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PROTECTION OF EGYPTIAN COTTON PLANTS, *Gossypium barbadense* BY CERTAIN SOIL ORGANIC AMENDMENTS AGAINST *Meloidogyne incognita*

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ABSTRACT

The aim of this work was to evaluate the potential of certain soil organic matters i.e. poultry or horse manures or dried-leaf powders of periwinkle (*Chatharanthus roseus*) or castor (*Ricinus communis*) in comparison with oxamyl against *Meloidogyne incognita* on Egyptian cotton cv. Giza 45 *in vivo*. Five grams of each soil organic amendments were separately added to cotton seedlings cultivated in pots, as well as oxamyl at the recommended dose, one day before nematode inoculation process. Results revealed that all tested materials significantly improved plant growth parameters and reduced nematode population density, number of galls, females and egg-masses on roots of cotton plants. Of the tested organic matters, poultry manure achieved the highest percentage increase in plant length, shoot dry weight and fresh weight of whole plant with values of 54.4, 74.7and 37.2%, respectively, followed by perwinkle powder for the first two parameters with values of 51.0 and 65.9%, respectively, whereas, castor powder for the later parameter with value of 44.7% as compared with nematode alone. Moreover, oxamyl treatment ranked first in percentage increase values of shoot dry weight (87.9%) and fresh weight of whole plant (62.5%), respectively, and second to poultry manure treatment with value of plant length (58.0%) comparing to nematode alone. In addition, non-significant differences between all tested organic matters regarding nematode parameters were noticed. However, oxamyl application surpassed them in suppressing nematode population density (68.9%), number of galls (67.6%) and egg-masses (65.8%), respectively, as compared with nematode alone. Meanwhile, among the organic matters tested, pots received poultry manure showed the highest percentage reduction in nematode population density (53.3%), followed by horse manure (51.3%), then periwinkle powder (50.4%), and castor powder (49.4%), as compared with nematode alone. These results demonstrated the potential of such organic matters to protect cotton plant against *M. incognita* under greenhouse conditions.

Keywords: Egyptian cotton cv. Giza 45, *Gossypium barbadense, Meloidogyne incognita,* organic amendments, oxamyl **,** management.

INTRODUCTION

Egyptian cotton plant, *Gossypium barbadense* L. represents the main agricultural national income of the Arab Republic of Egypt. Its total cultivated area in Dakahlia governorate reached to 79,400 feddans with an average of 8.6 Kentar/ feddan for the season of 2006. Several plant parasitic nematodes i.e. the reniform nematode, *Rotylenchulus reniformis* (Salem, 1970), the root-lesion nematode, *Pratylenchus brachyurus* (El-Sherif, 1976), the root-knot nematode *, Meloidogyne incognita* and *R. reniformes* (Starr&Page,1990), and the sting nematode ,*Belonolaimus longicaudatus* (Crow *et al*.,1997), were reported as pathogens of cotton plant in many soil types all over the world. The first four nematode species are widely found in the cultivated cotton

areas of Egypt, causing considerable crop losses. Recently, twelve nematode genera, i.e. *Tylenchus, Tylenchorhychus*, *Xiphinema, Meloidogyne, Rotylenchus, Hirschmanniella*, *Hoplolaimus*, *Rotylenchulus,Trichodorus, Helicotylenchus, Pratylenchus* and *Psilenchus* were recorded in cotton fields surveyed in Dakahlia governorate, where *Meloidogyne* spp. (J2) seemed to be one of the most prevailing cotton pest as they occurred at rates of 23 times with percentage of occurrence of 19.0% (El-Sherif *et al.*,2007). Moreover, they also reported that cotton cvs. Giza 45 and 86 were rated as susceptible hosts to *M. incognita* infection under greenhouse conditions. 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 itself (Korayem, 2003). Waste materials of cattle, chicken, sheep, rabbit and pigeon manures have been studied effectively to increase yield of eggplant and tomato (Rajesh *et al.*,1999; Al-Rehiayani,2005; and Mokbel, 2009). Moreover, organic amendments i.e. dried-leaf powder; extracts and green manure have been reported to suppress *Meloidogyne* spp. infecting fruit trees, ornamental plants, field and vegetable crops (Odour-Owino, 2003, Eid, 2005, El-Sherif *et al.,*2006 and Mokbel,2009). The objective of the present investigation was to evaluate the potential of certain organic matters (poultry, horse manures), dried-leaf powders of periwinkle and castor in comparison with oxamyl (Vydate 24%) against *Meloidogyne incognita* on Egyptian cotton cv. Giza 45 *in vivo*.

