Egypt. J. Phytopathol., Vol. 35, No. 1, pp. 13-24 (2007)

Control of the Root–Knot Nematode *Meloidogyne incognita* on Sunflower Plants with Certain Organic Plant Materials and Biocontrol Agents

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The efficacy of soil amendments with certain organic plant materials and biocontrol agents on controlling *Meloidogyne incognita* on sunflower plants was studied. Treatment with garlic cloves caused 89.9-93.8% reduction in root galls and nematode egg masses, while treatments with the marine algae *Botryocladia cabillaceae* and cabbage leaves gave 76.3-86.6% reduction in galls and nematode egg masses. Treatments with sesame and flax seed cakes resulted in 90.1-94.5% reduction in root galls and nematode egg masses, followed by treatment with cotton seed cake which caused 84.9-86.9% reduction in galls and nematode egg masses. Treatments with termis and fenugreek seed powders showed high reduction (92.2-98.6%) in root galls and nematode egg masses. Treatments of acacia seed powder and camphor dried leaves induced 54.6-66.3% reduction in root galls and nematode egg masses. Treatments of sesame, neem, wormwood, demssisa, rosemary and asparagus plant materials caused 90.9-98.3% reduction in numbers of root galls and nematode egg masses. On the other hand, treatment with coleus plant materials resulted in 75.3-76% reduction in numbers of root galls and nematode egg masses. Treatment with Furadan-10G induced high reduction (99.4%) in numbers of root galls and nematode egg masses. Treatment with Sincocin-AG caused 65.4-72.8% reduction in numbers of root galls and nematode egg masses, followed by Kapronite treatment with 60.6-66.5% reduction in number of root galls and nematode egg masses. Treatments of Agri-50 and Agerin resulted in 38.7-61.1% reduction in numbers of root galls and nematode egg masses.

Keywords: biocontrol, *Meloidogyne incognita*, organic plant materials, root knot and sunflower

The root-knot nematodes (*Meloidogyne* spp.) attacked sunflower plants causing a great damage to the infected plants. The nematode damage can be overcome by using soil amendments of dried marine algae *B. cabillaceae*, cabbage leaves, smashed garlic cloves, dried soil amendments, seed powders of termis, fenugreek and acacia, oil seed cakes, Agerin, Agri-50, Kapronite, Sincocin-AG, and the nematicide Furadan-10G (EL-Sherbiny, 2000; Ismail and Hasabo, 2000 and Heikal, 2001).

Application of organic amendments to soil to control plant-parasitic nematodes has been investigated extensively (Montasser, 1991; Abadir *et al.*, 1994 and Hammad, 1999). The use of marine algae and garlic as control agents against plant-parasitic nematodes has been studied by many workers (Paracer *et al.*, 1987 & Anter

et al., 1994). Also, previous studies showed that the addition of asparagus, Egyptian clover, marigold, margrite, neem, wormwood and olive dried plant materials caused significant reduction in galls and egg masses of *Meloidogyne* spp. on sunflower plants (EL-Nagar *et al.*, 1993 and Abadir *et al.*, 1994).

Oil cakes of cotton seeds, castor bean, linseed, mustard, sesame and soybean have been used as soil amendments for the control of root-knot nematodes (Abid *et al.*, 1995; Ali and EL-Hamawi, 1995; Khan *et al.*, 1995 and Shah *et al.*, 1992). Also, previous studies have shown significant reductions in nematode infestation by using certain bioproducts and different nematicides (Aboul-Eid *et al.*, 1993; Baird *et al.*, 2000 and Ibrahim *et al.*, 1994).

The present research studies were carried out to study the effects of soil amendments with dried marine algae *B. cabillaceae*, cabbage leaves, smashed garlic cloves, dried plant materials, seed powders of termis, fenugreek and acacia, oil seed cakes, Agerin, Agri-50, Kapronite, Sincocin-AG, and the nematicide Furadan-10G on *M. incognita* infection on sunflower plants cv. Myak.

