FIELD ASSESSMENT OF THE NEMATICIDAL PROPERTIES OF NEEM (*AZADIRACHTA INDICA*) AGAINST THE ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* ON INFECTED TOMATO (*LYCOPERSICON ESCULENTUM*)

ABOLUSORO S.A.[1] and OYEDUNMADE E.E.A.[2]

1. Department of Crop Production Technology, DAC/ABU, Kabba, Kogi State
2. Department of Crop Protection, University of Ilorin, Ilorin, Kwara State

ABSTRACT

The toxic effects of neem, Azadirachta indica fruit powder against a root-knot nematode, Meloidogyne incognita on tomato was investigated in the field in the year 2002. Tomato Roma var. Uf was planted on a ploughed and harrowed field. Each plant stand was inoculated with 2000 Meloidogyne incognita juveniles. The treatments were made up of four levels; 0.5, 1.0, 1.5 and 2.0 tonnes/ha of neem fruit powder, while there was an untreated control denoted by 0 tonne/ha. The experiment lasted for a period of sixteen weeks. The results from the experiment showed that neem fruit powder brought about a significant increase in growth and yield of nematode-infected tomato as compared with the control. At 10 and 12 WAP, plant height and number of leaves/plant were significantly higher in the treated plants. The number and weight of tomato fruits were also significantly higher in the treated plants than in the untreated control. The nematode multiplication rate and damage caused by the nematode on tomato roots (root gall index) were significantly lower in the treated plants than in the control. The higher concentrations of the neem powder were significantly more effective than the lower concentrations in controlling the nematode and consequently improving the growth and yield of treated tomato plants.

Key Words: Neem, Nematicidal Properties, Root Knot Nematode, Tomato.

INTRODUCTION

Tomato, *Lycopersicon esculentum* (L) Mill is a very important fruit vegetable in all homes in Nigeria. The average ripe fruit has been reported to contain about 90 kilocalories of energy, 1.0g of crude protein, 24mg of phosphorus, 0.4mg of iron, 1000 I.U of vitamin A, 25mg of vitamin C, 0.04mg of riboflavin, 0.05mg of thiamin and 0.1mg of Niacin (Sigmund and Gustav, 1991). In Nigeria, the yield of tomato is low as a result of attack by many pests, notable amongst which are the root knot nematodes belonging to the genus *Meloidogyne* (Verma and Anwar, 1997; Fatoki, 2001). The pressure on Nigeria for increased tomato production in order to meet its dietary supply for the growing population will continue to rise in the years ahead. There is therefore, the need to contend with the menace of the root knot nematodes in tomato production.

Majority of the Nigerian farmers in all nematode endemic areas are resource constrained. There is therefore the need to come up with nematode management strategy that is adoptable and sustainable by the farmers at affordable level of resource inputs at their disposal. Neem, *Azadirachta indica* A. Juss is one of the plants that have been tested and approved for its effectiveness against various field insect pests. For the control of root knot nematodes, neem cake derived from the fruit has been used (Akhtar and Mahmood, 1994). Since several Nigerian farmers lack the technology for producing neem cake, this study therefore focuses on the use of whole neem fruits for the control of the root-knot nematode, *Meloidogyne incognita* on tomato.

MATERIALS AND METHODS

The experiment was conducted on a root knot nematode-infested field measuring 250m^2 at Kabba College of Agriculture, Ahmadu Bello University. The trial was carried out between July and December in 2002 and the field was ploughed, harrowed and ridged. It was then marked into four blocks, each made of 5 plots. Each plot measured 16m^2 and contained 4 ridges. One meter between block and one ridge between adjacent plots were left as alley. The experimental design was randomized complete block comprising of 5 treatments replicated 4 times.

Pre-planting soil nematode population was assessed by the method of Whitehead and Hemming (1965) and additional 2000 juveniles of the root knot nematode (*Meloidogyne incognita*) were added to the soil of each plant stand. Fresh neem fruits were picked, air-dried and milled into powder form to serve as amendment material.

Tomato var Roma UF was raised in steam- sterilized nursery soil and was transplanted to the permanent field after a period of 3 weeks. Inoculation with 2000 juveniles of *M. incognita* followed after 2 weeks of transplanting, while the powder of the neem fruit was applied by banding and incorporated into the soil at the rates of 0 (untreated control), 0.5, 1.0, 1.5 and 2.0 tonnes/ha. Weeds were controlled manually, while the field observation lasted for 120 days.

