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Effect of Organic Soil Amendments on the Groundnut (*Arachis hypogea* L.) Infected by Nematode (*Meloidogyne incognita*) in Girei Local Government Area of Adamawa State

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ABSTRACT

A green house experiment was carried out to study the effect of organic soil amendment on groundnut (*Arachis hypogae* L.) root knot nematode pathogen (*Meloidogyne incognita*) in Modibbo Adama University of Tecnology, Yola., Girei local government area. Plant materials (*Azadirachta indica*, *Cassia fistula*, *Cassia siamea* and their mixture) were used as soil amendments to control *M. incognita* on groundnut. Leaf amendment at different weight of organic amendments 50, 100, 150 and 200g were used as treatments and the control was not amended with extracts. The result of the study showed that plants treated with extracts at different levels significantly ($p<0.001$) suppressed the development of *Meloidogyne incognita* in the soil and root system of groundnut leading to reduction in number of galls formed compared to control plants. The highest population of *Meloidogyne incognita* was in the unamended soil (286.9) while in the amended soil population was as low as 67.3. The highest number of *Meloidogyne incognita* in the root was recorded in the control plant (125.4) while roots of treated plants recorded as low as 25.6. The control had the highest number of galls (123.2) while the galls of treated plants was as low as 67.4. Among the amended, 200g extract had the lowest population of *M. incognita* in the soil, root and galls formation which showed a significant increase ($p<0.001$) in growth and yield of groundnut. All the leaf amendments in the treatment at different levels effectively controlled *M. incognita*, reduced gall formation particularly mixture of leave extracts.

Keywords: Galls, *Meloidogyne incognita*, Kampala, *Cassia fistula*, Juvenile, Nematode, *Cassia siamea*, *Azadirachta indica.*

INTRODUCTION

Agriculture is the mainstay of Nigeria's economy with about 60% of the rural folks depending on it for their livelihood (Mohammed, 2007). One of the most economic and versatile crops cultivated in the country is groundnut, *Arachis hypogea* L. (Chigbu, 2005). The leguminous crop has been listed as one of the 20 crops that stand between man and starvation (FRN, 2000). The seed is rich in calories and contains 25% protein (Wittwer, 1981). Groundnut may be boiled, roasted, fried, ground into paste or crushed for oil (Dickson and De Waele, 2005).The shells are used for fuel by some local oil factories or they are sometimes spread on the field as a soil amendment (Mukhtar, 2009). They could also be used as bulk in livestock rations or in making chipboard for use in joinery (Grosso and Guzman, 1995).

Groundnut is grown in nearly 100 countries with China, India, Nigeria, USA, Indonesia and Sudan as major producers. According to Rowland (1999), seed yield in Northern Nigeria is about 3000 Kg/ha. Adamawa Agricultural Development Programme, ADADP (1996) enumerated groundnut varieties commonly grown in Adamawa State to include: Ordaaji; Local (2 nuts/ shell), Kwamakuni; Local (3nuts/shell), Local (2 nuts/shell but larger), Kwathrumthrum; Kampala (striped brown/white nuts) and Kwanyambi or Ex Dakar. According to Kadams (1995), the first three local types listed predominated production in the old days but recently most people prefer to grow the new Kampala type which attracts money due to its high yield and oil contents. Idama (2000) reported that revenue generation is perhaps the most important responsibility of modern government. He asserted that the welfare needs of the people increase, sources of generating revenue to meet the need must be found. He further opined that, investing heavily on such wealth generating activities as groundnut production and other agricultural business, a lot of farmers would have greatly improved.