Materials and Methods

Effect of soil amendments with termis, fenugreek, acacia seed powders and dried leaves of camphor on controlling Meloidogyne incognita on sunflower:

Sunflower seeds were sown in 15 cm diam. clay pots containing autoclaved sandy clay soil 1:1 (v:v). One week after emergence, seedlings were thinned to two per pot. The test plant materials were applied to the soil at the rate of 35 g per pot. Treated pots were inoculated with 5000 nematode eggs/pot at the same time or two days after applying the plant materials. Uninoculated pots served as control. Treatments were replicated 4 times. Pots were harvested 45 days after nematode inoculation. Data of numbers of root galls and egg masses and dry weights of shoot and root systems were determined.

Effect of soil amendments with garlic, marine alga, Botryocladia cabillaceae and cabbage leaves on controlling Meloidogyne incognita on sunflower:

Sunflower seeds were sown in 15 cm diam. clay pots containing autoclaved sandy clay soil. Seven days after emergence, seedlings were thinned to two per pot. Smashed garlic cloves, air- dried alga and dried cabbage leaves were used at the rate of 30g per pot. Treated pots were inoculated with 5000 nematode eggs/pot at the same time or two days after applying the biocontrol plant materials. Uninoculated pots were served as control. Treatments were replicated 4 times. Pots were arranged in a randomized complete block design. Plants were harvested 45 days after nematode inoculation. The numbers of root galls and egg masses and dry weights of shoot and root systems were assessed.

Effect of soil amendments with cotton, flax and sesame seed cakes on controlling Meloidogyne incognita on sunflower:

Sunflower seeds were sown in 15cm diam. clay pots filled with autoclaved sandy clay soil. Seven days after emergence, seedlings were thinned to two per pot. The tested seed cakes were used at the rate of 30 g per pot. Pots were inoculated with

5000 nematode eggs per pot at the same time or two days after applying the tested plant materials. Un-inoculated pots were served as control. Treatments were replicated 4 times. Pots were arranged in a randomized complete block design. The experiment was terminated 45 days after nematode inoculation. Numbers of root galls and egg masses and dry weight of shoot and root systems were determined.

Effect of some dried plant materials on controlling Meloidogyne incognita on sunflower:

A greenhouse experiment was carried out to determine the effect of dried plant materials of asparagus (*Asparagus sprengeri*), wormwood (*Artemisia cinna*), rosemary (*Rosmarinus officinalis*), sesame (*Sesamum indicum*), coleus (*Coleus blumei*), neem (*Azadirachta indica*) and Demssisa (*Ambrosia maritima* L.) on controlling *M. incognita* infecting sunflower cv. Myak . Sunflower seeds were sown in 15 cm diam. clay pots filled with autoclaved sandy clay soil. One week after emergence, seedlings were thinned to two per pot. The test plant materials were applied to the soil at the rate of 30g per pot. Treated pots were inoculated with 5000 nematode eggs/pot at the same time of applying the plant materials. Uninoculated pots were served as control. Treatments were replicated 4 times. Pots were arranged in a randomized complete block design. Plants were harvested 45 days after nematode inoculation. Data on numbers of root galls and egg masses and dry weight of shoot and root systems were determined.

Effect of Agerin, Agri-50, Furadan-10G, Kapronite and Sincocin-AG on Meloidogyne incognita on sunflower:

This experiment was conducted to determine the effect of the following biocontrol agents and chemical materials on controlling *M. incognita* on sunflower cv. Myak:

* Agerin: obtained from Agriculture Genetic Engineering Research Institute (AGERI), Agriculture Research Centre (ARC) Giza, Egypt.
* Agri-50: Organic solutions, L.L.C., Los Angeles, California USA.
* The granular nematicide, carbofuran (Furadan-10G) FMC chemical, FPRL Agrochemical Products Group, Philadelphia- PA 19103 (USA)
* Kapronite: product from Soil and Water Use Dept., National Research Centre.
* Sincocin-AG: biological control solution, obtained from ATL Enterprises, INC, Dallas Texas, USA.