Plant height and number of leaves were recorded at 8, 10 and 12 weeks after planting (WAP), while number of branches/plant was recorded at 14 WAP. At harvest, plants from each plot were carefully uprooted, washed free of adhering soil particles and rated for galling using infection class index of 0-5 described by Taylor and Sasser (1978).

Final nematode population was determined by the method of Whitehead and Hemming (1965) from 200g soil sample collected from around the root zone of plants that were uprooted. Root nematode population was determined by the method of Byrd *et al.* (1983). Analysis of variance was carried out on all data and where necessary means were partitioned using Duncan`s multiple range test.

RESULTS

The effects of various levels of neem fruit powder on the growth of tomato var. Roma Uf on the root-knot nematode infested field are shown in Table 1. The number of leaves, branches and height recorded were significantly higher ($P<0.05$) in the treated plants than in the untreated control at 10 and 12 weeks after planting (WAP), while they were not significantly different at 8 WAP. Generally, the higher concentrations (1.5 and

2.0 t/ha) of the neem treatment were more effective in increasing the number of leaves and branches per plant than the lower concentrations.

The various levels of the neem amendment brought about variation in fruit number, fruit weight and the yield (Table 2). Fruit weight and yield were significantly higher in the 1.5 and 2.0 t/ha treatments than in the lower treatment concentrations. Number of fruits, weight of fruits and yield were significantly higher in all the treated plants than in the untreated control.

Table 3 shows the various levels of *A. indica* amendment on the final population of nematodes in the soil. The various levels of the neem soil amendment brought about differential soil population dynamics, which in turn determined the multiplication rate. The treatments also brought about various gall indices. The *A. indica* treatments at 1.5 and 2.0 t/ha reduced the soil and root nematode populations significantly better than 0.5 and 1.0 t/ha. Multiplication rate and gall index were also lower in soil treated with 1.5 and 2 t/ha and significantly different from the treatments at lower levels (0.5 and 1.0 t/ha). Final nematode population, multiplication rate and gall index were significantly less in all the treated plants than in the untreated control.

DISCUSSION

The root-knot nematode *M. incognita* significantly reduced the growth of tomato as manifested in the height, number of leaves and number of branches of the untreated control plants compared with the treated plants. The superior growth observed in the neem-treated plants is due to reduction in adverse effect of *M. incognita* as a result of reduced nematode population in the treated soil. This reduction in adverse effect in turn promoted growth and yield.

This observation agrees with those of earlier researches. D`Addabo (1995), Akhtar and Mahmood (1997) as well as Verma and Anwar (1997) reported the importance of various soil amendments in reducing nematode population build-up in the soil and consequent increase in crop yield.

The neem treatments suppressed the nematode population and gall index, while they increased the growth and yield of the treated tomato plants. The negative relationship observed between the parameters of soil nematode population and root galling index and those of growth and yield suggests that the damage was due to nematode density and their activities in the plant tissue. As reported by Sasser *et al.* (1975), high population of a nematode species brought about a high negative correlation for density versus growth-index and yield factor.

From the results of this work, it can be recommended that farmers who are producing tomato in root knot nematode endemic areas should use neem fruit powder for effective nematode control and yield increase.

REFERENCES

Akhtar, M. and I. Mahmood (1994). "Control of root-knot nematodes by bare root dip in undecomposed and decomposed extracts of neem cake and leaf". ***Nematol. Medit***. 22: 55-57.

Akhtar, M. and I. Mahmood (1997). "Impact of organic and inorganic management and plant based products on plant parasitic and microbivorous nematode communities". ***Nematol. Medit.*** 25: 21-23.

Anjum, A., M.M. Alam and A. Ahmad (1996). "Efficacy of some organic amendments against reniform nematode, ***Rotylenchulus reniformis*** on blackgram," ***Annals of Plant Protection Science*** 4(2): 122-125.

Byrd, D.W., T. Kirkpatrick and K.R. Bakers (1983) "An improved technique for clearing and staining plant tissue for detection of nematodes" ***Journal of Nematology*** 15:142-143.

