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Nematode Dynamics in a Soil Amended with Neem Leaves and Poultry Manure

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Abstract: The effects of neem leaves and poultry manure soil amendments on the changing trends of some plant-parasitic nematodes were determined in pots under field conditions for 12 weeks. Populations of *Meloidogyne*, *Scutellonema*, *Pratylenchus* and *Paratrichodorus* decreased with time in all the amendments and the unamended soil. Numbers of nematodes were, however, significantly lower in the amended soil than the unamended soil. The neem based amendments were the most suppressive, recording zero nematode numbers at the end of the study. The application of neem products as soil amendment on fallow land may significantly reduce the numbers of plant-parasitic nematodes before subsequent cropping.

Key words: Plant-parasitic nematodes, neem leaves, poultry manure, soil amendment

INTRODUCTION

Plant-parasitic nematodes cause significant yield reduction in a large number of crops[1,2]. These parasitic nematodes are controlled mostly through crop rotation and the use of chemicals. Synthetic pesticides are heavily used by farmers globally with success.

Significant increases in crop yield have been recorded with the use of these chemicals[3]. The use of the chemicals, however, has adverse effect on the environment[4]. There is thus the need in finding alternatives to chemical nematocides. Alternatives with some economic benefits are currently being developed[5,6].

The control of plant-parasitic nematodes with organic soil amendment especially with neem based materials have proved very effective[7]. Reddy *et al.*[8] effectively used 50 g neem/kg soil to control root-knot nematodes on papaya, the changing numbers of the nematodes in the amendment with time was, however, not studied. The present investigation was conducted to study the dynamics of some parasitic nematodes in soil amended with neem leaves and poultry manure.

MATERIALS AND METHODS

Plant-parasitic nematode infected Haplic Acrisol soil was collected at a depth of 15 cm from a vegetable field at the experimental field of the University of Cape Coast, Ghana.

Dried and ground neem leaves and poultry manure were mixed with the soil at various rates as:

Unamended	:	Raw soil with no addition of poultry manure or neem leaves,
5 g PM/kg soil	:	5 g of poultry manure in a kg of soil,
50 g NL/kg soil	:	50 g of neem leaves in a kg of soil and
50 g NL + 5 g PM/kg soil	:	50 g of neem leaves and 5 g of poultry manure in a kg of soil. Each treatment was put into a pot of 3 kg capacity. The treatments were replicated four times. Each replicate consisted of a batch of ten of the pots. The replicates were randomly arranged on the field in May 2003 using the Completely Randomized Design (CRD).

Sampling was immediately done for the extraction of nematodes. Further sampling was done after 2, 4, 6, 8, 10 and 12 weeks of incubation of treatments. No plant was allowed to grow in the pots. Rainfall was enough at this time of the season to keep the samples moist. During sampling one pot per replicate was picked

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as a representative sample. The content of the pot was thoroughly mixed and 100 g sub-sample taken for nematode extraction.

A modified Baermann's method for nematodes extraction was used[9]. Nematodes in the 100 g sub-sample were migrated through a double-ply tissue sheet into water for 24 h. The migrated nematodes were identified and counted under the a stereomicroscope at 40X magnification[10].

The data were analyzed by using appropriate software tool.

RESULTS AND DISCUSSION

Table 1 represents the impact of the soil amendments on the numbers of *Meloidogyne* sp., *Scutellonema* sp., *Pratylenchus* sp. and *Paratrichodorus* sp. Numbers of *Trichodorus* sp., *Helicotylenchus* sp., *Criconemella* sp. and *Rotylenchus* sp. were also monitored, however, they were very low even in the unamended soil for data presentation. Compared to the unamended soil, the addition of the neem leaves and poultry manure brought a significant reduction in *Meloidogyne* sp. numbers across all the sampling dates. The suppression of the nematode numbers was more significant for the sole neem and the neem plus poultry manure amendments. There was no significant difference, however, between the sole neem and the neem plus poultry manure amendments. The *Scutellonema* sp., *Pratylenchus* sp. and *Paratrichodorus* sp. also followed the same trend as the *Meloidogyne* sp. described above. However, judging from the numbers of nematodes the *Meloidogyne* sp. was found to be higher in population than the rest of the plant-parasitic nematodes assessed. This supports the assertion that *Meloidogyne* sp. are abundant in tropical soils[9].