Agerin was applied in two doses 2.5 and 5g/pot twice at the same time of nematode inoculation and 30 days later. Agri-50 was applied in two concentrations 2.5% and 5% /pot twice at the same time of nematode inoculation and 30 days later. Furadan-10G (2,3-Dihydro-2-dimethyl-7 benzofuranyl methyl carbamate) was applied at the rate of 5g/pot at the same time of nematode inoculation.

Kapronite was applied at the rate of 2 and 4g/pot twice at the same time and after 30 days of nematode inoculation. Sincocin-AG was applied in two concentrations 5% and 10% per pot at the same time of nematode inoculation and weekly for 1 month (4 times).

Sunflower seeds were sown in 15 cm diam. clay pots filled with mixture of 1: 1 (v:v) autoclaved sandy clay soil. One week after emergence, seedlings were thinned

to two per pot and treated with 5000 nematode eggs/pot alone or in combination with the examined bioproducts and nematicide. Treatments were replicated 4 times. Untreated pots served as control. The experiment was terminated 45 days after nematode inoculation. Numbers of galls and egg masses and dry weight of shoot and root systems were determined.

Results

Effect of soil amendment with garlic, marine alga, Botryocladia cabillaceae and cabbage leaves on Meloidogyne incognita on sunflower:

Data in Table (1) show that all applied treatments caused significant reduction in numbers of root galls and egg masses of *M. incognita*. Treatments with garlic cloves either before or at the same time of nematode inoculation resulted in the highest reductions (89.9-93.8%) in the number of root galls and nematode egg masses. Treatments with marine alga *Botryocladia cabillaceae* showed (82.4-86.6%) reduction in the numbers of root galls and egg masses. Treatments with dried cabbage leaves either before or at the same time of nematode inoculation gave (76.3-85.5%) reduction in the numbers of root galls and egg masses. Also, the results showed that treatments with marine alga and cabbage leaves at the same time of nematode inoculation resulted in a significant increase in shoot dry weight. Treatment with marine alga before nematode inoculation caused significant increase in root dry weight in comparison with that of the nematode treatment (Table 1).

Table 1. Effect of soil amendments with garlic, marine alga, *Botryocladia cabillaceae* and dried cabbage leaves on *Meloidogyne incognita* (MI) infecting sunflower plants

Treatment	Dry weight (g)		No. of root galls & egg masses/plant		Decrease (%) of galls & egg masses	
	Shoot	Root	Galls	Egg masses	Galls	Egg masses
Control	13.74 e	5.34 ab	–	–	–	–
M. incognita (MI)	14.46 bc	4.06 b	2760.8 a	2703.5 a	–	–
Garlic + MI at the same time	14.80 bc	5.85 ab	185.3 ed	168.3 ed	93.3	93.8
Garlic + MI 2 days later	15.94 bc	5.96 ab	276.5 cd	240.8 cde	89.9	91.1
Marine alga + MI at the same time	21.98 a	7.46 ab	393.8 cd	361.8 cd	85.7	86.6
Marine alga + MI 2 days later	21.80 a	8.59 a	499.5 bc	476.3 bc	81.9	82.4
Cabbage leaves + MI at the same time	23.07 a	7.19 ab	405.5 cd	391.8 bcd	85.3	85.5
Cabbage leaves + MI 2 days later	18.77 ab	6.80 ab	655.0 b	627.3 b	76.3	76.8

Data are averages of 4 replicates. Values within a column followed by the same letter(s) are not significantly different at (P=0.05).

Effect of soil amendments with sesame, cotton and flax seed cakes on sunflower plants infected with Meloidogyne incognita:

Data in Table (2) show that treatments with the tested seed cakes caused significant decrease in the numbers of root galls and nematode egg masses developed on sunflower plants in comparison with those of the nematode treatment. Treatments with sesame and flax seed cakes either before or at the same time of nematode inoculation showed the highest reduction (90.1-94.5%) in the numbers of root galls and nematode egg masses. Treatments with cotton seed cake caused (84.9-86.9%) reduction in numbers of root galls and nematode egg masses. The applied treatments caused insignificant differences in shoot or root dry weights in comparison with those of the control treatment.

