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EFFECT OF CERTAIN ORGANIC AMENDMENTS ON CONTROLLING *Meloidogyne incognita* ON POTATO

Bekhiet, M.A.; A.M. Shady; A.A.A. El-Deeb and M.H. El-Hamawi
Plant Pathology Research, Institute, (ARC) Giza, Egypt.

ABSTRACT

The effect of certain organic amendments i.e: cattle and sheep, dungs; composted farm yard manure, and city garbage; and pigeon and poultry dropping with different dosages for controlling *Meloidogyne incognita* on potato plant cv. Diamant was tested under greenhouse and open field conditions during spring season 2002. Results revealed that all the tested amendments greatly reduced the number of galls and nematode population, as well as increased plant growth response. Amendments of pigeon and poultry manures obviously proved to be the most effective materials for the control of *Meloidogyne incognita* and improving plant growth parameters. Furadan (10% G) gave the best results in the same respect in comparison with all organic manures tested.

Keywords: organic amendments, *Meloidogyne incognita* potato, cv. Diamant, nematode management, Furadan.

INTRODUCTION

The use of organic amendments for the control of plant-parasitic nematode has been extensively studied. Several investigators have found a reduction in the population levels of plant-parasitic nematode, following the addition of organic manures to soil. In most cases, increased activity of organisms in the soil, followed these treatments, and reduction in nematode populations was assumed to be caused by the build up of nematode-destroyed organisms in the soil (National research council, 1970). Research workers suggest that the addition of many of these materials, particularly those high in nitrogen, may be effective alternatives to nematicides for the control of *Meloidogyne* spp. and other plant-parasitic nematodes. (Main and Rodriguez – Kabana, 1982a; and Rodriguez – Kabana, 1986). Many investigators studied the effect of organic manures for controlling the root-knot nematode *M. incognita* on vegetables (Chindo and Khan, 1986; Sharma and Raj, 1987; Osman *et al.*, 1989; Stephan *et al.*, 1989; Stirling, 1990; Stephan, 1995; Akhtar and Mahmood, 1997; and Abd-Alla, 1999). The addition of chicken litter to soil suppresses *Meloidogyne* spp., limits of root galling caused by the nematode and stimulates plant growth, (Main and Rodriguez – Kabana, 1982b). The crop-management benefits and widespread availability of organic manuring especially poultry and cattle manures make it of great efficacy and suitable in agricultural control programs. Mentioned that the treatments of cattle manures, chicken and dove as soil amendments at 2% w/w greatly suppressed the disease index (root-galling) and nematode reproduction (egg-mass production) of *Meloidogyne incognita* on common bean (*Phaseolus vulgaris*). They mentioned also that fresh and dry weights of shoot and root systems of common beans were generally increased by the addition of cattle and chicken manures.

The present study was carried out to evaluate the effect of certain organic amendments on the infection and reproduction of *Meloidogyne incognita* on potato plants as well as plant growth response under greenhouse and field conditions.

MATERIALS AND METHODS

I) Greenhouse experiment:-

Six organic amendments (cattle and sheep dungs; compost farm yard manure and city garbage; pigeon and poultry droppings; and one nematicide, Furadan 10% G) were tested against the root-knot nematode *Meloidogyne incognita* parasitizing potato under greenhouse conditions. All organic materials were air dried and screened (2m.m. mesh) before mixing thoroughly with sand loam soil at the rates of 3 and 6% (w/w) in 20cm. diam. clay pots. Pots were kept moist for ten days to allow decomposition of organic amendments, then one sprout of potato tuber cv. Diamant was planted in the amended pot. Ten days after germination each seedling was inoculated with 3000 newly hatched juveniles (j2) of *M. incognita*. All treatments were replicated three times including those kept without inoculation to serve as check. Pots were kept in greenhouse at 30 ± 5°C in randomized block design. Fifty days after inoculation, the plants were harvested. Data on plant growth, nematode population in the soil and roots; and nematode root-gall indices were counted and recorded.

II) Field experiment:-

A heavy infested area with *M.incognita* was selected to carry out these field experiments. Three of the best treatments were selected from the greenhouse experiment to evaluate them under field conditions. These treatments were (pigeon, poultry dropping; and sheep dung) as well as the nematicide (Furadan 10% G). The nematicide was added as soil application directly before planting time at the rate of 0.6/plant (13Kg/feddan), while the organic treatments were applied two weeks before the planting time at two rates of application i.e 45 and 90 g per plant. Three microplots were chosen for each treatment including the check treatment without any addition of chemicals or organic manures. Each microplot include 20 plants of potato in two rows. The level of infestation of each microplot was determined before and after the treatments. One hundered and ten days after planting, all plants in each microplot were harvested. The number of juveniles in 250g soil was processed for nematode exttraction by means of the Oastenbrink elutriation (Goody, 1963). The root of each plant was stained in lactophenol acid fuchsin. (Goody, 1957). The number of galls and egg masses per root and number of eggs per egg masses were counted for each treatment, and compared with the check.