MATERIALS AND METHODS

Area of the Study

The study was carried out in Plant Science Botanical garden in Modibbo Adama University of Technology Yola from May to December 2015. Top soil (sandy loam) was used for the experiment. The soil was collected from the Plant Science Botanical garden in Modibbo Adama University of Technology Yola. The soil was sterilized with oven to a temperature of 100^0C and was maintained for four hours. Leaves of golden shower (*Cassia fistula* L.), blue gum (*Azadirachta indica)***,** and kassod tree (*Cassia siamea*) were used for the experiment. The leaves were separately collected with shears from their respective plant locations within the premises of Modibbo Adama University of Technology Yola and spread on polythene sheets in a corridor for one week to dry under shade. The leaves were grounded separately into fine particles when dried using grinding machine as adopted by (Hussey and Barker, 1973).

Experimental Design

A completely randomized design was used for the experiment with four (4) replicates. The experiment consisted of *C. fistula, A. indica, C. siamea*, mixture of leave extracts and control. The design was used for the amendment rates of 50, 100, 150 and 200g respectively.

Amendment Rate

Weights of 50, 100, 150 and 200gms each of the grounded leaves was mixed separately with 25kg of sterilized soil in a 25cm diameter perforated polythene bag and transferred into the plot. The control plants were measured into the perforated polythene bag without mixture.

Collection and Sowing of Seeds

Groundnut seed cultivar (Kampala) was obtained from Adamawa Agricultural Development Program (ADADP) Yola. The seeds were sown into the 25cm diameter perforated polythene bags each containing the three leaf extracts differently, the control bags were sown with sterilized soil without leaf extract and mixture of the leaf extracts (*Cassia fistula, Azadirachta indica and Cassia siamea*) were combined and sown in each bag containing sterilized soil. The seeds were sown 2cm depth and allowed under rain fed condition and the soil were loosened from time to time to avoid compaction using hand fork. A similar set-up was carried out consisting of mixtures of the three leaf extracts mentioned above in each bag (16.66g of each leaf extract for 50g, 33.33g for 100g, 50g for 150g and 66.66g for 200g respectively).

Collection of Root Knot Nematode Samples

The pathogen was obtained from a garden in Federal Housing Estate Bajabure, Girei local government area, Adamawa state. Pathogen of root knot nematode (*Meloidogyne incognita*) was collected from pawpaw plants and the soil within the garden. The pathogen is shown in Plate i. Roots of diseased plants showing characteristic symptoms of gall formed of root knot nematode were carefully uprooted at 5 to 10cm depth using shovel in a zig-zag form from the rhizosphere of the diseased plants with approximately 1kg of soil. The samples collected were placed in a polythene bag and taken for laboratory analysis.

Inoculation Procedure

The groundnut plants were inoculated with nematode two weeks after planting for it to be active. The population of about 100 juvenile nematodes per plant was used. Holes of about 2cm deep and 1cm wide each was made in the soil around each seedling to expose the roots. The second-step juvenile nematode suspension was applied into each hole using syringe and the hole was mixed with moist soil. The treatment was replicated four times for the period of six days.

Method of Data Analysis

Data collected were analyzed using analysis of variance (ANOVA). The means were separated using Least Significant Difference (LSD) at ($p<0.001$) with Statistical Analysis System (SAS) software.

RESULTS AND DISCUSSION

Effect of Different Leaf Extracts on Population of *Meloidogyne incognita* in the Soil and Root System of Groundnut

The result of the study showed that all treatments significantly (P<0.001) reduced the population of *M. incognita*, in the soil and root and increased plant growth and yield compared to control plants. The highest number of *M. incognita* was in the untreated soil (286.9) while in the treated soil with extracts population was reduced as low as 67.3 in the mixtures of plant extracts. Similarly, the highest *M. incognita* population in the roots was recorded in the control plants (125.4), while roots of treated plants had the lowest (25.6) as shown in Table 1.