Table 2. Effect of soil amendments with sesame, cotton and flax seed cakes on sunflower plants infected by *Meloidogyne incognita* (MI)

Treatment	Dry weight (g)		No. of root galls & egg masses/ plant		Decrease (%) of galls & egg masses	
	Shoot	Root	Galls	Egg masses	Galls	Egg masses
control	13.11 ab	1.96 a	–	–	–	–
M. incognita (MI)	10.71 ab	1.74 ab	1485.3 a	1448.3 a	–	–
Sesame cake + MI at the same time	17.02 a	2.56 a	85.0 cd	79.3 cd	94.3	94.5
Sesame cake + MI 2 days Later	16.99 a	3.32 a	147.5 bc	129.8 bc	90.1	91.0
Cotton cake + MI at the same time	8.96 b	3.40 a	201.0 bc	189.5 bc	86.5	86.9
Cotton cake + MI 2 days later	14.91 ab	3.56 a	224.0 b	209.8 b	84.9	85.5
Flax cake + MI at the same time	13.77 ab	2.92 a	119.0 bdc	107.0 bcd	91.9	92.6
Flax cake + MI 2 days later	14.18 ab	2.11 a	129.0 bc	121.8 bc	91.3	91.6

Data are averages of 4 replicates. Values within a column followed by the same letter(s) are not significantly different at (P=0.05).

Effect of soil amendment with termis, fenugreek, acacia seed powders and camphor dried plant materials on controlling Meloidogyne incognita on sunflower:

Data in Table (3) show that treatments with the tested plant materials have significantly decreased the number of root galls and nematode egg masses developed on sunflower plants in comparison with those of the nematode treatment. Treatments of termis and fenugreek seed powders either before or at the same time of nematode inoculation showed high reduction (92.2-98.6%) in numbers of root galls and nematode egg masses. Treatments with acacia seed powder either before or at same time of nematode inoculation gave 63.6-66.3% reduction in root galls and nematode

Table 3. Effect of soil amendments with termis, fenugreek, acacia powders and camphor dried leaves on sunflower plants infected by *Meloidogyne incognita* (MI)

Treatment	Dry weight (g)		No. of root galls & egg masses/ plant		Decrease (%) of galls & egg masses	
	Shoot	Root	Galls	Egg masses	Galls	Egg masses
Control	13.74 abc	5.34 b	--	--	--	--
M. incognita (MI)	14.46 abc	4.06 bc	2760.8 a	2703.5 a	--	--
Termis seeds + MI at the same time	19.25 a	5.35 b	79.3 d	34.8 d	97.1	98.6
Termis seeds+ MI 2 days Later	17.30 ab	9.27 a	106.0 d	54.3 d	96.2	97.9
Fenugreek seeds + MI at the same time	15.60 abc	4.69 bc	90.3 d	85.8 d	96.7	96.8
Fenugreek seeds +MI 2 days later	18.16 ab	5.47 b	214.5 d	201.3 d	92.2	92.6
Acacia seeds +MI at the same time	13.17 bcd	2.10 bc	933.3 c	912.3 c	66.2	66.3
Acacia seeds +MI 2 days later	16.42 ab	3.82 bc	993.0 c	983.8 c	64.0	63.6
Camphor leaves +MI at the same time	10.62 cd	1.76 c	994.0 c	972.0 c	63.9	64.0
Camphor leaves+ MI 2 days later	9.86 d	2.06 bc	1253.0 b	1224.3 b	54.6	54.7

Data are averages of 4 replicates. Values within a column followed by the same letter are not significantly different at (P=0.05).

egg masses. On the other hand, treatments of camphor dried leaves caused 54.6-64% reduction in numbers of root galls and nematode egg masses. Treatment of termis seed powder before nematode inoculation caused a significant increase in root dry weight.