RESULTS

The effect of six organic amendments i.e cattle and sheep dungs; pigeon and poultry droppings; composited city garbage and farm yard manure, as well as one nematicide, Furadan, were studied against *M. incognita* on potato cv. Diamant under greenhouse and open field. Data in table (1) revealed that all soil amendments tested were significantly effective

Table (1) : Effect of some organic amendments added to soil on galling and reproduction of the root - knot nematode *Meloidogyne incognita* infected potato cv. Diamant in greenhouse condition.

Treatments	Amount added (%w/w)	No. of galls /root	Nematode Population				Nematode final population (Pf)	Rate of Nematode reproduction (Pf/Pi)
			Juveniles in soil/pot	Nematode developmental stages/root	No. of egg masses/ root	No. of eggs/eggs mass		
Cattle dung	3 g	60 B	980 B	23 B	65 B	404 B	27263	9 10
	6 g	37 CD	600 C	15 C	39 DE	377 B	15381	5.106
Compost city garbage	3 g	47 BC	307 EF	14 CD	46 CD	262 CDE	12373	4.124
	6 g	26 DEF	197 GH	11 CDE	34 DE	231 DEF	8062	2.687
Compost farm yard	3 g	30 DE	463 D	6 EF	56 BC	226 DEFG	13125	4.357
manure	6 g	10 G	237 E	11 CDE	12 FG	250 CDE	3348	1.116
Pigeon dropping	3 g	5 G	180 GH	4 F	6 G	210 EFG	1444	0.481
	6 g	3 G	120 H	2 F	3 G	175 G	647	0.215
Poultry dropping	3 g	11 FG	433 D	13 CD	15 FG	273 CD	4541	1.513
	6 g	10 G	257 FG	4 F	13 FG	192 FG	2496	0.832
Sheep dung	3 g	28 DE	487 D	10 CDE	26 EF	295 C	8167	2.722
	6 g	16 EFG	300 EF	4 F	15 FG	252 CDE	4084	1.361
Furadan 10% G	0.6 g	9 G	60 I	12 CD	6 G	166 G	1068	0.356
Check	0	178 A	1093 A	37 A	135 A	540 A	74030	24.67

Values in a column followed by the same letter(s) are not significantly different (P= 0.05) according to Duncan's multi-range test.

in reducing numbers of galls per root, numbers of juveniles in the soil, numbers of eggs per egg-masses, and consequently rate of nematode reproduction. The highest reduction in root galling, number of juveniles in soil and numbers of egg-masses per root were associated with the treatments of pigeon and poultry droppings, and sheep dung manure amendments, respectively under the greenhouse as well as the open field conditions. The modest reduction was obtained with the soil treated by compost of farm yard manure and city garbage, while the least reduction was occurred with the treatment of cattle manure. Data in Table (2) and Figure (1) revealed that the increment in the length and fresh weight of both shoot and root of potato plants was varied greatly according to the type of organic manure. Such improvement in the plant growth was correlated positively with the increase in the dosage of organic amendment. It is interesting to notice that the highest increments in shoot and root lengths as well as in the fresh weights were achieved with the sheep dung and poultry dropping, respectively. While the modest increment was noticed by pigeon dropping and cattle dung. Whereas the least increament was noticed by composted city garbage and farm yard manures.

On the other hand the best increment in plant growth parameters was recorded with sheep dungs compared with all other treatments in the greenhous condation. Data in table (3) show the effects of the addition of organic amendments on the infection and reproduction of *M. incognita* on potato under open field conditions. These data revealed that the effects of such organic amendments were less in the case of open field conditions. Generally, the highest effect was associated with pigeon, followed by poultry, and the sheep dung, respectively. While the nematicide, Furadan gave good results when compared with all organic amendments tested in reducing the rate of nematode reproduction.