MATERIALS AND METHODS

1- Source of nematodes and preparation of nematode inoculum:

Second stage juveniles (J2) of *Meloidogyne incognita* (Kofoid&White) Chitwood, were obtained from a pure culture of *M. incognita* that was initiated by single egg-mass and propagated on coleus plants, *Coleus blumei* in the greenhouse of Nematology Research Unit, Agricultural Zoology Department, Faculty of Agriculture, Mansoura University, Egypt, where this experiment was carried-out. Nematode inoculum was then prepared by extracting *M. incognita* (J2) from soil through sieves and modified Baermann technique (Goodey, 1957).

2- Pesticides:

(Vydate 24% L) Methyle-NN-dimethyle-N{(methyle) carbamycocyl}-1-1-hioxamidate).

3- Source of soil organic amendments:

Plant products i.e. dried-leaf powder of periwinkle (*Chatharanthus roseus*) and castor (*Ricinus communis*) as well as poultry and horse manures after sun-dried on a greenhouse bench were used as soil organic matters.

4- Control of *Meloidogyne incognita* infecting Egyptian cotton seedling using certain animal wastes or plant powders in comparison with oxamyl under greenhouse conditions (30±5 ºC):

A greenhouse experiment was conducted in order to determine the impact of certain animal wastes i.e. poultry and horse manures as well as plant products i.e. dried-leaf powders of periwinkle and castor in comparison with oxamyl separately in controlling *M. incognita* on cotton, *G. barbadense*

cv. Giza 45. Each type of soil organic amendments tested was separately sun-dried on a sheet of paper that placed on the greenhouse bench for two days, ground and used. Five grams of each soil organic amendments was added per pot (10-cm-d.), containing steam-sterilized sandy loam soil (1:1, v:v), while oxamyl was separately introduced at the recommended dose at the rate of 0.3 ml/pot. Twenty one plastic pots, filled with soil were planted with five cotton seeds /pot and received water as needed. After ten days from seed germination, cotton seedlings were thinned to one healthy seedling/pot. One week later, eighteen cotton seedlings were inoculated with 1000 J2 of *M. incognita* per pot. All doses of soil organic amendments under study as well as oxamyl were separately introduced to fifteen cotton seedlings one day before nematode inoculation. Three uninoculated and untreated cotton seedlings left to serve as control. Each treatment was replicated three times. Treatments were as follows:

1-N+ poultry manure (5g.), 2- N+ horse manure (5g.), 3-N+ periwinkle (5g.), 4-N+ castor (5g.), 5-N+Oxamyl (0.3 ml), 6- N alone and 7- plant free of N or any treatment.

Pots were randomly arranged on a greenhouse bench at 30±5ºC, and plants were received water and NPK fertilizers at the recommended dose. Plants were protected by conventional pesticides against mites and insects as needed ,and treated horticulturally the same during the course of experiment. After forty five days from nematode inoculation, plants were uprooted. Data dealing with lengths and weights were also measured and recorded. Infected roots were fixed in formalin 4%, then stained in lactic acid–fuchsin (Byrd *el al.,* 1983), and examined for number of galls, developmental stages, females and egg-masses. Number of *M*. *incognita* (J2) in 100 g. soil was also determined by extracting through sieves and modified Baermann technique (Goodey, 1957), and recorded. Data were subjected to analysis of variance (ANOVA) (Gomez and Gomez, 1984), followed by Duncan's multiple range test to compares means (Duncan, 1955).

RESULTS AND DISCUSSION

Data in the tables (1&2) documented the impact of certain soil organic amendments i.e. poultry manure, horse manure, periwinkle and castor dried-leaf powders in comparison with oxamyl on plant growth response of cotton cv. Giza 45 infected with *M. incognita*; and its population in soil and root, number of galls and egg-masses on roots under greenhouse condition (30±5ºC). Results revealed that all tested treatments significantly improved plant growth parameters and reduced nematode population density, number of galls, females and egg-masses on roots of cotton plants (Tables, 1&2). Of the tested organic matters, poultry manure achieved the highest percentage increase in plant length, shoot dry weight and fresh weight of whole plant with values of 54.4, 74.7and 37.2%, respectively, followed by periwinkle powder for the first two parameters with values of 51.0, 65.9, and 43.5, respectively, whereas, that of fresh weight of whole plant, castor powder value of (44.7%), exceeded that of periwinkle treatment value (43.5%).