Effect of soil amendment with some dried plant materials on controlling Meloidogyne incognita on sunflower:

Data in Table (4) show that treatments with the tested plant materials significantly decreased the numbers of root galls and nematode egg masses developed on sunflower plants in comparison with those of the nematode treatment. Treatments of sesame, neem, wormwood and demssisa plant materials caused high reduction (94.8-98.3%) in numbers of root galls and nematode egg masses. Treatments of rosemary and asparagus plant materials showed reduction of 90.9-92.3% in numbers of galls and nematode egg masses. On the other hand, treatment of coleus plant materials showed reduction of 75.3-76% in numbers of galls and nematode egg masses. Treatment of asparagus gave a significant increase in shoot dry weight, whereas treatments of rosemary, asparagus and wormwood caused significant increases in root dry weigh in comparison with the other treatments and check (Table 4).

Table 4. Effect of soil amendments with some dried plant materials on sunflower plants infected by *Meloidogyne incognita* (MI)

Treatment	Dry weight (g)		No. of root galls & egg masses/ plant		Decrease (%) of galls& egg masses	
	Shoot	Root	Galls	Egg masses	Galls	Egg masses
Control	12.62 bcd	2.36 c	--	--	--	--
M. incognita	9.15 d	1.90 c	1977.8 a	1896.3 a	--	--
Wormwood + MI	16.97 bc	5.74 ab	97.3 cde	90.0 cde	95.1	95.3
Rosemary + MI	17.91 b	8.76 a	152.8 cd	147.3 cd	92.3	92.3
Asparagus + MI	32.80 a	6.04 ab	179.3 c	168.5 c	90.9	91.2
Coleus + MI	11.78 bcd	4.75 bc	488.3 b	460.0 b	75.3	76.0
Neem + MI	10.49 cd	1.54 c	49.5 cde	46.0 cde	97.9	97.6
Demssisa + MI	13.30 bcd	2.43 c	102.0 cde	96.8 cde	94.8	94.9
Sesame + MI	11.21 bcd	2.35 c	34.8 de	33.3 de	98.2	98.3

Data are averages of 4 replicates. Values within a column followed by the same letter(s) are not significantly different at (P=0.05).

Effect of Agerin, Agri-50, Furadan-10G, Kapronite and Sincocin-AG on Meloidogyne incognita on sunflower

This experiment was carried out to determine the effect of Agerin, Agri-50, Kapronite, Sincocin-AG, and the granular nematicide (Furadan-10G) on *M. incognita* infection on sunflower cv. Myak. Data in Table (5) show that most of the applied treatments resulted in significant reduction in the numbers of root galls and nematode egg masses. Treatment with Furadan-10G induced the highest reduction 99.4% in numbers of root galls and egg masses. Treatments with Sincocin-AG caused 65.4%-72.8% reduction in numbers of root galls and egg masses followed by kapronite treatments either 2 g/pot or 4 g/pot which caused 60.6%-66.5% reduction in numbers of root galls and nematode egg masses. On the other hand, Treatments of Agri-50 (2.5%) and Agerin showed low reductions in root galls and nematode egg masses. The applied treatments with kapronite (2 & 4 g/pot) induced the highest values of the dry weights of shoot and root systems of sunflower plants in comparison with those of control and the other treatments (Table 5).

Table 5. Effect of Agerin, Agri-50, Furadan-10G, Kapronite and Sincocin-AG on *Meloidogyne incognita* infecting sunflower plants

Treatment	Dry weight (g)		No. of root galls & egg masses/ plant		Decrease (%) of galls& egg masses	
	Shoot	Root	Galls	Egg masses	Galls	Egg masses
Control	5.04 bc	1.25 bc	-	-	-	-
M. incognita	3.45 cd	0.89 c	2075.0 a	2004.0 a	-	-
Agerin .5g/pot	3.15 d	1.34 bc	1123.8 bc	1082.3 bc	45.8	45.9
Agerin 5g/pot	5.96 b	1.85 bc	1176.0 bc	1110.3 bc	43.3	44.6
Agri-50 % 2.5%	3.60 cd	1.68 bc	1273.0 b	1221.5 b	38.7	39.0
Agri-50 % 5%	3.37 cd	1.58 bc	827.0 cd	780.0 cd	60.1	61.1
Furadan10G /pot	3.73 cd	2.11 ab	13.0 e	11.3 e	99.4	99.4
Kapronite 2g/pot	8.48 a	1.84 bc	807.3 cd	789.3 cd	61.1	60.6
Kapronite 4g/pot	8.84 a	3.20 a	694.3 d	678.5 d	66.5	66.1
Sincocin-AG 5%	4.58 bcd	2.03 b	715.0 d	693.5 d	65.5	65.4
Sincocin-AG 10%	3.53 cd	1.04 bc	573.3 d	545.3 d	72.4	72.8