DISCUSSION

The present data are in conformity with the findings of Lear (1959); Sayre *et al.* (1964) and (1965); Srivastava *et al.* (1971); Johanson (1974); Khan *et al.* (1974) and (1997); Sitaramaiah, and Singh (1978); Alam *et al.* (1978) and (1980); and Badra *et al.* (1979); who reported that the action of organic amendments against phytonematodes may be attributed to accelerative proliferation of microbial form, which capable of synthesizing and producing substance or toxics against plant-parasitic nematodes or to direct toxicity by the ammonification during decomposition of organic materials in soil. High concentrations of ammonia and nitrite released from high nitrogen concentration organic manure amendments which can act as nematicides [Taylor (1951); Walker (1971); and Akhtar and Mahmood (1997)]. Also all the organic amendments were not equally effective against *M. incognita*, but each one had its greater effect when used in higher dosages on either the nematode population or the plant growth, according to Abd-Alla (1999); and Bekhiet *et al.* (2002). Also Aboul-Eid (1963) showed that all types of organic manures were effective against plant-parasitic nematodes, including the farm

Table (2): Growth response of potato cv. Diamant infected with *M.incognita* under the addition of some organic amendments to soil in greenhouse.

Treatments	Amount added (%w/w)	Lengths in (cm)				Fresh weight in (gm)			
		Shoot	Increasing %	Root	Increasing %	Shoot	Increasing%	Root	Increasing%
Cattle dung	3 g	66 D	136	41 EF	24	82 F	256	32 DE	78
	6 g	86 B	207	44 DEF	33	100 DE	334	36 D	100
Compost city garbage	3 g	42 F	50	45 DE	36	33 HI	43	23 F	28
	6 g	56 E	100	43 DEF	30	56 G	143	36 D	100
Compost farm yard manure	3 g	49 E	75	39 FG	18	44 H	91	29 E	61
	6 g	56 E	100	46 CDE	39	40 H	74	33 DE	83
Pigeon droppings	3 g	53 E	89	48 BCD	45	67 G	191	35 D	94
	6 g	54 E	93	52 B	58	91 EF	296	45 C	150
Poultry droppings	3 g	69 D	146	48 BCD	45	105 D	357	49 BC	172
	6 g	79 C	182	53 B	61	135 C	487	57 A	106
Sheep dung	3 g	88 AB	214	51 BC	55	182 B	691	49 BC	172
	6 g	94 A	236	60 A	82	205 A	791	54 AB	200
Furadan 10% G	0.6 g	90 A	221	62 A		200 A	769	50 AB	
Check	0	28 G		33 G		23 I		18 F	

