab	1.0ab	1.9a
4 Turnip + Vapam	37.5	8.9abc	25.3ab	0.9ab	1.1a
5 Mustard + Vapam	37.5	7.6de	24.0ab	1.0ab	1.2a
6 Rye + Vapam	37.5	7.6de	24.3ab	0.4ab	1.6a
7 Rye + Methyl Bromide	300 <sup>e</sup>	9.0ab	23.5ab	0.3b	1.2a
8 Turnip		6.9de	25.8a	0.9ab	1.9a
9 Mustard		7.8cde	24.3ab	1.0ab	1.4a
10 Rye		6.8e	23.0b	0.7ab	0.7a
11 Turnip + Vapam	37.5	7.8cde	23.5ab	0.7ab	1.2a
12 Mustard + Vapam	37.5	6.8e	24.5ab	1.3a	2.2a
13 Rye + Vapam	37.5	7.3de	24.3ab	0.8ab	1.4a
14 Rye + Methyl Bromide	300 <sup>e</sup>	9.5a	24.0ab	0.5ab	1.4a

- a. Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to LSD. Treatments 1-7 had the biomass incorporated into the soil and treatments 8-14 had the biomass removed from the soil prior to bed preparation.
- b. Vigor was done on a scale of 1-10 with 10 = live and healthy plants and 1 = dead plants and an average was taken of vigor for 23 May .
- c. Counts of live plants were taken on 23 May.
- d. Gall ratings were done on a scale of 0-10 with 10 = dead plant and roots and 0 = no galls and a healthy plant. An average was taken of the gall ratings for 9 June and then again for 22 July.
- e. Methyl bromide was added in at a rate of 300 lbs/A.

**Table 2. Effect of Brassica Spp. and Other Cover Crops on Fruit Numbers and Yield of ‘Nightshade’ Eggplant, Spring 2005  
Tifton, GA.**

Treatment <sup>a</sup>	Application Rate (gal/A)	Marketable Yield/Plot		Cull Yield/Plot		Total Yield/Plot	
		Number <sup>b</sup>	Weight (lb) <sup>c</sup>	Number <sup>d</sup>	Weight (lb) <sup>e</sup>	Number <sup>f</sup>	Weight (lb) <sup>g</sup>
Turnip		49.0bc	54.5bc	7.8abc	8.3ab	56.8bc	62.8bcde
2 Mustard		54.3abc	59.1abc	6.5abc	6.7ab	60.8bc	65.9bcd
3 Rye		47.8c	47.6c	10.0abc	8.9ab	57.8bc	56.5cde
4 Turnip + Vapam	37.5	54.3abc	49.4c	12.0a	10.0a	66.3abc	66.9bc
5 Mustard + Vapam	37.5	49.3bc	50.7c	7.5abc	6.6ab	56.8bc	57.3cde
6 Rye + Vapam	37.5	54.3abc	51.0c	8.0abc	6.0ab	62.3abc	57.0cde
7 Rye + Methyl Bromide	300 <sup>h</sup>	67.0a	73.8a	10.3abc	8.8ab	75.0a	82.6a
8 Turnip		45.0c	44.1c	8.0abc	5.4ab	53.0c	49.4e
9 Mustard		53.0bc	57.6abc	7.3abc	9.8a	60.3bc	67.4abc
10 Rye		52.0bc	48.5c	9.5abc	8.1ab	61.5abc	56.6cde
11 Turnip + Vapam	37.5	45.8c	48.7c	11.5ab	9.9a	57.3bc	58.6cde
12 Mustard + Vapam	37.5	49.5bc	46.9c	5.3c	4.4b	54.8bc	51.3de
13 Rye + Vapam	37.5	56.0abc	55.8bc	6.0bc	4.3b	62.0abc	60.8bcde
14 Rye + Methyl Bromide	300 <sup>h</sup>	62.0ab	70.6ab	5.5c	6.4ab	67.5ab	75.5ab

- a. Data are means of five replications. Means in the same column followed by the same letter are not different (P = 0.05) according to LSD. Treatments 1-7 had the biomass incorporated into the soil and treatments 8-14 had the biomass removed from the soil prior to bed preparation.
- b. The fruit from each individual plot that was considered to be marketable and showed no symptoms of disease was separated and counted on 28 June, 8 and 18 July.
- c. The fruit was collected separately by each plot and the fruit considered marketable and non-diseased was weighed on 28 June, 8 and 18 July.
- d. The fruit from each individual plot that was considered to be non-marketable and diseased was separated and counted on 28 June, 8 and 18 July.
- e. The fruit was collected separately from each plot and the fruit considered non-marketable and diseased was weighed on 28 June, 8 and 18 July.
- f. The number of marketable and non-marketable fruit were totaled for each plot on 28 June, 8 and 18 July.
- g. The weight of marketable and non-marketable fruit were totaled for each plot on 28 June, 8 and 18 July.
- h. Methyl bromide was added in at a rate of 300 lbs/A.