T1-2

However, castor powder ranked second to periwinkle application in the increment percentage values of plant length, shoot dry weight which were amounted to 43.0 and 60.4% , respectively. Moreover, oxamyl treatment ranked first in percentage increase values of plant length (58.0%), shoot dry weight (87.9) and fresh weight of whole plant (62.5), respectively, (Table 1).

With respect to nematode parameters tested, all soil organic matters significantly reduced nematode population density, number of galls and egg-masses on root system of cotton plant cv. Giza 45, however, oxamyl application surpassed them with values of 68.9, 67.6 and 65.8%, respectively, comparing to nematode alone. Moreover non-significant difference between all tested soil organic amendments regarding nematode parameters was recorded as compared with oxamyl and nematode alone. However, pots received poultry manure showed the highest percentage reduction in nematode population density (53.3%), followed by horse manure (51.3%), then periwinkle powder (50.4%), whereas, the least percentage of reduction was recorded by castor powder which was amounted to (49.4%), as compared with nematode alone (Table 2). Apparently, pots received poultry manure or periwinkle applications achieved the best treatments in improving plant growth parameters of cotton cv.Giza 45 as well as, suppressing nematode population density. On the other hand, oxamyl treatment showed the highest values of same criteria, however, castor powder gave considerable percentage values of both plant and nematode parameters mean, while, horse manure treatment revealed the lowest percentage increase in improving plant growth parameters and percentage of reduction of nematode population density in cotton roots. These results are in harmony with those reported by Ali (1995); Akhtar and Mohamed (1997); Rajesh *et al*. (1999), in respect to poultry manure, Nour El-Deen (2002) , in respect to horse manure, Odour-Owino (2003), in respect to *Ricinus communis* against *M*. *javanica* on tomato, Al-Rehiayani (2005) in respect to camel urine, Eid (2005) in respect to *R*. *communis* dried-leaf powder against *M. incognita* on olive cv. Picual, and El-sherif *el al.* (2006) in respect to periwinkle, *Chatharanthus roseus* against *Aphelenchoides besseyei* on rice cv. Sakha103 and Mokbel (2009), in respect to water extracts of cattle, rabbit and pigeon manures and Jatropha seed powder and Vydate L. 24% against *M. incognita* on tomato. Improving Egyptian cotton growth and suppression of root-knot nematode parameters tested following the application of poultry or horse manures or periwinkle or castor dried-leaf powders could be attributed to the presence of significant quantities of N,P,K,Ca,Mg and micronutrients in the organic matter (Nadegwa *et al*.,1991; Sims and Wolf,1994). Obviously, the present work indicated the potential use of poultry manure or periwinkle powder as soil amendments (biofertilizers) as well as their nematicidal properties on root-knot nematodes, *M. incognita* infecting Egyptian cotton cv. Giza 45 seedlings and improving plant growth. It is well known that organic matters play an important role in improving soil structure, promoting plant growth and may activate different organisms against the target nematode. The safety of such materials and their low cost is one of its advantages. However additional researches are needed using plant or animal organic amendments mixing with certain bioagents and oxamyl at half dose before using effectively in integrated pest management (IPM).

REFERENCES

Akhtar, M. and Mahmoud, I. (1997). Integrated nematode control in potato, *Solanum tuberosum*. International Pest Control, 38(2): 62-64.

Ali, S.S. (1995). Management of *Meloidogyne javanica* through organic amendments in mungbean. India J. Pluses Research, 8(2): 204-208.

Al-Rehiayani, S. (2005). Suppression of *Meloidogyne javanica* infecting eggplant by diluted camel urine applied with irrigation water. J. Agric. Sci. Mansoura Univ., 30(7):4237-4245.

Byrd, D.W.J;T. Kirkpatrick and K.R.Barker (1983). An improved technique for clearing and staining plant tissue for detecting of nematodes. J. Nematol. 15:142-143.

Crow, W.T.; D.W.Dickson and D.P. Weigartner,(1997). Stubby root symptoms on cotton induced by *Belonolaimus longicaudatus*. J. Nematol. 29:574 (Abstr.).

Duncan, D.B. (1955). Multiple range and multiple, F-test. Biometrics, 11:1-47.

Eid, Samia, A.H. (2005). Studies on nematodes in North Sinai. M.Sc. Thesis, Fac. Environ. Agric. Sciences, Suez Canal Univ., 193 pp.

EL-Sherif, A.G.M (1976). Studies on the root-lesion nematode, *Pratylenchus brachyurus* on Egyptian cotton, *Gossypium barbadense*. Ph.D. Thesis, Fac. Agric., Cario Univ., 94pp.

