J. Agric. Sci. Mansoura Univ., 32 (10): 8219 - 8230, 2007

IMPACT OF CERTAIN ORGANIC SOIL AMENDMENTS AND CHEMICAL NEMATICIDES ON CONTROLLING *Meloidogyne incognita*

Mokbel, Asmaa A.

Department of Plant Pathology, Faculty of Agriculture, Alexandria University. Alexandria, Egypt.

ABSTRACT

The effects of water extracts of cattle, rabbit and pigeon manures and jatropha seed powder and the chemical nematicides Furadan 10G, Ragby 60% and Vydate L 24% on controlling *Meloidogyne incognita* were studied. *In vitro*, the tested organic matters and nematicides caused significant decrease of nematode activity after 4 and 7 days of exposure. Treatments with the tested nematicides caused 98.4-99.2% inhibition of egg-hatching. Treatment with water extract of pigeon manure caused 50.6%, followed by water extracts of cattle and rabbit manures and jatropha seed powder which showed 32.4-34.8% inhibition of egg-hatching. The effect of the previous organic matters and chemical nematicides each alone or the combination between them on controlling *M. incognita* on tomato plants cv. Marmande was evaluated. Treatment with the tested nematicides Furadan10G, Ragby 60% and Vydate L 24% resulted in great reductions (93.3-99.1%) in root galls and nematode egg-masses. Treatment with pigeon manure gave 65.3 and 67.5 % reductions in root galls and nematode egg-masses, respectively. The application of cattle and rabbit manures and jatropha seed powder resulted in 15.3-32.2% reduction in root galls and nematode egg-masses. Treatments with pigeon, rabbit manures and jatropha seed powder resulted in a significant increase in fresh and dry weights of shoot and root systems compared to other treatments. Treatment with each of the tested organic matters plus any of the tested nematicides caused 78.9-99.3% reduction in root galls and nematode egg-masses and caused a significant increase in fresh and dry weights of shoot and root systems compared to control (nematode treatment).

Keywords: Chemical nematicides**,** Furadan 10G, Ragby 60% and Vydate L 24%, Organic soil amendments, *Meloidogyne incognita*, egg-hatching, juveniles motility, tomato.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill) is one of the most important vegetable crops grown in Egypt. Root-knot nematodes (*Meloidogyne* spp.) are the most widespread nematode pests limiting tomato productivity in Egypt and other parts of the world. Most of the plants that accounted for the majority of human and animal food supply are susceptible to one or more of the root-knot nematode species (Taylor and Sasser, 1978). However, root-knot nematodes, especially, *M. incognita* and *M. javanica* are the most abundant and damaging nematodes on vegetable crops in Egypt (Ibrahim and Rezk, 1988).

The importance of soil organic matter has long been recognized by Egyptian farmers, and the process of incorporation of crop residues and animal manures into soil was a practice as old as agriculture it self (Korayem, 2003). Organic soil amendments were reported to possess nematicidal properties *in vitro* and *in vivo* (Ibrahim and Ibrahim, 2000 and Singh and Sitarmaiah, 1978). Water extracts of different plant materials and animal

manures were effective in reducing hatchability of root-knot nematode eggs and the juveniles motility (Abdel-Rahman and Saleh, 2006; Adegbite and Adesiyan, 2005; Alshalaby and Noweer, 2003; Koryem, 2003; Yousif and Badra, 1981). The study of Joymati *et al*. (1998) on the effect of some aqueous plant extracts on egg hatching and juveniles mortality of *M. incognita*, indicated that seed extract of *Melothria purpusilla* was the most inhibitory one followed by those of *Jatropha curcas* and *Lantana camara*. Waste materials of cattle, chicken, sheep, rabbit and pigeon manures have been used effectively to reduce root-knot nematodes population and significantly increased yield of eggplant and tomato (Amin, 1985; Hasabo and Noweer, 2005; Hendy *et al*., 1994; Maareg, 1984).

The use of chemical nematicides has been considered as an effective strategy for controlling plant parasitic nematodes throughout the world (Adegbite and Agbaje, 2007; Badawi and Abu-Gharbieh, 2000; Edwards, 1991; Hasabo and Noweer, 2005).

The objectives of the present study were: (1) to evaluate *in vitro* the effect of water extracts of some organic matters (cattle, rabbit and pigeon manures), jatropha seed powder and nematicides i.e. Furadan 10G, Ragby 60% and Vydate L 24% on egg-hatching and juveniles motility of *M. incognita*. (2) to study the effect of some organic matters and chemical nematicides on controlling *M. incognita* on tomato plants.(3) to study the effect of high dose of some organic matters with high and medium doses of each chemical nematicides on controlling *M. incognita* on tomato plants.

MATERIALS AND METODS

Nematode culture:

Meloidogyne incognita was originally isolated from infected tomato plants and identified according to the morphological features of prenieal patterns and the differential host tests (Hartman and Sasser, 1985). A single egg-mass culture was initiated and increased on tomato plants, *Lycopersicon esculentum* cv. Rutgers in the greenhouse. Whenever needed, egg inoculum was prepared by extracting eggs from 8-10 wk-old tomato roots with sodium hypochlorite NaOCl (Hussey and Barker, 1973). Some other egg-masses were subjected to 0.5 % sodium hypochlorite and the released eggs were collected for hatching test.