Table1. *Population of Meloidogyne incognita in the Soil and Root System of Groundnut Plant.*

Plant extracts	Population per 25kg of soil	Population per root system
C. fistula	189.7	40.9
A. indica	*207.4*	53.7
C. siamea	*190.9*	51.5
Mixture	*67.3*	25.6
Control	*286.9*	125.4
LSD	*70.42*	21.81

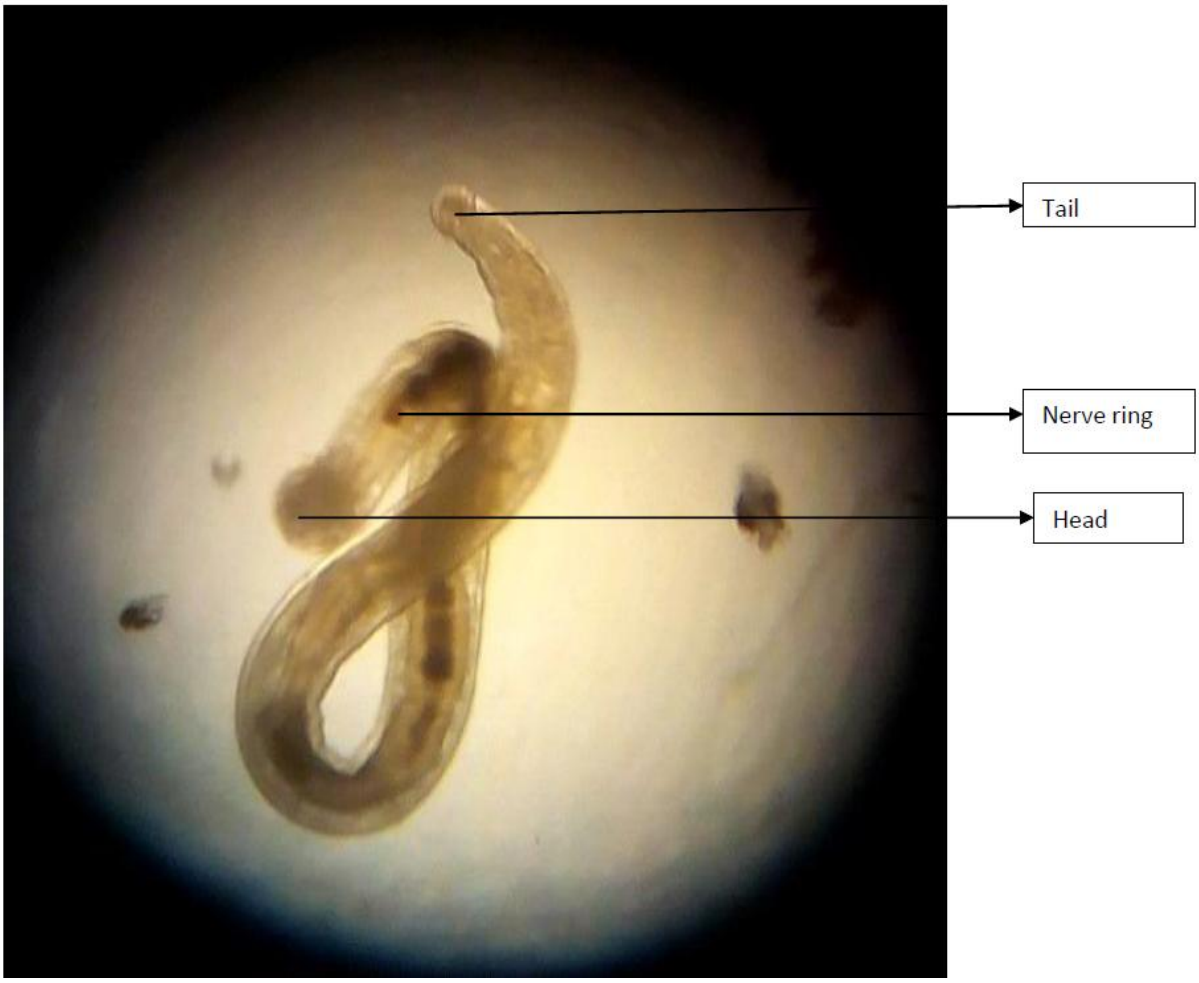

Plate I. *Meloidogyne incognita*

Weight of Leaf Extracts on the Population of *Meloidogyne incognita* in the Soil and Root System of Groundnut Plant

Among the weight, the result of the study showed a significant variation (p<0.001) at each level of amendment. Weight of 50g had the highest population of *M. incognita* in the treated soil and root with 239.3 and 68.4 respectively while 200g reduced to as low as 117.3 and 33.5 respectively as shown in Table 2.