EL-Sherif, A.G.; A.E.M. Khalil; A.R. Refaei and A.H. Nour EL-Deen (2006). Occurrence of white-tip nematode, *Aphelenchoides besseyi* in certain rice cultivation at South Dakahlia Governorate, Egypt and its management under field conditions. J. Agric. Sci. Mansoura Univ., 31(5):3215-3225.

EL-Sherif, A.G.; A.R. Refaei and A.E.M. Khalil (2007). Status of plant parasitic nematodes associated with cotton fields in North Eastern Nile Delta region, Egypt with special reference to host suitability to *Meloidogyne incognita* infection. J. Agric. Sci. Mansoura Univ., 32(10):8695-8704.

Gomez, K. A. and A.A. Gomez (1984). Statistical procedures for Agricultural Research. 2nd Ed., John Wiley &Sons: Inc., New York.

Goodey, J.B. (1957). Laboratory methods for work with plant and soil nematodes. Tech. Bull. No. 2. Min. Agric. Fish Ed. London, pp 47.

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

Mokbel, A. Asma (2009). Impact of certain organic soil amendments and chemical nematicides on controlling *Meloidogyne incognita*. J. Agric. Sci. Mansoura Univ., 34(4): 3975-3983.

Nadegwa, P.M.; Thomposon and W.C.Merka (1991). Fractional of poultry litter for enhance utilization. Trans. Am. Soc. Agric. Eng., 34: 992-997.

Nour El-Deen, A.H.H (2002). Studies on some plant parasitic nematodes associated with peach orchards. M.Sc. Thesis, Fac. Agric., Mansoura Univ., 94 pp.

Odour-Owino, P. (2003). Control of root-knot nematodes in Kenya with aldicarb and selected antagonistic plant. Nematologia Mediterranea 31(1): 125-127.

Rajesh, V.; J. Singh and R.K.Jain (1999). Effect of few organic manures against root-knot nematode, *Meloidogyne incognita* infecting cotton, *Gossypium hirsutum*. Proceeding of National Symposium on rational approaches in nematode management for sustainable Agriculture, Anand, India, 23-25.

Salem, A.A.,(1970). Pathogenicity of the *Rotylenchulus reniformis* on cotton *Gossypium barbadense*. Ph.D. Thesis, Fac.of Agrc., Cario Univ., 55pp.

Sims, J.T. and D.S.Wolf (1994). Poultry waste management: Agricultural and Environmental Issues. Adv. Agron., 52: 1-82.

Starr, J.L., and S.L.J.Page (1990). Nematode parasitic of cotton and other tropical fiber crops, pp. 539-556. In M.Luc., R.A. Sikora, and J. Bridge (eds). Plant parasitic nematodes in sub tropical and tropical Agriculture. CAB. International, Walling Ford, U.K.

حماية نباتات القطن المصري (*Gossypium barbadense* L.) بواسطة محسنات التربة العضوية ضد "*Meloidogyne incognita*".

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أجري هذا البحث لتقييم قدرة بعض محسنات التربة العضوية مثل مخلفات الدواجن والخيل ومساحيق الأوراق الجافة للونكا والخروع بالمقارنة بمبيد الاوكساميل ضد نيماتودا "*Meloidogyne incognita*"علي القطن المصري (*Gossypium barbadense* L.) صنف جيزة ٤٥ تحت ظروف الصوبة. تم إضافة ٥ جرام من كل مادة عضوية وكذا الجرعة الموصي بها لمبيد الاوكساميل الي كل أصيص منزرع به بادرة قطن قبل إضافة عدوي النيماتودا بيوم واحد حيث كان معدل العدوى ١٠٠٠ يرقة لكل أصيص. أسفرت النتائج عن أن جميع المواد المختبرة أدت إلي تحسن قياسات نمو النباتات المختبرة بدرجة معنوية كما خفضت أعداد النيماتودا وعدد العقد النيماتودية والإناث وكتل البيض علي جذور نباتات القطن. وأعطي مخلف الدواجن أعلي النتائج في معدلات الزيادة لطول النبات الكلي والوزن الجاف للمجموع الخضري والوزن الرطب الكلي للنبات بقيم قدرها ٥٤,٤و٧٤,٧و٣٧,٢% علي التوالي يليها في ذلك مسحوق أوراق الونكا الجافة لكل من الطول الكلي للنبات ٥١% والوزن الجاف للمجموع الخضري ٦٥,٩% بينما كان مسحوق الأوراق الجافة للخروع متفوقا عن الونكا في معدل الزيادة في قيمة الوزن الرطب الكلي للنبات بقيمة قدرها٤٤,٧% عندما قورنت بالنيماتودا بمفردها . زيادة علي ذلك كانت المعاملة بمبيد الاوكساميل الأعلي في معدلات الزيادة في الوزن الجاف للمجموع الخضري ٨٧,٩% والوزن الرطب الكلي للنبات ٦٢,٥% والثانية في الترتيب بعد معاملة مخلف الدواجن في معدل الزيادة بالنسبة للطول الكلي للنبات ٥٨% عند المقارنة بالنيماتودا لوحدها .ولا توجد أي فروق معنوية بين كل المواد العضوية المختبرة بشأن مقاييس النيماتودا المختبرة ولكن كانت المعاملة بالمبيد متفوقا عليهم جميعا في خفض أعداد النيماتودا ٦٨,٩% وعدد العقد ٦٧,٦% وكتل البيض ٦٥,٨ عند المقارنة بالنيماتودا بمفردها . ومن بين المواد العضوية المختبرة أعطت أيضا المعاملة بمخلف الدواجن أعلي معدل نقص في أعداد النيماتودا ٥٣,٣% يليها المعاملة بمخلف الخيل ٥١,٣% ومسحوق الونكا ٥٠,٤% ثم مسحوق الخروع ٤٩,٤% علي التوالي عن المعاملة بالنيماتودا بمفردها . هذه النتائج أوضحت قدرة المواد العضوية المختبرة علي حماية نبات القطن ضد الإصابة بنيماتودا تعقد الجذور "*Meloidogyne incognita*"