Organic matter preparation:

Three domestic animal manures (cattle, pigeon and rabbit) and Jatropha seed powder were air dried, homogenized and passed through 20-mesh sieve and then mixed thoroughly with the soil in pots as powder at the rate of 30 g/pot. Pots were irrigated daily up to field capacity for 7 days for the decomposition of the organic substances and then planted with two-wk old tomato seedlings.

Organic matter extracts preparation:

Three animal manures and Jatropha seed powder were prepared by keeping in aerated polyethylene bags at 30% humidity and 28°C temperatures for 15 days to ensure full decomposition of materials. Water extracts from each of the previous decomposed organic materials were prepared by soaking 250 g of each one in 500 ml water. After 15 minutes, the

infusions were well stirred and filtrated with Watman No.1 filter paper, the filtrates were considered as a standard stock solution (Korayem, 2003).

Nematicides preparation:

Carbofuran 10G (Furadan®-10%G) FMC chemical, FPRL Agrochemical Products Group, Philadelphia-PA 19103 (USA) was used at the rate of 5 & 2.5 g/pot for pot experiments and 0.5 g/100 ml for egg-hatching experiment. Ragby 60% (Cadusafos 60% L, Hatchel, United Kingdom) was used at the rate of 4 & 2 ml/L for pot experiments and 4ml/L for egg-hatching experiment. Oxamyl (Vydate L, DuPont Crop Protection, Wil-mington, DE; containing 0.24 Kg a.i/Liter) was used at the rate of 10 & 5ml/L for pot experiments, in addition to a single foliar spray three weeks after transplanting and 10 ml/L for egg-hatching experiment (Gugino *et al*., 2006).

***In vitro* experiment:**

Effect of water extracts of organic soil amendments and chemical nematicides on egg hatching and juveniles motility of *M. incognita*

The effects of water extracts of cattle, rabbit and pigeon manures, jatropha seed powder and nematicides Furadan 10G, Ragby 60% and Vydate L 24% were tested. About 380 eggs of *M. incognita* were transferred to 5 ml of standard stock solution of the previous organic matter extracts, and the mentioned rate of the previous nematicides in sterilized 5 mm Petri-dishes. Egg hatching and juveniles motility were examined by a compound microscope after incubation periods of 2, 4 and 7 days. Distilled water was served as a control, and each treatment was replicated three times.

***In vivo* experiments:**

Effect of high doses of organic soil amendments and chemical nematicides on controlling *M. incognita* on tomato plants

Clay pots of 15 cm diam. were filled with autoclaved sandy clay soil mixed with each of the previously mentioned organic matters with the rate of 30 g/pot. Two seedlings of tomato cv. Marmande two-wk-old were planted in each pot, one week later. Pots were inoculated with 2000 nematode eggs for each treatment. The nematicides Furadan 10G was used at the rate of 5g per pot, fifty ml per pot of Ragby 60% and Vydate L 24% were used with the rate of (4 ml/L. and 10 ml/L) respectively, at the same time of nematode inoculation.

Effect of high dose of organic soil amendments in combination with high dose of chemical nematicides on controlling *M. incognita* on tomato plants

Organic soil amendments at high dose 30 g per pot were mixed with autoclaved sandy clay soil in clay pots 15 cm diam., one week later two seedlings of tomato cv. Marmande two-wk old were planted. Pots were inoculated with 2000 nematode eggs for each treatment. The nematicides Furadan10G, Ragby 60% and Vydate L 24% were used at the same time of nematode inoculation at the rate of (5g per pot, 4 ml/L and 10 ml/L), respectively.

Effect of high dose of organic soil amendments in combination with medium dose of chemical nematicides on controlling *M. incognita* on tomato plants

The organic matter (cattle, rabbit and pigeon manures and jatropha seed powder) were used at the rate of 30 g per pot. Pots were inoculated with 2000 nematode eggs for each treatment. The nematicides Furadan 10G, Ragby 60% and Vydate L 24% were used at the rate of (2.5g/pot, 2 ml/L and 5 ml/L) respectively, at the same time of nematode inoculation. Untreated pots were served as control. Each treatment was replicated five times. All pots were arranged in a greenhouse at 27±2 °C, in a randomized complete block design.

Each experiment was terminated 60 days after nematode inoculation. Plants were gently removed from pots and roots were washed with a gently stream of tap water. Number of root galls and nematode egg-masses per plant, and fresh and dry weights of shoot and root systems were determined.

Soil of each infected plant per pot was mixed thoroughly and 250 cc soil were used to extract juveniles of *M. incognita* using a modified sieving and centrifugal technique (Ayoub, 1980). Nematode juveniles in each sample were counted under a compound microscope using Peter's 1ml counting slide.

Data statistical analysis

Data obtained statistically analyzed according to SAS software program (SAS Institute, 1997).

RESULTS

Effects of water extracts of organic soil amendments and certain chemical nematicides on egg hatching and juveniles motility of *M. incognita*

The effects of water extracts of cattle, rabbit and pigeon manures and jatropha seed powder and nematicides Furadan 10G, Ragby 60% and Vydate L 24% were tested on egg hatching and juveniles motility. Data of Table 1 showed that the different treatments after 2, 4 and 7 days caused significant decrease in nematode activity compared with distilled water. Nematicides treatments led to the highest significant inhibition of egg-hatching (98.4-99.2%), followed by treatment with pigeon water extract which caused 50.6% in egg-hatching. Treatments with water extracts of cattle, rabbit manure and jatropha seed powder showed the least values which ranged from 32.4-34.8% inhibition of egg-hatching.