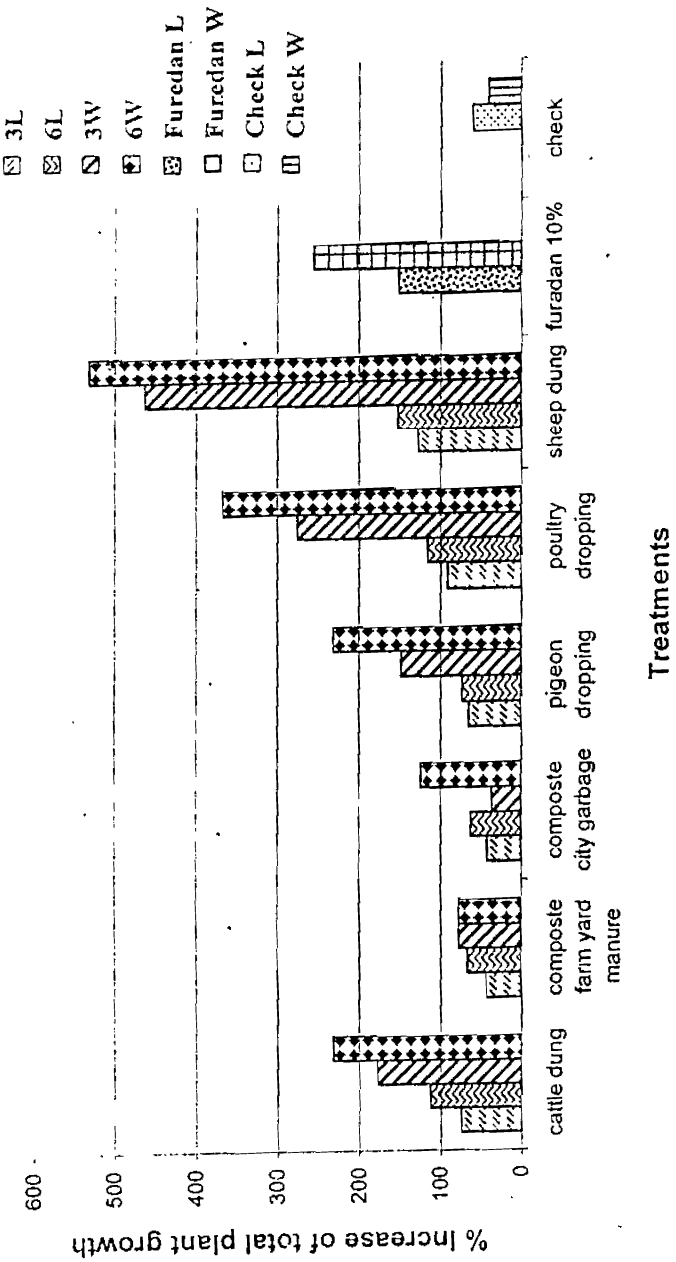

Fig. (1) Increment in total plant growth lengths and fresh weights of potato infected with *M.incognita* and treated with some organic amendments in greenhouse condition.

Table (3) : Avarge numbers of juveniles, galls, egg masses and egg-egg mass of *Meloidgyne incognita* as affected by the addition of some organic amendments to soil potato cultivated with var. Diamant under open field condition.

TreatmentS	Amount added (W/P)	Juveniles in soil	No. of galls/root	No. of egg masses /root	No. of egg-egg masses	% Juveniles in soil reduction	% Root galls reduction	% Egg masses reduction	% Egg-egg masses reduction
Pigeon dropping	45 gr.	220	45	26	260	82.0	85.5	85.0	55.2
	90 gr.	160	33	18	200	87.0	89.4	89.4	66.0
Poultry dropping	45 gr.	500	48	34	295	58.3	85.0	80.0	49.1
	90 gr.	320	36	23	240	73.3	88.4	86.4	59.0
Sheep dung	45 gr.	420	66	43	320	65.0	79.0	75.0	45.0
	90 gr.	240	55	32	280	80.0	82.3	81.1	52.0
Furadan 10% G	0.6 gr.	120	14	12	220	90.0	95.4	93.0	62.0
Check	0	1200	310	170	580				

$$\text{Reduction \%} = \frac{\text{No. of juveniles or galls or egg masses or egg-egg masses} \times 100}{\text{check}} = \text{Resultant} - 100 = \text{Reduction.}$$

yard manure, cattle dung, and pigeon dropping. Generally, the organic manures are necessary for the activities of soil microorganisms, which are in turn necessary for the decomposition of the organic materials in the soil. Furthermore the addition of organic manures to the soil improved its physical and chemical properties and decrease the soil pH, which is necessary for the activities of microbial fungus. This mechanism improves the natural resistance of the soil against nematodes and other pathogens, specially when encourage the natural enemies or release of toxic substances in the soil during the decomposition of organic matter.The present mentioned promising data may be gave more attention to the non-chemical methods for the control of the nematode problems by safe, economic and less dangerous methods.

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تأثير بعض المخلفات العضوية فى مكافحة نيماتودا تعقد الجـــذور (ميلودوجينـــى أنكوجنيتا) على البطاطس

محمد على بخيت ، أحمد محمد شادى ، عبدالمقصـــود عبدالمقصـــود أحمـــد الديـــب ، محمود حسن الحموى

قسم بحوث النيماتودا – معهد بحوث أمراض النباتـــات – مركـــز البحـــوث الزراعيـــة – وزارة الزراعة – مصر

تم اختبار تأثير إضافة بعض المخلفات العضوية مثل مخلفات الماشية والغنم ومخلفـــات المدن ومخلفات المزرعة والدواجن والحمام بجرعات مختلفة فى مكافحة نيماتودا تعقـــد الجـــذور (ميلودوجينى انكوجنيتا) على نباتات البطاطس صنف دايمونت وذلك تحت ظروف الصوبة والحقل. وأسفرت النتائج المتحصل عليها أن جميع المخلفات العضوية أحدثت خفض ملحوظ فى عدد العقـد النيماتودية على الجذور وتكاثر النيماتودا كما أدت إلى تحسن وزيادة فى نمو النبات. وقد اتضح أن مخلفات الحمام والدواجن كانا من أكفء المواد العضوية فى مكافحـــة نيمـــاتودا تعقـــد الجـــذور (ميلودوجينى انكوجنيتا) وكذلك تحسن فى نمو النبات بينما المبيـــد النيمـــاتودى الفيـــوردان ١٠% محبب فقد أعطى أفضل النتائج ضد التعقد الجذرى وتكاثر النيماتودا بالمقارنة بالمخلفات العضويـــة المختبرة.