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Evaluation of Organic Soil Amendments on Groundnut (*Arachis hypogeal* L.) Roots Infected by *Meloidogyne incognita* In Modibbo Adama University of Technology Girei Local Government Area of Adamawa State.

[1]Bamsida, Z., [2]Aji, P. O., [3]Williams, W.
[1]*Department of Plant Science, Modibbo Adama University of Technology, Yola*
[2]*Department of Biological Science, Federal University, Wukari*
[3]*Department of Agriculture Technology, Adamawa State Polytechnic, Yola*

Abstract: *A study was conducted in Plant Science garden in Modibbo Adama University of Technology Yola to evaluate the influence of organic soil amendment on girth, shoot height and number of branches of groundnut (Arachis hypogae L.) infected by nematode (Meloidogyne incognita) in Girei local government area. Azadirachta indica, Cassia siamea and Cassia fistula extracts with the concentrations of 50, 100, 150 and 200g were used as soil amendments to treat Meloidogyne incognita. There was significant difference (p<0.001) observed between the treatments and best growth was observed at dose 150g for C. fistula, A. indica and C. siamea with 2.1138cm, 2.0988cm and 2.1388 respectively for the girth. At dose 200g, the best shoot height was 19.25, 17.71 and 19.73 C. fistula, A. indica and C. siamea respectively. The treated plants had the higher number of branches produced at dose 200g for C. fistula (12.95%), while highest number of branches was observed at dose 100g for A. indica and C. siamea with 12.30% and 11.95% respectively.*

Keywords: *C. siamea, Girth, Kampala, C. siamea, Shoot, extract, A. indica, Meloidogyne incognita*

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I. Introduction

Nigeria is generously endowed with abundant natural resources including biological and non biological resources. It constitutes one of the most important sectors of the economy. The significance of agriculture resource in bringing about economic growth and sustainable development of a nation cannot be underestimated. Agriculture contributes to the growth of the economy, provides employment opportunities for the teaming population, export revenue earnings and eradicates poverty in the economy. Abayomi (1997) stated that stagnation in agriculture is the principal explanation for poor economic performance, while rising agricultural productivity has been the most important concomitant of successful industrialization.

The root knot nematode (RKN) *Meloidogyne incognita* is an important plant parasitic nematode that infects different plant species causing significant yield losses either through direct feeding on roots or indirectly through interactions with soil borne fungal pathogens (Srivastava, 1973). The changes that occur in the roots include disruption of the root xylem epidermal and cortical tissues development, which in turn affect water and nutrient uptake resulting in stunted growth (Kirkpatrick *et al*., 1991). Nematode damage affects root efficiency on the one hand, but addition-ally leads to root necrosis and death, undermining plant anchorage; heavily infected bunch-bearing plants can topple due to poor root anchorage leading to total loss of the unripe fruit (Gowen *et al*., 2005). The root knot nematode (RKN) *Meloidogyne incognita* is an important plant parasitic nematode that infects different plant species causing significant yield losses either through direct feeding on roots or indirectly through interactions with soil borne fungal pathogens (Srivastava, 1973).

In the recent past, the use of nematicides has led to a significant reduction of *Meloidogyne* spp. populations in crop production (Jones *et al*., 2013). However, due to their toxicity and adverse effects on the environment, many nematicides have been or are currently being withdrawn from the market (Jones *et al*., 2013). The root-knot nematode has been variously controlled by nematicides, fungicides or the combination of both and with insecticides (Wang *et al*., 2004). Although the use of those chemicals were proven to be effective but has negative effects on the environment and other ecological consequences cannot be overlooked (Wang *et al*., 2004). Therefore there is an urgent need to shift attention from the conventional use of synthetic hazardous control measures to more environmentally friendly use of less toxic methods of pest and disease control such as plant based substances (Wang *et al*., 2004). The application of organic manure and root exudates have been widely reported to reduce nematode populations in the soil as a result of the large quantity of organic material that is added to the soil (Egunjobi and Onayemi, 1981). Organic amendments have been advocated as a suitable

biological control measure against plant parasitic nematodes particularly for the resource poor farmers from many African countries (Olaniyi *et al*., 2005).

II. Materials and Methods

2.1 Study area

Study was carried out in Plant Science garden in Modibbo Adama University of Technology in Girei local government area from May to October 2015. Sandy loam soil was used for the experiment. The soil was collected from the garden and sterilized using oven at 100^0C for four hours. The Leaves of *Cassia fistula* L., *Azadirachta indica***,** and *Cassia siamea* were collected separately from their respective plants within the school premises of Modibbo Adama University of Technology Yola and spread on polythene sheets under a shade for one week to dry. The method of Hussey and Barker (1973) for obtaining the leave powder was used.