Effect of high doses of organic soil amendments and certain chemical nematicides on controlling *M. incognita* on tomato plants

Treatments with different soil amendments and nematicides differed in their influence on the numbers of root galls and nematode egg-masses developed on tomato plants in comparison with control treatment. Treatments with Furadan 10G, Ragby 60% and Vydate L 24% showed great reduction (93.9-99.1%) in numbers of root galls and nematode egg-masses, followed by Pigeon manure which gave 65.3 and 67.5 % reductions in numbers of root galls and nematode egg-masses, respectively. Treatment with cattle, rabbit

manures and jatropha seed powder caused the least rates of (15.3-32.2%) reduction in numbers of root galls and nematode egg-masses. Treatment with Furadan 10G, Ragby 60% and Vydate L 24% caused the highest rates of (92.9-97.8%) reduction in numbers of juveniles per 250 cc soil, followed by Pigeon manures treatment which led to 78.9% reductions. Treatments with cattle, rabbit manures and jatropha seed powder showed the least rates of (22.8-44.4%) reduction in numbers of juveniles per 250 cc soil (Table 2).

Table 1. Effect of water extracts of organic soil amendments and certain chemical nematicides on egg-hatching and juveniles motility of *M. incognita*

Treatment	Number of active juveniles after different exposure times (days) [x]			Number of hatched juveniles after 7 days exposure	Relative [y] hatching %	Hatching [z] inhibition %
	2	4	7			
Cattle manure +N	47 b	119 b	88 bc	254	66.8	33.2
Jatropha seed powder +N	37 b	98 bc	113 b	248	65.2	34.8
Rabbit manure +N	49 b	135 b	73 bc	257	67.6	32.4
Pigeon manure +N	19 b	99 bc	75 bc	188	49.4	50.6
Furadan 10G +N	4 cd	2 d	0 d	6	1.6	98.4
Ragby 60% +N	2 cd	2 d	0 d	4	1.1	98.9
Vydate L 24% +N	2 d	1 d	0 d	3	0.8	99.2
Distilled water +N	234 a	340 a	380 a	380	100	-

[x] Number of active juveniles was transformed to angular transformation before statistical analysis.
[y] Relative hatching % = No. of hatched juveniles in each treatment / No. of hatched juveniles in water × 100
[z] Hatching inhibition % = 100 – Relative hatch (%)
N=380 eggs of *M. incognita*. Data are averages of 3 replicates.
Values in columns followed by the same letter(s) are not significantly different at *P* = 0.05.

Table 2. Effect of high doses of organic soil amendments and certain chemical nematicides on *M. incognita* infected tomato plants

Treatment	Number of galls/ plant	Redaction%	Number of egg masses/ plant	Redaction%	Number of juveniles/ 250 cc soil	Redaction %
M. incognita (control) N	699 a	-	570 a	-	610 a	-
Cattle manure +N	585 a	*16.3*	482.8 ab	*15.3*	470.8 ab	*22.8*
Jatropha seed powder +N	501.4 b	*28.3*	456.2 bc	*19.9*	358 b	*41.3*
Rabbit manure +N	474.2 b	*32.2*	398.4 c	*30.1*	338.8 b	*44.4*
Pigeon manure +N	241.4 c	*65.3*	185 d	*67.5*	128.8 c	*78.9*
Furadan 10G 5g/pot +N	22.4 d	*96.8*	5.2 e	*99.1*	16.4 d	*97.3*
Ragby 60% 4ml/l +N	42.2 d	*93.9*	27.4 e	*95.2*	43.6 d	*92.9*
VydateL 24% 10ml/l +N	25.6 d	*96.3*	19 e	*96.7*	13.6 d	*97.8*

N=2000 eggs of *M. incognita*. Data are averages of 5 replicates.
Values within a columns followed by the same letter(s) are not significantly different at *P* = 0.05.

Data in Table (3) indicated that treatments with pigeon, rabbit manures and jatropha seed powder caused a significant increase in fresh and dry weights of shoot and root systems in comparison with other treatments. Treatment with cattle manure and nematicides Furadan 10G, Ragby 60% and

Vydate L 24% caused no significantly differences in fresh and dry weights of shoot and root systems compared to that of control treatment (N alone).

Table 3. Effect of high doses of organic soil amendments and certain chemical nematicides on the growth parameters of tomato plants infected with *M. incognita*

Treatment	Fresh weight (g)		Dry weight (g)	
	Shoot	Root	Shoot	Root
M. incognita (control) N	14.5 c	13.0 c	2.1 c	1.9 c
Cattle manure +N	19.9 bc	15.5 bc	2.3 c	1.8 c
Jatropha seed powder +N	36.2 a	21.7 a	5.3 a	4.4 a
Rabbit manure +N	36.7 a	22.3 a	5.1 a	4.2 a
Pigeon manure +N	38.9 a	25.3 a	6.9 a	4.5 a
Furadan 10G 5g/pot +N	17.3 bc	14.8 bc	3.1 bc	2.6 bc
Ragby 60% 4ml/l +N	18.9 bc	15.5 bc	2.9 bc	2. 4 bc
VydateL 24% 10ml/l +N	19.8 bc	13.9 bc	2.8 bc	2.5 bc

N=2000 eggs of *M. incognita*. Data are averages of 5 replicates.
Values within a columns followed by the same letter(s) are not significantly different at *P* = 0.05.