Data are averages of 4 replicates. Values within a column followed by the same letter(s) are not significantly different at (P=0.05).

Discussion

The obtained data showed that treatments with smashed garlic cloves, marine alga *B. cabillaceae* and dried cabbage leaves caused reduction in root galls and egg masses of *M. incognita* on sunflower plants. Also, these treatments showed an increase in the growth parameters of sunflower plants. Similar findings were reported by other investigators (Paracer *et al.*, 1987 and Ibrahim, 1989). Sukul (1994) indicated that the toxicity of garlic may be due to toxic effects of certain sulpher compounds such as Allicin diallyl disulphide oxide.

It is evident that treatments with sesame, flax and cotton seed cakes caused great reduction in root galls and egg masses of *M. incognita* on sunflower plants. Also, treatments with the tested seed cakes caused significant increase in growth parameters of sunflower plants. These results are in agreement with those of other workers (Khan *et al.*, 1995; Abid *et al.*, 1995 and Shah *et al.*, 1992).

Results of the control study revealed that soil treatment with termis, fenugreek, acacia seed powders and camphor dried leaves caused great reduction in root galls and egg masses of *M. incognita* on infected sunflower plants. Also, these treatments resulted in a significant increase in growth parameters of sunflower plants. These results are in agreement with those of Abadir *et al.* (1994) and Hammad (1999).

It is evident that soil treatment with dried plant materials of wormwood, rosemary, asparagus, coleus, neem, demssisa and sesame caused reduction in root galls and egg masses of *M. incognita* on sunflower plants. Similar findings were reported by Gommers and Bakker (1988) who indicated that some plant extracts contain nematicidal or nematotoxic compounds.

Recently, much information has been generated on the efficacy of soil amendment with organic matter on controlling plant-parasitic nematodes. It is evident that biological effects produced by the degradation of organic matter in the soil could result in some adverse effects or antagonistic action on phytonematode populations in the ecosystem. Bello *et al.* (2002) indicated that bio-fumigation (gases produced during the bio-decomposition of organic matter in the soil) is a control alternative based on the use of local organic sources and that could reduce environmental impact from agricultural waste and increases the quality of plant production. The effectiveness of bio-fumigation is much similar to conventional fumigants, and at the same time, it improves chemical, physical and biochemical soil characteristics. Results of the nematode control study showed that treatment with Furadan-10G (Carbofuran) greatly reduced numbers of root galls and egg masses of *M. incognita* on sunflower plants. Similar results were reported by other workers (EL-Sherbiny, 2000 and Heikal, 2001).

The present results also indicated that treatments with Sincocin-AG at the rate of 5% and 10% decreased root galls and egg masses of *M. incognita* on sunflower plants. These findings are in accordance with those of Ibrahim (1989) and Mahgoub (1996). The control study also showed that treatments with Agerin, Agri-50 and Kapronite were effective in reducing root galls and egg masses of *M. incognita* on sunflower plants. These results are much similar to those of other workers (EL-Sherbiny, 2000; Ismail and Hasabo, 2000 and Heikal, 2001).

Since the data of nematode control from pot experiments are very promising, further investigations are necessary, especially under field conditions. Such studies could help growers in controlling plant–parasitic nematodes especially the root-knot nematodes.

