

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

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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 pepper. The Brassica cover crop was planted during the winter 2005 followed by pepper in spring 2006. A second crop of zucchini is planned for summer 06.

### **Materials and Methods**

The study was located at the Blackshank farm, CPES, Tifton, GA. The area has a history of assorted vegetable. The area was prepared using all current University of Georgia Extension Service recommendations. The test was a randomized complete block design consisting of single bed plots replicated four times. Each plot was 25 feet long and 6 feet wide with 5 foot alleys.

Brassica crops were radish (Scarlet Globe), rapeseed (Dwarf Essex), rutabaga, and mustard (Florida Broadleaf). The other treatments were bare fallow and wheat with and without Vapam. Brassicas were planted 8 September, 2005 with a monosem vacuum

planter. On 1 March, 2006, Brassica covers were cut with a flail mower, fertilizer (10-10-10) at a rate of 700 lb/A, and the plots were rototilled. 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, Vapam (metam sodium) was drip-applied at 50 gal/A on only one treatment. Plastic covered plots were 25 feet long and 30 inches wide.

Pepper cv. 'Stiletto' 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 21 March, 2006. Plant spacing was 18 inches. All plots were sprayed with Manex (Maneb) (2 qt/A on 12 May) and Kocide (Copper Hydroxide) 4.5 LF (2 pt/A on 28 March, 14 and 28 April, 25 May, and 2 June) for foliar diseases, and Pounce 3.2 (Permethrin) (8 oz/A on 12 May), Asana .66 EC (Esfenvalerate) (9 oz/A on 14 and 28 April and 2 June), and Spintor 25C (Spinosad) (8 oz/A on 25 May) for insect control.

Stand counts were done on 3 April and vigor ratings were conducted on 12 April and 11 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 at harvest of Brassica's (14 February), and at planting (23 March) and harvest (14 June) of peppers. Nematodes were extracted from a 150-cm<sup>3</sup> soil sub-sample using a centrifugal sugar flotation technique. Soil fungal assays were conducted using a sub sample from the

collected soil. Aliquots of soil were removed from each sub sample and air dried for 24 hours. Five grams of dry soil were added to 100 ml of 0.3% water agar and mixed thoroughly. Immediately afterward, 1 ml of soil/agar was removed and mixed with 20 ml of 0.3% water agar. One ml of the first preparation was dispensed and spread evenly onto a petri plate containing an oomycete-selective medium (pimaricin-ampicillin-rifampicin-PCNB) for isolation of Pythium species. One ml of the second preparation was dispensed and spread onto a petri plate containing a Fusarium-selective medium (peptone-PCNB). Fungal plates were incubated for 120 hours for Fusarium species and 48 hours for Pythium species. After incubation, CFUs were counted and recorded.

On 25 April 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 12 June, 2006 five plants per plot were evaluated for root galls using that same scale.

All pepper fruits were hand harvested from the 10 foot center area of each bed. Each harvest was separated into marketable and cull fruits, counted and weighed. There were a total of four harvests, 17 and 25 May, 2 and 9 June.

## **Results and Summary**

Stand Counts similar among treatments. Plant vigor was significantly lower in Wheat compared to Rutabaga on 12 April and Radish and Rutabaga on 11 May (Table 1). Root-knot nematodes at the field location were not in significant numbers and root damage resulting from the infection and feeding of root-knot was minimal (Table 2). Evaluation of the affects of *Brassica* species on soil fungal organisms showed that *Pythium* and *Fusarium* species were

not significantly affected by the incorporation of the *Brassica* cover crops (Table 3). This was also true for the wheat cover crop with Vapam.

Affects of the *Brassica* and non-*Brassica* treatments were also evaluated on pepper vegetable crop. The results indicated that Radish, Rutabaga, and the control fallow had the highest numerical pepper yield in marketable number and weight with the radish treatment having significantly higher yields than mustard in marketable fruit weight and rapeseed, mustard, and control fallow in total fruit weight (Table 4). Results for the number and weight of culled fruit were similar among all treatments (Table 4).

The results of this test indicated that some cover crop treatments had a beneficial affect on crop growth and yield. This increase in crop growth and yield might be the result of increased biomass and/or nutrients. Although previous test have demonstrated nematicidal and fungicidal activity from *Brassica* species, the affect of the treatments in this test on nematodes and fungal organisms were inconclusive due to low pest pressure during the spring.

**Table 1. Effect of Brassica Spp. on Plant Vigor and Stand Counts on "Stiletto" Peppers, Spring 2006, Tifton, GA**

Treatment	Application Rate (gal/A)	Stand Counts <sup>a</sup> April 3		Vigor Rating <sup>b</sup> (0 to 10) April 12		Vigor Rating (0 to 10) May 11	
Radish		22	A <sup>c</sup>	6.6	AB <sup>c</sup>	8.1	A <sup>c</sup>
Rapeseed		21	A	6.1	AB	6.6	AB
Rutabaga		21	A	7.0	A	7.6	A
Mustard		21	A	5.5	AB	6.4	AB
Control Fallow		21	A	5.4	AB	6.4	AB
Wheat		21	A	4.8	B	5.6	B
Wheat and Vapam	50	22	A	5.6	AB	6.3	AB

- a. Counts of live plants were taken on 3 April.  
 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 12 April and 11 May .  
 c. Data are means of four replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Fishers's LSD.