Effect of high dose of organic soil amendments in combination with high dose of certain chemical nematicides on controlling *M. incognita* on tomato plants

Data in Table (4) showed that the organic matters were used at the rate of 30 g per pot, the nematicides Furadan 10G, Ragby 60% and Vydate L 24% were used at the rate of 5g per pot, 4 ml/L and 10 ml/L, respectively. Treatment with high dose of cattle, rabbit and pigeon manures and jatropha seed powder, each one in combination with high dose of Furadan 10G, Ragby 60% and Vydate L 24% caused great significant reductions (90.6-98.3%) in numbers of nematode root galls, (93.5-99.3%) in nematode egg-masses and (78.9-94.1%) in numbers of juveniles per 250 cc soil in comparison with control treatment (N alone).

Table 4. Effect of high dose of organic soil amendments in combination with high dose of certain chemical nematicides on *M. incognita* infected tomato plants

Treatment	Number of galls/ plant	Redaction %	Number of egg masses/ plant	Redaction %	Number of juveniles/250 cc soil	Redaction %
***M .incognita* (control) N**	750.8 **a**	**-**	628.0 **a**	**-**	360.0 **a**	**-**
N+ C.M.+Fur.10G 5g/pot	34.3 **bc**	***95.4***	22.6 **b**	***96.7***	21.4 **cd**	***94.1***
N+ C.M. + Rag. 60% 4ml/l	26.2 **bc**	***96.5***	17.2 **b**	***97.5***	31.0 **bc**	***91.4***
N+ C.M. + Vyd. L 24% 10 ml/l	12.6 **cd**	***98.3***	5 **b**	***99.3***	33.0 **bc**	***90.8***
N+ J.S.P.+Fur.10G 5g/pot	36.4 **bc**	***95.2***	25.2 **b**	***96.3***	24.0 **cd**	***93.3***
N+ J.S.P. + Rag. 60% 4 ml/l	32.2 **bc**	***95.7***	18.0 **b**	***97.4***	25.0 **cd**	***96.1***
N+ J.S.P.+Vyd.L 24% 10 ml/l	23.4 **cd**	***96.9***	11.6 **b**	***98.3***	57.0 **bc**	***84.2***
N+ R.M. +Fur.10G 5g/pot	18.8 **cd**	***97.5***	7.8 **b**	***98.9***	27.0 **cd**	***92.5***
N+ R.M. + Rag. 60% 4ml/l	55.6 **bc**	***92.6***	44.4 **b**	***93.5***	76.0 **b**	***78.9***
N+ R.M. +Vyd. L 24% 10ml/l	31.8 **bc**	***95.8***	22.8 **b**	***96.7***	63.0 **bc**	***82.5***
N+ P.M. +Fur.10G2. 5g/pot	26 **bc**	***96.5***	16.8 **b**	***97.5***	47.0 **bc**	***86.9***
N+ P.M. + Rag. 60% 4ml/l	28.4 **bc**	***96.2***	19.8 **b**	***97.1***	15.0 **cd**	***95.8***
N+ P.M. + Vyd. L 24% 10ml/l	70.8 **b**	***90.6***	42.2 **b**	***93.8***	16.6 **cd**	***95.4***

N=2000 eggs of *M. incognita* Data are averages of 5 replicates.
Values within a columns followed by the same letter (s) are not significantly different at *P* = 0.05.
Cattle manure (C.M.), Jatropha Seed Powder (J.S.P.), Rabbit manure (R.M.), Pigeon manure (P.M.)

Data in Table (5) showed that the previous treatments caused a significant increase in fresh and dry weights of shoot and root systems in comparison with control treatment (N alone).

Table 5: Effect of high dose of organic soil amendments in combination with high dose of certain chemical nematicides on the growth parameters of tomato plants infected with *M. incognita*

Treatment	Fresh weight (g)		Dry weight (g)	
	Shoot	Root	Shoot	Root
M .incognita (control) N	10.4 d	8.4 d	1.5 c	0.9 c
N+ C.M.+Fur.10G 5g/pot	32.1 b	19.2 ab	4.6 b	3.1 ab
N+ C.M. + Rag. 60% 4ml/l	30.2 b	13.6 ab	4.8 b	2.8 be
N+ C.M. + Vyd. L 24% 10 ml/l	39.4 b	19.4 ab	6.6 a	3.8 ab
N+ J.S.P.+Fur.10G 5g/pot	48.4 a	23.7 a	10.7 a	4.9 a
N+ J.S.P. + Rag. 60% 4 ml/l	30.3 b	19.2 ab	4.5 b	3.7 ab
N+ J.S.P.+Vyd.L 24% 10 ml/l	31.8 b	18.6 ab	5.1 ab	3.8 ab
N+ R.M. +Fur.10G 5g/pot	24.4 bc	14.3 bc	3.5 b	3.0 ab
N+ R.M. + Rag. 60% 4ml/l	20.1 c	12.8 bc	3.1 b	2.9 b
N+ R.M. +Vyd. L 24% 10ml/l	30.0 b	16.4 b	5.1 ab	3.1 ab
N+ P.M. +Fur.10G2. 5g/pot	36.6 ab	16.9 b	6.1 a	4.0 ab
N+ P.M. + Rag. 60% 4ml/l	31.0 b	17.0 b	5.8 ab	3.3 ab
N+ P.M. + Vyd. L 24% 10ml/l	31.4 b	16.7 b	5.4 ab	3.4 ab

Data are averages of 5 replicates.
Values within a columns followed by the same letter (s) are not significantly different at *P* = 0.05.
Cattle manure (C.M.), Jatropha Seed Powder (J.S.P.), Rabbit manure (R.M.), Pigeon manure (P.M.)