In general, information on integrated control of plant- parasitic nematodes is very important and must be applied to suppress nematode populations under field conditions. It is clear that nematode control on economic plant crops can be achieved if resistant plant cultivars, crop rotation, biological control agents or soil organic amendments are used properly.

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(Received 12/12/2006;
in revised form 06/03/2007)

مقاومة نيماتودا تعقد الجذور *Meloidogyne incognita* على نباتات عباد الشمس بأستخدام بعض المواد العضوية النباتية والمركبات الحيوية

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تم دراسة استخدام الطحلب البحرى المجفف تيروكلاديا وأوراق الكرنب المجففة ومهروس فصوص الثوم لمقاومة نيماتودا *Meloidogyne incognita* على نباتات عباد الشمس صنف مياك . وقد وجد أن إضافة هذه المواد النباتية إلى التربة قد سبب خفضاً معنوياً فى إصابة النيماتودا بالمقارنة بالكنترول . وأن معاملة مهروس الثوم كانت أفضل المعاملات حيث قللت أعداد العقد الجذرية وكتل بيض النيماتودا بنسب تتراوح ما بين 89.9-93.8% مقارنة بالكنترول اما المعاملة بطحلب تيروكلاديا فقد قللت أصابة النيماتودا بنسبة 81.9-86.6% والمعاملة بأوراق الكرنب المجففة قللت الإصابة بنسبة 76.3-85.5%مقارنة بالكنترول.

تم أختبار تأثير إضافة كمب كل من القطن والسمسم والكتان إلى التربة على إصابة نيماتودا *M. incognita* على نباتات عباد الشمس صنف مياك . أظهرت النتائج أن هذه المعاملات كانت فعالة فى خفض إصابة النيماتودا حيث قللت أعداد العقد الجذرية وكتل بيض النيماتودا بنسبة 85.5- 94.5% مقارنة بالكنترول .

تم أختبار تأثير إضافة مسحوق بذور الترمس والحلبة والقرظ (أكاسيا) وأوراق الكافور الجافة إلى التربة لمقاومة نيماتودا *M. incognita* على نباتات عباد الشمس صنف مياك وأوضحت النتائج أن جميع هذه المعاملات قللت الإصابة النيماتودية بدرجة معنوية وكانت أفضل هذه المعاملات معاملة بذور الترمس والحلبة حيث قللت إصابة النيماتودا بنسبة 92.2-98.6% مقارنة بالكنترول . أما معاملة بذور القرظ وأوراق الكافور فقد قللت إصابة النيماتودا بنسبة 66.3% -55.6 مقارنة بالكنترول.

تم إختبار تأثير إضافة مجففات نباتات الشيح Wormwood، حصا لبان Rosemary، الأسبرجس Asparagus، كوليس Coleus، النيم Neem، الدمسيسه Demssisa، السمسم Sesame إلى التربة لمقاومة نيماتودا *M. incognita*على نباتات عباد الشمس صنف مياك .وأوضحت النتائج أن جميع هذه المعاملات قد قللت إصابة النيماتودا بدرجة معنوية .وكان أفضل هذه المعاملات أستخدام مجففات النيم والشيح والدمسوسة والسمسم حيث أدت إلى خفض إصابة النيماتودا بنسبة 94.8- 98.3% مقارنة بالكنترول .

تم أختبار تأثير المعاملة ببعض المركبات الحيوية والكيماوية مثل المنكوسين أ ج ، كابرونيت ، أجرى–50 ، أجرين، فيوردان لمقاومة نيماتودا *M. incognita* على نباتات عباد الشمس صنف مياك، وقد أظهرت النتائج أن معاملة التربة بأى من هذه المركبات قد قلل بدرجة معنوية أعداد العقد الجذرية وكتل بيض النيماتودا على النباتات المصابة مقارنة بالكنترول. وقد كانت أفضل هذه المعاملات إستخدام مبيد الفيوردان حيث أدت إلى خفض إصابة النيماتودا بنسبة 99.4% ويليها فىالتأثير إستخدام محلول منكوسين أ.ج ، مسحوق الكابرونيت ، أجرى–50 ثم الأجرين.