**Table 3. Effect of Brassica Spp. on Soil Populations of Pythium, Fusarium, and Rhizoctonia (CFU/g soil) on ‘Nightshade’ Eggplant, Spring 2005 Tifton, GA.**

Treatment <sup>a</sup>	Application Rate (gal/A)	At Planting Eggplant <sup>c</sup>		At Harvest Eggplant <sup>d</sup>		Eggplant Sachets
		P. irregulare	F. solani	P. irregulare	F. solani	R. solani <sup>e</sup>
1 Turnip		0b	1420b	0b	2260ab	38.8ab
2 Mustard		1ab	2660a	1ab	1940ab	32.5ab
3 Rye		2ab	1260b	0b	1360ab	47.5ab
4 Turnip + Vapam	37.5	0b	560bc	1ab	3020a	6.3b
5 Mustard + Vapam	37.5	1ab	480bc	0b	1800ab	32.5ab
6 Rye + Vapam	37.5	1ab	440bc	2ab	1520ab	58.8a
7 Rye + Methyl Bromide	300 <sup>b</sup>	1ab	20c	0b	0b	13.8b
8 Turnip		0b	1440ab	0b	2320ab	20.0ab
9 Mustard		2ab	1060bc	1ab	3040a	58.8a
10 Rye		0b	740bc	3a	940ab	28.8ab
11 Turnip + Vapam	37.5	0b	320bc	0b	1920ab	20.0ab
12 Mustard + Vapam	37.5	0b	360bc	0b	1720ab	40.0ab
13 Rye + Vapam	37.5	3a	460bc	0b	300ab	21.3ab
14 Rye + Methyl Bromide	300 <sup>b</sup>	0b	0c	0b	20b	21.3ab

a. Data are means of five replications. Means in the same column followed by the same letter are not different ( $P = 0.05$ ) according to LSD. Treatments 1-7 had the biomass incorporated into the soil and treatments 8-14 had the biomass removed from the soil prior to bed preparation.

b. Methyl bromide was added in at a rate of 300 lbs/A.

c. The at plant soil sample was taken on 27 April.

d. The at harvest soil sample was taken on 25 July.

e. Percent survival of *Rhizoctonia solani*.

**Table 4. Effect of Brassica Spp. on Populations of Plant-Parasitic Nematodes at Planting of ‘Nightshade’ Eggplant, Spring 2005 Tifton, GA.**

Treatment <sup>a</sup>	Application Rate (gal/A)	Plant Parasitic Nematodes / 150 cc soil <sup>c</sup>	
		Root-knot	Lesion
1 Turnip		7.5ab	0.0b
2 Mustard		10.0ab	0.0b
3 Rye		7.5ab	0.0b
4 Turnip + Vapam	37.5	7.5ab	0.0b
5 Mustard + Vapam	37.5	2.5ab	0.0b
6 Rye + Vapam	37.5	2.5ab	0.0b
7 Rye + Methyl Bromide	300 <sup>b</sup>	5.0ab	0.0b
8 Turnip		2.5ab	2.5ab
9 Mustard		7.5ab	0.0b
10 Rye		7.5ab	7.5a
11 Turnip + Vapam	37.5	10.0ab	0.0b
12 Mustard + Vapam	37.5	2.5ab	0.0b
13 Rye + Vapam	37.5	12.5a	0.0b
14 Rye + Methyl Bromide	300 <sup>b</sup>	0.0b	0.0b

a. Data are means of four replications. Means in the same column followed by the same letter are not different (P = 0.05) according to LSD.

b. Methyl bromide was added in at a rate of 300 lbs/A.

c. The soil sample was taken on 27 April. Root-knot nematode (*Meloidogyne* spp.); Lesion Nematode (*Pratylenchus* spp.).

**Table 5. Effect of Brassica Spp. on Populations of Plant-Parasitic Nematodes at Planting of ‘Nightshade’ Eggplant, Spring 2005 Tifton, GA.**

Treatment <sup>a</sup>	Application Rate (gal/A)	Plant Parasitic Nematodes / 150 cc soil <sup>c</sup>				
		Root-knot	Lesion	Stubby	Sting	Tylenchus
1 Turnip		37.5abc	2.5ab	5.0abc	5.0a	0.0a
2 Mustard		55.0a	2.5ab	10.0ab	0.0b	0.0a
3 Rye		5.0c	0.0b	2.5bc	0.0b	0.0a
4 Turnip + Vapam	37.5	17.5abc	5.0a	0.0c	0.0b	0.0a
5 Mustard + Vapam	37.5	10.0c	0.0b	2.5bc	0.0b	0.0a
6 Rye + Vapam	37.5	50.0ab	2.5ab	5.0abc	0.0b	0.0a
7 Rye + Methyl Bromide	300 <sup>b</sup>	15.0bc	0.0b	0.0c	0.0b	2.5a
8 Turnip		35.0abc	2.5ab	5.0abc	0.0b	0.0a
9 Mustard		30.0abc	0.0b	5.0abc	0.0b	0.0a
10 Rye		20.0abc	0.0b	12.5a	0.0b	0.0a
11 Turnip + Vapam	37.5	30.0abc	0.0b	5.0abc	0.0b	0.0a
12 Mustard + Vapam	37.5	20.0abc	0.0b	10.0ab	0.0b	0.0a
13 Rye + Vapam	37.5	30.0abc	0.0b	2.5bc	0.0b	2.5a
14 Rye + Methyl Bromide	300 <sup>b</sup>	35.0abc	0.0b	5.0abc	0.0b	0.0a

a. Data are means of four replications. Means in the same column followed by the same letter are not different (P = 0.05) according to LSD.

b. Methyl bromide was added in at a rate of 300 lbs/A.

c. The soil sample was taken on 25 July. Root-knot nematode (*Meloidogyne* spp.); Lesion Nematode (*Pratylenchus* spp.); Stubby Nematode (*Trichodorus* spp.); Sting Nematode (*Belonolaimus* spp.); *Tylenchus* spp.