Effect of high dose of organic soil amendments and medium dose of chemical nematicides on controlling *M. incognita* on tomato plants

Data in Table (6) showed that the organic matters were used at the rate of 30 g/pot. The nematicides Furadan 10G, Ragby 60% and Vydate L 24% were used at the rate of 2.5g/pot, 2 ml/L and 5 ml/L, respectively.

Table 6. Effect of high dose of organic soil amendments and medium dose of certain chemical nematicides on controlling *M. incognita* on tomato plants

Treatment	Number of galls/ plant	Redaction %	Number of egg masses/ plant	Redaction %	Number of juveniles/250 cc soil	Redaction %
M .incognita (control) + N	565 **a**	-	543 **a**	-	358 **a**	-
N + C.M. +Fur.10G 2. 5g/pot	237.6 **b**	***57.9***	219 **b**	***59.7***	185.6 **b**	***48.2***
N + C.M. + Rag. 60% 2ml/l	225 **b**	***60.1***	209 **b**	***61.5***	191.2 **b**	***46.6***
N + C.M. + Vyd. L 24% 5 ml/l	243 **b**	***56.9***	231 **b**	***57.5***	196.8 **b**	***45***
N + J.S.P.+Fur.10G 2.5g/pot	229 **b**	***59.5***	222 **b**	***59.1***	198 **b**	***44.7***
N + J.S.P. + Rag. 60% 2 ml/l	226 **b**	***60***	218.6 **b**	***59.8***	190.8 **b**	***46.7***
N + J.S.P. +Vyd.L 24%5 ml/l	230.6 **b**	***59.2***	228.2 **b**	***57.9***	180.6 **b**	***49.5***
N + R.M. +Fur.10G 2.5g/pot	227.8 **b**	***59.7***	219.2 **b**	***59.6***	200.6 **b**	***44***
N + R.M. + Rag. 60% 2ml/l	228.6 **b**	***59.6***	214.2 **b**	***60.5***	199.2 **b**	***44.3***
N + R.M. +Vyd. L 24% 5ml/l	232.2 **b**	***58.9***	223.6 **b**	***58.8***	206.6 **b**	***42.3***
N + P.M. +Fur.10G 2. 5g/pot	169.8 **c**	***69.9***	152.2 **c**	***71.9***	168.6 **bc**	***52.9***
N + P.M. + Rag. 60% 2ml/l	181.2 **c**	***67.9***	173.6 **c**	***68***	172.2 **b**	***51.9***
N + P.M. + Vyd. L 24% 5ml/l	160.6 **c**	***71.6***	152.4 **c**	***71.9***	181.4 **b**	***49.3***

N=2000 eggs of *M. incognita*. **Data are averages of 5 replicates.**
Values within a columns followed by the same letter (s) are not significantly different at *P* = 0.05.
Cattle manure (C.M.), Jatropha Seed Powder (J.S.P.), Rabbit manure (R.M.), Pigeon manure (P.M.)

Among all the treatments combination between high dose of pigeon manure and medium dose of chemical nematicides resulted in significant reductions (67.9-71.6%) in numbers of nematode root galls, (68-71.9%) in numbers nematode egg-masses and (49.3-52.9%) in numbers juveniles per 250 cc soil in comparison with control treatment (N alone). The other treatments of cattle and rabbit manures and jatropha seed powder in combination with medium dose of nematicides behaved quite similarly but with lower rates caused (56.9-60.1%), (57.5-60.5%) and (42.3-49.5%) reductions in numbers of nematode root galls, egg-masses and juveniles per 250 cc soil, respectively in comparison with control treatment (N alone). Data in Table (7) showed that the previous treatments caused a significant increase in fresh and dry weights of shoot and root systems in comparison with control treatment (N alone).

Table 7. Effect of high dose of organic soil amendments in combination with medium dose of certain chemical nematicides on the growth parameters of tomato plants infected with *M. incognita*

Treatment	Fresh weight (g)		Dry weight (g)	
	Shoot	Root	Shoot	Root
M .incognita (control) + N	11.8 c	9.7 c	2.9 c	2.1 b
N + C.M. +Fur.10G 2. 5g/pot	19.4 b	14.5 b	4.8 a	3.8 a
N + C.M. + Rag. 60% 2ml/l	19.7 b	15.6 b	4.3 ab	3.6 a
N + C.M. + Vyd. L 24% 5 ml/l	18.1 b	16.1 b	4.7 ab	3.2 a
N + J.S.P.+Fur.10G 2.5g/pot	20.3 b	15.7 b	5.1 a	3.7 a
N + J.S.P. + Rag. 60% 2 ml/l	21 b	14.7 b	4.9 a	3.9 a
N + J.S.P. +Vyd.L 24%5 ml/l	21.2 b	16.3 b	4.8 a	4.1 a
N + R.M. +Fur.10G 2.5g/pot	19.9 b	15.1 b	5.3 a	4.3 a
N + R.M. + Rag. 60% 2ml/l	19.3 b	15.9 b	4.6 a	4. 2 a
N + R.M. +Vyd. L 24% 5ml/l	20.4 b	16.9 ab	4.4 ab	4.7 a
N + P.M. +Fur.10G 2. 5g/pot	27.5 a	19.2 a	5.6 a	3.9 a
N + P.M. + Rag. 60% 2ml/l	28.6 a	19.5 a	6.4 a	4.2 a
N + P.M. + Vyd. L 24% 5ml/l	24.6 a	18.8 a	5.5 a	3.8 a

Data are averages of 5 replicates.
Values within a columns followed by the same letter(s) are not significantly different at *P*= 0.05.
Cattle manure (C.M.), Jatropha Seed Powder (J.S.P.), Rabbit manure (R.M.), Pigeon manure (P.M.)