D`Addabo T. (1995), "The nematicidal effects of organic amendment; Literature 1982-1994, ***Nematol. Medit.*** 23: 299-385.

Fatoki, O.K. (2001) "Comparative effects of carbofuran and some selected plants on the biology and pathogenicity of ***Meloidogyne incognita*** on cowpea and tomato. Ph.D. thesis, Dept of Crop Protection and Environmental Biology, University of Ibadan, Ibadan, Nigeria.

Purseglove, J.W.P. (1974), ***Tropical Crops. Dicotyledons.*** Longman Group Ltd, London, pp 531-538.

Sasser, J.N., Baker K.R. and Nelson N.A. (1975) "Correlation of field population of nematodes with crop growth response for determining relative involvement of species" ***Journal of Nematology*** 7(2): 193-198.

Sigmund, R. and Gustav, E. (1991) ***The cultivated plants of the tropics and subtropics.*** CTA. pp 133-140.

Taylor, A.L. and Sasser J.W. (1978) ***Biology, identification and composition of root-knot nematode. (Meloidogyne spp.)*** Coop Pub. Dev. Plant Pathol. North Carolina State University and USAID, Raleigh, 111pp.

Verma, A.C. and Anwar A. (1997) "Control of *Meloidogyne incognita* on pointed Gourd". ***Nematol. Medit.*** 25: 31-32.

Whitehead, A.D. and Hemming J.A. (1965) "A comparison of methods of extracting small vermiform nematodes from soil" ***Ann. Appl. Biol.*** 55: 25-38.

Table 1: Effect of neem fruit powder on the growth of tomato var. Roma Uf infected with the root-knot nematode, *Meloidogyne incognita*

Neem Concentration (t/ha)	Average plant height (cm^2)			Average number of leaves / plant			Average number of branches/plant
T/ha	8WAP	10WAP	12WAP	8WAP	10WAP	12WAP	14WAP
0.5	35.13	59.5^{b}	60.75^{b}	14.9	28^{c}	31.8^{b}	6.33^{b}
1.0	36.42	67.9^{a}	69.25^{ab}	16	31.8^{b}	37.3^{b}	6.90^{b}
1.5	37.32	72.05^{a}	74.8^{a}	15.5	32^{b}	39.4^{a}	7.38^{a}
2.0	37.40	73.0^{a}	78.3^{a}	16.3	37.4^{a}	42.3^{a}	7.40^{a}
0 (control)	35.2	47.8^{c}	49.3^{c}	15	20.5^{d}	23.9^{c}	2.45^{c}
	*NS			NS			

Means with the same letter in the same column do not differ significantly at P = 0.05 according to Duncan`s multiple range test.

*NS = Not Significant

Table 2: Effect of neem fruit powder on the yield component of tomato Var Roma uf infected with the root knot nematode, *M. incognita*

Neem concentration (t/ha)	Average number of fruit	Average weight of a fruit (g)	Yield (t/ha)
0.5	12.0^{b}	23.4^{b}	9.40^{d}
1.0	12.6^{ab}	24.8^{ab}	10.63^{c}
1.5	12.9^{ab}	25.3^{a}	12.33^{b}
2.0	13.1^{a}	26.0^{a}	13.18^{a}
0 (control)	5.2^{c}	15.8^{c}	2.77^{e}

Means with the same letter in the same column do not differ significantly at P = 0.05 according to Duncan`s multiple range test.

Table 3: Initial root-knot nematode population and effect of different levels of neem fruit powder on final nematode population, nematode multiplication and gall index of tomato root

Neem concentration (t/ha)	Initial nematode population	Final nematode population in 200g soil	Nematode multiplication rate (pf / pi x 100)	Root gall index	No. of juveniles/ 5g root
0.5	2043	835 [d]	40.9 [d]	3.0 [c]	16.2 [b]
1.0	2046	761 [c]	37.2 [c]	2.75 [b]	13.6 [b]
1.5	2033	667 [b]	32.8 [b]	2.60 [ab]	10.3 [a]
2.0	2039	547 [a]	26.8 [a]	2.40 [a]	8.7 [a]
0 (control)	2050	2472 [e]	120 [e]	4.85 [d]	26.0 [c]
	*NS				

Means with the same letter in the same column do not differ significantly at P = 0.05 according to Duncan`s multiple range test.
*NS = Not Significant