**Table 2. Effect of Brassica Spp. on Root Knot Nematode Soil Populations and Root Damage Counts on "Stiletto" Peppers, Spring 2006, Tifton, GA**

Treatment	Application Rate (gal/A)	Root-knot <sup>a</sup> Juveniles Feb 14		Root-knot <sup>a</sup> Juveniles March 23		Root-knot <sup>a</sup> Juveniles June 14		Root Gall <sup>b</sup> Index (0 to 10) April 25		Root Gall <sup>b</sup> Index (0 to 10) June 12	
Radish		3	A <sup>c</sup>	0	B <sup>c</sup>	0	A <sup>c</sup>	0	A <sup>c</sup>	0	A <sup>c</sup>
Rapeseed		0	A	3	AB	0	A	0	A	0	A
Rutabaga		3	A	0	B	0	A	0.2	A	0	A
Mustard		3	A	0	B	0	A	0	A	0	A
Control Fallow		0	A	0	B	0	A	0	A	0	A
Wheat		0	A	8	A	0	A	0	A	0.3	A
Wheat and Vapam	50	0	A	3	AB	0	A	0	A	0	A

- a. Number of root-knot (*Meloidogyne incognita*) nematode juveniles based on 150 cm<sup>3</sup> of soil. Samples were taken on 14 February, 23 March, and 14 June.  
 b. Gall ratings were done on a scale of 0-10 with 0 = no galls on roots and 10 = dead plants. An average was taken of the gall ratings on 25 April and 12 June.  
 c. Data are means of four replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Fisher's LSD.

**Table 3. Effect of *Brassica* Spp. on Fungal Soil Populations (CFU/g soil) on "Stiletto" Pepper, Spring 2006, Tifton, GA**

Treatment	App. Rate (gal/A)	At Harvest <i>Brassica</i> 14 February				At Plant Pepper 28 April				Harvest Pepper 29 June			
		<i>Pythium</i> species		<i>Fusarium</i> species		<i>Pythium</i> species		<i>Fusarium</i> species		<i>Pythium</i> species		<i>Fusarium</i> species	
Radish		430	A <sup>c</sup>	0	A <sup>c</sup>	1100	A <sup>c</sup>	0	B <sup>c</sup>	4	A <sup>c</sup>	3660	A <sup>c</sup>
Rapeseed		425	A	0	A	840	A	1000	AB	0	A	4540	A
Rutabaga		420	A	0	A	1040	A	0	B	2	A	1400	A
Mustard		425	A	0	A	1520	A	0	B	0	A	1280	A
Control Fallow		420	A	2	A	880	A	0	B	3	A	1640	A
Wheat		415	A	1	A	1660	A	3000	A	3	A	1900	A
Wheat and Vapam	50	430	A	3	A	728	A	1000	AB	21	A	4400	A

- The at harvest of *Brassica* soil sample as taken on 14 February.
- The at plant Pepper soil sample was taken on 28 April.
- The at harvest Pepper soil sample was taken on 29 June.
- 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.

**Table 4. Effect of *Brassica* Spp. on Yield of "Stiletto" Pepper, Spring 2005, Tifton, GA**

Treatment	App. Rate (gal/A)	Marketable Fruit <sup>a</sup>				Cull Fruit <sup>b</sup>				Total Fruit <sup>c</sup>			
		Number		Weight (lbs)		Number		Weight (lbs)		Number		Weight (lbs)	
Radish		107	A <sup>d</sup>	25.5	A <sup>d</sup>	7	A <sup>d</sup>	1.4	A <sup>d</sup>	113	A <sup>d</sup>	26.8	A <sup>d</sup>
Rapeseed		86	A	14.4	B	7	A	1.4	A	93	A	15.8	B
Rutabaga		99	A	17.6	AB	7	A	1.4	A	106	A	18.9	AB
Mustard		73	A	12.6	B	7	A	1.4	A	80	A	14.0	B
Control Fallow		91	A	14.7	AB	6	A	0.8	A	96	A	15.6	B
Wheat		86	A	15.4	AB	3	A	0.9	A	89	A	16.3	AB
Wheat and Vapam	50	91	A	15.6	AB	6	A	1.2	A	97	A	16.8	AB

- The fruit from each individual plot that was considered to be marketable and showed no symptoms of disease were separated, counted and weighed on 17 and 25 May and 2 and 9 June.
- The fruit from each individual plot that was considered to be non-marketable and diseased was separated, counted, and weighed on 17 and 25 May and 2 and 9 June.
- The number and weight of marketable and non-marketable fruit were totaled for each plot on 17 and 25 May and 2 and 9 June.
- Data are means of four replications. Means in the same column followed by the same letter are not different (P = 0.05) according to Fisher's LSD.