DISCUSSION

The present study showed that treatments with water extract of the tested organic matters and nematicides significantly reduced egg-hatching and juveniles activity of *M. incognita.* These findings are in agreement with those of other workers (Abdel-Rahman and Saleh, 2006; Alshalaby and Noweer, 2003; Koryem, 2003 and Joymati *et al*., 1998). The action of soil microorganisms on an organic material during the decomposition process can produce a wide range of chemicals like ammonia, nitrites, hydrogen sulphide, organic acids and enzymes. These chemicals are known to possess nematicidal properties that affect egg hatch and /or juveniles motility of plant parasitic nematodes (Stirling, 1991 and Zasada, 2006).

Application of Furadan 10G, Ragby 60% and Vydate L 24% resulted in great reduction in numbers of nematode root galls and egg-masses. Also,

treatments with these nematicides caused a significant increase in dry weight of shoot and root systems, in compared with other treatments. These results are in line with those of other worker (Huange *et al*., 1983; Badawi and Abu-Gharbieh, 2000). Gugino *et al*., (2006) reported that oxamyl (Vydate L 24%) was effective in reducing root-galling severity in commercial carrot fields, and increased carrot yield. Adegbite and Agbaje (2007) reported that the application of Furadan (carbofuran) resulted in an increase in the yield of the yam varieties and suppressive *M. incognita* multiplications on yam varieties. Also, Edwards (1991) reported that the application of carbofuran and fenamiphos reduced the multiplications of *M. javanica* and *Tylenchulus semipenetrans* on grapevine and gave a significant yield increases.

The tested organic matter had direct and indirect effects on both nematode and tomato plants, as they reduced nematode reproduction and increased plant growth. Different authors e.g. (Alam *et al*., 1980and Alam, 1992) suggested that the application of organic matter remarkably reduce nematode population in soil. Application of organic matter in the soil may release ammonia (NH_3) during the decomposition of organic matter which reduced the population of plant parasitic nematodes (Alam, 1992). Also, certain nema-toxic compounds or volatile organic acids may be released which kill nematodes and create conditions favorable for growth and reproduction of natural enemies of nematodes already present in the soil (Badra *et al*., 1979; and Zasada, 2006), and / or increase the plant resistance (Alam *et al*., 1980).

Treatment with pigeon manure gave a great reduction in root galls, nematode egg-masses and number of juveniles per 250 cc soil and significantly increased plant growth. These data are in agreement with those of other workers (Amin, 1985; Ibrahim and Ibrahim, 2000; Maareg, 1984; Al-Ghnam, 2006 and Salam, 2006). The improvement in plant growth following the use of organic soil amendments may be due to the nematode suppression and / or the effect of these amendments as organic manures, especially those with high nitrogen contents (Abadir *et al*., 1996 and Zasada, 2006).

Results of pot experiments showed that high doses of Furadan 10G, Ragby 60% and Vydate L 24% were most effective in reducing nematode activity and reproduction. Although combination between organic matter, specially pigeon manure, and high doses of nematicides resulted in a great reduction in nematode parameters and improved the growth of tomato plants. However, the combination between organic matter and the medium dose of the applied nematicides gave intermediate effects on the nematode parameters and showed considerable improvement on plant growth. These findings are in agreement with the work of Hendy *et al*., (1994), Maareg *et al*., (1999) and (2000); and Badawi and Abu-Gharbieh (2000).

More research in this respect is needed before recommendation can be made for applying these treatments in IPM programmer for controlling certain plant parasitic nematodes on such economic crops.

REFERENCES

Abadir, S. K.; Ismail, A. E. and Kheir, A. M. 1996. Efficacy of soil amendment with plant wastes in the control of *Meloidogyne incognita* on sunflower. Pak. J. Nematol., 14: 95-100.

Abdel-Rahman, F. and Saleh, M. A. 2006. Nematicidal activity of phytochemicals from some arid land plants. J. Nematol., 38: 258(Abstr.).

Adegbite, A. A. and Adesiyan, S. O. 2005. Root extracts of plants to control root-knot nematodes on Edible soybean. World J.Agric. Sci.,1(1):18-21.

Adegbite, A. A. and Agbaje, G. O. 2007. Efficacy of Furadan (carbofuran) in control of root-knot nematodes (*Meloidogyne incognita*) race 2 in hybrid yam varieties in south-western Nigeria. World J. Agric. Sci., 3: 256-262.

Alam,M.M.1992.Effect of ammonia on the population of plant parasitic nematodes and growth of some vegetables.Pak.J.Nematol.,10:133-137.

Alam, M. M.; Ahmed, M. and Khan, A. M. 1980. Effect of organic amendments on the growth and chemical composition of tomato, eggplant and chilli and their susceptibility to attack by *Meloidogyne incognita*. Plant and Soil, 57: 231-236.