Table2. *Amendment Rate on Population of M. incognita in the Soil and Root of Groundnut.*

Doses of leave extracts (g)	*M. incognita* in soil	*M. incognita* in root
50	239.3	68.4
100	222.1	59.9
150	221.9	55.6
200	177.3	33.5
LSD	70.42	21.81

Effect of Different Leaf Extracts on Root Gall Formation in the *Meloidogyne incognita* Infected Root System of Groundnut Plant

There was significant difference ($p<0.001$) between the control and treated plants. Maximum number of galls formed was recorded in the control plant (123.2), while mixtures of plant materials of the treated plants had the lowest number of galls (67.4) as shown in Table 3.

Table3. *Effect of different leave extracts on the of gall formation of Meloidogyne incognita infected root of groundnut Plant.*

Leave extracts	**Number of galls form**
C. fistula	**80.4**
A. indica	**72.1**
C. siamea	**87.8**
Mixture	**67.4**
Control	**123.2**
LSD	**13.53**

Effect of Weights of Leaf Extracts on Root Gall Formation of *Meloidogyne incognita* Infected Root System of Groundnut Plant

There result among the doses showed that 50g leave extract had the highest galls formed with 80.4 while 200g had the lowest with 67.4 as shown in Table 4.

Table4. *Effect of Amendment Rate on the Number of Galls Formed*

Doses of leave extracts (g)	**Number of galls form**
50	80.4
100	72.1
150	87.8
200	67.4

DISCUSSION

The results of this study showed that amending the soil using some organic materials, namely: leaf powder of *Cassia fistula, Azadirachta indica Cassia siamea* and mixtures of leaf powder reduced the population of *Meloidogyne incognita* in both the soil and root system of groundnut plants, reduced galls formed. Similar work was reported by Saravanapriya and Sivakumar (2003); Mohilal and Dhanachand (2003); Tariq and Siddiqui (2005); Dohroo and Gupta (1995) that the use of organic soil amendment affects the production of nematode and increase the growth and yield of plants. The use of plant materials for the management of nematode populations is apparently effective and environmentally friendly compared to synthetic nematicides. Soil amendments with leaves of many plants have been shown to reduce the rhizosphere population of *Meloidogyne* spp. (Wang *et al*., 2004; Tsay *et al*., 2004; Wani, 2006). The result of the study showed that plants treated with leave extracts had significant difference compared to control plants with mixture of plant material having highest population reduction of nematode in the treated soil and root. There is another possibility that the addition of organic matter to the soil stimulates the microbial activities of bacteria, fungi, algae and other microorganisms (Webster, 1972; Sayre, 1980; Rodriguezkabana *et al*., 1987). It is reported that addition of compost to soil decreases nematode pest and results in increased crop growth and yield. This might be due to the fact that addition of compost to the soil increases soil nutrient status, changes the physical and tropic structure of soil which might affect the plant growth and yield performances (Akhtar and Mahmood, 1996 and Pandey, 2000).

CONCLUSION

The findings of this study showed that the use of leaf powder of *Cassia fistula, Azadirachta indica, Cassia siamea,* particularly their mixtures have significant control on the population of *Meloidogyne incognita* and results to better growth of groundnut. The findings indicate that controlling root knot nematode (*Meloidogyne incognita*) with leaf powder is a potential variable venture.

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