The neem based amendments recorded no count for nematodes at start for all the four genera of nematodes, a higher count at week 2 and a constant drop in numbers of the nematodes afterwards. The nematodes at start for the neem based amendments might have been weakened or killed through the preparation of the samples and the neem compounds and thus, rendering their detection impossible. The nematodes counted at week 2 could be the combination of some revived weakened nematodes at week zero and newly hatched ones. The sole poultry manure amended soil followed the same patterns of nematode changes, however, there were some nematode counts at 0 week (Table 1).

The effectiveness of organic amendments in the control of plant-parasitic nematodes has been assigned to the enhancement of soil microbial populations and the chemical by-products from the decomposition of the amendments[11]. The higher suppressive effect of the neem leaves in controlling the nematodes could be attributed to its compounds especially azadirachtin[12].

The nematode numbers also declined consistently from start to the end of the experiment for the unamended soil under all the four genera of nematodes, however, the nematode numbers at the sampling dates as mentioned were all significantly higher than in the amended soil. In

Table 1: Neem Leaves (NL) and Poultry Manure (PM) soil amendment on numbers of some plant parasitic nematode

	Nematode No.						
	Weeks of incubation						
Nematode/Treatment	0	2	4	6	8	10	12
Meloidogyne sp.							
Unamended	128 a(a)	120 a(b)	83 a(c)	35 a(e)	40 a(d)	29 a(f)	28 a(f)
5 g PM/kg soil	40 b(b)	45 b(a)	30 b(c)	16 b(e)	24 b(d)	12 b(f)	7 b(g)
50 g NL/kg soil	0 c(e)	15 c(ab)	17 c(a)	13 c(b)	3 c(d)	10 c(c)	1 c(de)
50 g NL+5 g PM/kg soil	0 c(e)	20 c(a)	9 d(b)	6 d(c)	3 c(d)	4 d(d)	0 c(e)
Scutellonema sp.							
Unamended	55 a(a)	54 a(a)	34 a(b)	18 a(cd)	20 a(c)	16 a(de)	14 a(e)
5 g PM/kg soil	38 b(a)	24 b(b)	20 b(c)	13 b(d)	8 b(e)	6 b(f)	4 b(g)
50 g NL/kg soil	0 c(d)	6 c(a)	4 c(b)	3 c(bc)	3 c(bc)	1 c(d)	1 c(d)
50 g NL+5 g PM/kg soil	0 c(d)	7 c(a)	3 c(b)	2 c(bc)	1 c(cd)	1 c(cd)	0 c(d)
Pratylenchus sp.							
Unamended	16 a(a)	12 a(a)	13 a(a)	8 a(b)	4 a(c)	2 a(c)	2 a(c)
5 g PM/kg soil	3 b(b)	8 b(a)	7 b(a)	3 b(b)	2 b(bc)	1 b(cd)	1 b(cd)
50 g NL/kg soil	0 c(c)	4 c(a)	2 c(b)	1 c(bc)	0 c(c)	0 c(c)	0 c(c)
50 g NL+5 g PM/kg soil	0 c(c)	5 c(a)	2 c(b)	1 c(bc)	0 c(c)	0 c(c)	0 c(c)
Paratrichodorus sp.							
Unamended	20 a(a)	14 a(b)	15 a(b)	12 a(c)	9 a(d)	8 a(d)	8 a(d)
5 g PM/kg soil	10 b(b)	12 a(a)	8 b(c)	4 b(de)	5 b(d)	3 b(e)	1 b(f)
50 g NL/kg soil	0 c(b)	2 b(a)	2 c(a)	1 c(ab)	0 c(b)	0 c(b)	1 b(ab)
50 g NL+5 g PM/kg soil	0 c(b)	3 b(a)	1 c(bc)	1 c(bc)	0 c(c)	0 c(b)	0 c(b)

Letter(s) adjacent figures (means from the four replicates) show separation of means using the Duncan's Multiple Range Test within each genera of nematode. Letter(s) without brackets shows differences among figures within columns while those in bracket shows differences along rows ($p \leq 0.05$)

the absence of a plant host the populations of plant-parasitic nematodes decline in soil with time under fallow conditions[13], however, amending fallow soils with organic materials especially neem products may completely control plant-parasitic nematodes before crops are planted afterwards.

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