Alshalaby, Mona E. M. and Noweer, E. M. A. 2003. Effect of five plant extracts on the reproduction of root-knot nematode (*Meloidogyne incognita*) infested peanut under field condition. J. Agric. Sci., Mansoura Univ., 28: 7447-7454.

Amin, W. A. 1985. Factors affecting nematicides efficiency on controlling nematodes. M.Sc. Thesis, Fac. Agric., Cairo Univ. 87 pp.

Ayoub, S. M. 1980. Plant nematology, an agriculture training aid. Nema. Aid. Publications, Sacramento, California. USA, 195pp.

Badawi, S. M. and Abu-Gharbieh, W. I. 2000. Efficacy of certain non-fumigant nematicides for the control of *Meloidogyne javanica* on tomato. Pak. J. Nematol., 18: 59-68.

Badra, T.; Saleh, M. B and Oteifa, B. A. 1979. Nematicidal activity and decomposition of some organic fertilizers and amendments. Revue Nematol., 2: 29-36.

Edwards, M. 1991. Control of plant parasitic nematodes in sultana grapevines (*Vitis vinifera*) using nematicides. Australian J. Experimental. Agric., 3: 579-584.

Gugino, B. K.; Abawi, G. S. and Ludwig, J. W. 2006. Damage and management of *Meloidogyne hapla* using oxamyl on carrot in New Yourk. J. Nematol., 3: 483-490.

Hartman, K. M. and Sasser, J. N. 1985. Identification of *Meloidogyne* species on the basis of differential host test and perineal pattern morphology. In: Advanced Treatise on *Meloidogyne.* Vol. II. Methodology. Barker, K.R., Carter, C.C. and Sasser, J.N. (Eds). Raleigh, NC: North Carolina State Univ. Graph.

Hasabo, Susan A. and Noweer, E. M. A. 2005. Management of root-knot nematodes on eggplant with some plant extracts. Egypt. J. Phytopathol., 33: 65-72.

Hendy, H. H.; El-Nagar, H. I.; Osman, A. A. and Farahat, A. A. 1994. The role of biological agents in regulating plant parasitic nematodes infecting tomato plants. Egypt. J. Appl. Sci., 9: 316-327.

Huange, S. P.; Reseude, I. C.; De Souza, P.E. and Campos, V. P. 1983. Effect of Aldicarb, Ethoprop and Carbofuran on control of coffee root-knot nematode, *Meloidogyne exigua*. J. Nematol., 15: 510-514.

Hussey, R. S. and Barker, K. R. 1973. Acomparison of methods of collecting inocula of *Meloidogyne* spp., including a new technique. Plant Dis. Reptr., 57: 1025-1028.

Ibrahim, A. A. M. and Ibrahim, I. K. A. 2000. Evaluation of non-chemical treatments in the control of *Meloidogyne incognita* on common bean. Pak. J. Nematol., 18:51-57.

Ibrahim, I. K. A. and Rezk, M. A. 1988. The root-knot nematode – A major problem in crop production in Egypt. In: Advances in Plant Nematology. Maqbool, M.A. Golden, A.M., Ghaffar, A. and Krusberg, L.R. (eds.) NNRC, Univ. Karachi, Pakistan.

Joymati, L.; Dhanachand, C. and Devi, L. S. 1998. Effect of plant extracts on *Meloidogyne incognita*. Indian J. Nematol., 28: 225-230.

Korayem, A. M. 2003. Effect of some organic wastes on *Meloidogyne incognita* development and tomato tolerance to the nematode. Egypt. J. Phytopathol., 31: 119-127.

Maareg, M. F. 1984. The role of organic amendments on controlling nematode. Ph.D Thesis Fac. Agric.; Menoufia Univ., 188 pp.

Maareg, M. F.; Badr, Sohir, T. and Allam, A. I. 1999. Controlling of root-knot nematodes *Meloidogyne incognita* using organic soil amendments, nematicides and their mixtures in sugar beet. Egypt. J. Agronematol., 3: 75-94.

Maareg, M. F.; Salem, F. M. and Ebieda, A. M. 2000. Effect of certain organic and inorganic soil amendments on *Meloidogyne javanica* in sandy soil. Egypt. J. Agronematol., 4: 83-94.

SAS Institute. 1997. SAS software Rel.6.12, SAS Inst., Cary, NC. USA

Singh, R. S. and Sitarmaiah, R. 1978. Effect of organic amendments on phenolic content of soil and plant response of *Meloidogyne javanica* and its host to related compounds. Plant and Soil, 5: 671-679.

Stirling, G. R. 1991. Biological control of parasitic nematodes: Progress, problem and prospects.CAB International,Wallingford,Oxon UK.282 pp.

Taylor, A. L. and Sasser, J. N. 1978. Biology, identification and control of root-knot nematodes (*Meloidogyne* species) Raleigh, NC, North Carolina State Univ. Graph.

Yousif, G. W. and Badra, T. 1981. Effect of some organic and inorganic amendments on hatching, infectivity and development of *Meloidogyne javanica*. J. Nematol., 11: 159-164.

Zasada, I. A. 2006. Understanding how soil conditions affect the ability of organic amendment to suppress plant parasitic nematodes. J. Nematol., 38: 303(Abstr.).

Al-Ghnam, Heba, A. A. 2006. Studies on controlling citrus nematode, Tylenchulus semipenetrans by various biological Methodes: M. Sc. Thesis, Fac. Of Agric., Mansoura Univ., 134 pp.