ملحوظة هامة: هذا البحث ممول من وحدة البحوث بجامعة المنصورة.

قام بتحكيم البحث

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Table (1): Plant growth response of Egyptian cotton cv. Giza 45 infected with *Meloidogyne incognita* as affected by certain organic amendments in comparison with oxamyl under greenhouse conditions.

Treatments	*Plant growth response									
	Length (cm)			Increase %	Fresh weight (g)		Fresh wt. of whole plant (g)	Increase %	Shoot dry wt. (g)	Increase %
	Shoot	Root	Total		Shoot	Root				
Poultry manure	54.0 b	23.2 abc	77.2	54.4	31.2 c	14.5 bc	45.7 c	37.2	15.9 b	74.7
Horse manure	46.0 d	20.5 c	66.5	33.0	27.5 d	13.2 cd	40.7 d	22.2	13.5 b	48.4
Periwinkle	51.0 c	24.5 ab	75.5	51.0	36.4 ab	12.5 de	47.8 c	43.5	15.1 b	65.9
Castor	50.0 c	21.0 bc	71.5	43.0	34.5 b	13.7 cd	48.2 c	44.7	14.6 b	60.4
Oxamyl	54.0 b	25.0 a	79.0	58.0	38.2 a	15.9 b	54.1 b	62.5	17.1 b	87.9
N alone	36.0 a	15.0 d	50.0	-	21.7 e	11.6 e	33.3 e	--	9.1 c	--
Plant free of N or any treatment	60.4 a	22.0 abc	82.4	64.8	35.7 ab	20.6 a	66.3 a	99.1	20.9 a	99.1

*Each value is a mean of three replicates.
Means in each column followed by the same letters(s) did not differ at P< 0.05 according to Duncan's multiple-range test.
N=1000 *M. incognita* J2

Table (2): Number of nematode in soil, developmental stages, females, egg-masses and galls on roots of Egyptian cotton cv. Giza 45 infected with *Meloidogyne incognita* as affected by certain organic amendments in comparison with oxamyl under greenhouse conditions.

Treatments	*Nematode population in				Reduction %	No. of galls	Reduction %	No. of Egg-masses	Reduction %
	100g. Soil	Root							
		Develomental stages	Females	Total					
Poultry manure	333.3 b	90 b	100 b	523.3 b	53.3	110 b	49.1	90 b	22.4
Horse manure	360.0 b	88 b	98 b	546 b	51.3	113 b	47.7	90 b	22.4
Periwinkle	380.0 b	86 b	93.3 b	555 b	50.4	105 b	51.4	85 b	26.7
Castor	390.0 b	85 b	92 b	567 b	49.4	106 b	50.9	83 b	28.4
Oxamyl	250.0 c	46 c	52 c	348 c	68.9	70 c	67.6	397 c	65.8
N alone	570.0 a	180 a	190 a	940 a	--	216 a	---	116 a	---

*Each value is a mean of three replicates.
Means in each column followed by the same letters(s) did not differ at P< 0.05 according to Duncan's multiple-range test.
N=1000 *M. incognita* J2