Salem, Hager, M. M. 2006. Studies on root-knot nematodes *Meloidogyne* spp. parasitizing certain solaneceae plants with reference to biological control: M. Sc. Thesis, Fac. Of Agric.,Mansoura Univ.,139pp.

تـأثير بعض المخلفـات العضـوية والمبيـدات النيماتوديـة علـى مقاومـة نيمـاتودا تعقد الجذور *Meloidogyne incognita*

أسماء عبد الحميد مقبل
قسم أمراض النبات –كلية الزراعة –جامعة الاسكندرية

تم دراسة تأثير بعض الأسمدة العضوية للماشية والأرانب والحمام وكذلك مسحوق نبات الجاتروفا بنسبة (3%) و بعض المبيدات النيماتودية مثل الفيوردان 10 ج ، الراجبي 60% والفايدت ل 24% بمعدل (5جم / اصيص ، 4مل/لتر ، 10مل/لتر) على التوالي على نيماتودا تعقد الجذور *M. incognita* التي تصيب نباتات الطماطم في أربعة تجارب منفصلة.

في دراسة معملية تم قياس تأثير المستخلصات المائية لكلاً من الاسمدة العضوية ومسحوق بذور نبات الجاتروفا وكذلك المبيدات النيماتودية على فقس البيض وحيوية اليرقات لنيماتودا تعقد الجذور بعد فترات تعرض مختلفة (2 ، 4 ، 7 ايام) . حيث وجد ان استخدام المستخلصات المائية للاسمدة العضوية و المبيدات النيماتودية ادت الي حدوث خفض معنوي في حيوية اليرقات بعد 4 ، 7 ايام من التعرض .
استخدام المبيدات النيماتودية ادى الى نسبة تثبيط لفقس البيض (99.2 – 98.4%) تلاها استخدام المستخلص المائي لسماد الحمام الذي اعطى 50.6% نسبة تثبيط لفقس البيض . وكان استخدام المستخلصات المائية لباقي المواد العضوية المستخدمة قد ادى الى (32.4 – 34.8%) نسبة تثبيط لفقس بيض نيماتودا تعقد الجذور مقارنة بالمعاملة بالماء المقطر .

في تجارب الأصص أدى استخدام المبيدات النيماتودية إلي حدوث أعلى نسبة خفض في اعداد العقد الجذرية واكياس بيض النيماتودا (93.9 – 99.1%) وكذلك حدوث اعلى نسبة خفض (92.9 – 97.8%) لاعداد يرقات الطور الثاني الموجودة في كل 250جم تربة تلاها استخدام سماد الحمام العضوي الذي نتج عنه 65.3 ، 76.5 ، 78.9% نسبة خفض في كلاً من اعداد العقد الجذرية واكياس البيض واعداد يرقات الطور اليرقي الثاني لكل 250جم تربة على التوالي . استخدام كلا من سماد الماشية و الأرانب وكذلك مسحوق بذور نبات الجاتروفا ادي الي حدوث (15.3 – 32.2%) خفض في اعداد العقد الجذرية واكياس البيض و 22.8% و 44.4% علي التوالي خفض في اعداد يرقات الطور اليرقي الثاني لنيماتودا تعقد الجذور لكل 250جم تربة. و كان استخدام الأسمدة العضوية لكل من الحمام والأرانب و مسحوق بذور نبات الجاتروفا والمبيدات النيماتودية ادي الي حدوث زيادة معنوية في الوزن الرطب والجاف لكل من المجموع الخضري والمجموع الجذري مقارنة بالمعاملات الاخرى .

في تجربة اخرى تم دراسة استخدام مخلوط لكل من الأسمدة العضوية للماشية والارانب والحمام ومسحوق بذور نبات الجاتروفا مع واحد من المبيدات النيماتودية المستخدمة لمقاومة نيماتودا تعقد الجذور مثل الفيوردان 10 ج ، الراجبي 60% والفايدت ل 24% بجرعة مرتفعة (5جم / أصيص ، 4مل/لتر ، 10مل/لتر) على نباتات الطماطم. حيث ادت كل المعاملات الي حدوث (78.9 – 99.3%) خفض في اعداد العقد الجذرية واكياس البيض واعداد يرقات الطور اليرقي الثاني لكل 250جم تربة . وكذلك نتج عن كل المعاملات زيادة معنوية في الوزن الجاف والرطب لكل من المجموع الجذري والخضري على السواء مقارنة بالمعاملة بالنيماتودا فقط .

في تجربة اخرى تم دراسة استخدام مخلوط لكل من الأسمدة العضوية للماشية والارانب والحمام ومسحوق بذور نبات الجاتروفا مع أحد المبيدات النيماتودية المستخدمة لمقاومة نيماتودا تعقد الجذور وهي الفيوردان 10 ج ، الراجبي 60% والفايدت ل 24% بجرعة متوسطة (2.5جم / أصيص ، 2مل/لتر ، 5مل/لتر) على نباتات الطماطم حيث ادت كل المعاملات الي حدوث (42.3– 71.9%) خفض في اعداد العقد الجذرية واكياس البيض واعداد يرقات الطور اليرقي الثاني لكل 250جم تربة . وكذلك ادت كل المعاملات الي حدوث زيادة معنوية في الوزن الجاف والرطب لكل من المجموع الجذري والخضري على السواء مقارنة بالمعاملة بالنيماتودا فقط .