2.2 Experimental Design

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

2.3 Leave Doses

Leave doses of 50, 100, 150 and 200g each of the leaves powder was mixed separately into 25kg of sterilized soil in a 25cm diameter perforated polythene bags and transferred into the plot. The control plants were measured into the perforated polythene bags without mixture of leave amendments as adopted by Chimbekujwo and Modu (2013).

2.4 Collection and seeds sowing

Groundnut seed (Kampala) was obtained from Upper Benue River Basin Authority Yola. The seeds were sown into the 25cm diameter perforated polythene bags each containing the three leaf amendments differently, the control bags were sown without leaf extract. 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.

2.5 Collection of root knot nematode samples

The pathogen of root knot nematode (*Meloidogyne incognita*) was obtained from both pawpaw plants and soil in the garden of Federal Housing Estate Bajabure, Girei local government area, Adamawa state. The samples collected were placed in a polythene bag and taken for laboratory for further studies.

2.6 Inoculation procedure

The groundnut plants were inoculated with 100 juvenile nematodes two weeks after planting by making holes of about 2cm deep and 1cm wide. The treatments were replicated four times for the period of six days using the method of Hussey and Barker (1973)

2.7 Data analysis

The 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 version 8.

III. Results and Discussion

3.1 Effect of different leaf amendment on girth size of *Meloidogyne incognita* infected root system of groundnut plant.

The maximum size of girth per plant was recorded in the plants treated with leaf amendments of *Cassia fistula* (2.24cm), followed by *Azadirachta indica* (2.18cm) and *Cassia siamea* (2.14cm). The lowest girth size per plant was recorded in the control plants with (2.04cm). The result showed that treatments were significant at $p< 0.001$ (Table 1).

Table 1. Effect of Leaf Extract on the Girth size of Leave *Meloidogyne incognita* Infected Root System of Groundnut Plant from Period of Germination to Harvest.

Plant extracts	**Girth size (cm)**	
C. fistula	2.24	
A. indica		2.18
C.siamea		2.14
Control	2.04	
LSD	0.113	

3.2 Doses of different leaf extracts on the girth size of *Meloidogyne incognita* infected root system of groundnut plant.

The result showed a significant difference ($p<0.001$) among the doses. The highest girth size was recorded in leave extract of *C. siamea* at dose 200g (2.1388cm) while leave extract of *A. indica* at 100g was recorded the lowest (1.9738cm). It was observed that, there is significant difference ($p<0.001$) in the treatments (50, 150 and 200g) Table 2.

Table 2. Amendment Rate on the Girth Size of Leaves Produced

Doses of Leave extracts (g)	*C. fistula* (cm)	*A. indica* (cm)	*C. siamea* (cm)
50	2.1138	1.9988	2.0888
100	2.0388	1.9738	2.0888
150	2.1138	2.0988	2.1388
200	1.9888	2.1738	2.0138
LSD	0.11334	0.11334	0.11334

3.3 Effect of different leaf extracts on the shoot height of *Meloidogyne incognita* infected root system of groundnut plant.

The result showed that plant extract of *C. siamea* was recorded with the highest shoots height of 1973cm followed by *C. fistula* (1925cm), and *A. indica* (1771cm). Plant without extract amendments recorded the lowest with 1741cm. There was significant difference ($p>0.001$) in the treatments is shown in Table 3.

Table 3. Effect of Different Leaf Extracts on the Shoot Height per Plant on *Meloidogyne incognita* Infected Root System of Groundnut Plant.

Plant extracts	Shoot height (m)
C. fistula	19.25
A. indica	17.71
C. siamea	19.73
Control	17.41
LSD	3.018

3.4 Doses of different leaf extracts on the shoot height of *Meloidogyne incognita* infected root system of groundnut plant.

The result showed that leave extract of *C. siamea* at dose 200g had the higher shoot height (19.73m) while leave extract of *A. indica* at 50g had the lowest (14.06m). There was significant difference at ($p<0.001$).

Table 4. Amendment Rate of Shoot Height of Groundnut Plant

Doses of Leave extracts (g)	*C. fistula* (m)	*A. indica* (m)	*C. siamea* (m)
50	15.87	14.06	15.35
100	14.95	16.96	15.40
150	18.10	17.04	17.20
200	19.25	17.71	19.73
LSD	3.018	3.081	3.081

3.5 Effect of different leaf extracts on the number of branches of *Meloidogyne incognita* infected root system of groundnut plant.

The result showed that *A. indica* had the higher number of branches produced (12.95%) followed by *C. siamea* (11.95%) and *C. fistula* (11.85%) while control plant had the lowest (11.40%). There was no significant

difference (p>0.001) observed in number of branches produced between the treated and the control plants as shown in Table 5.

Table 5. Effect of Different Leaf Extracts on the Number of Branches per Plant on *Meloidogyne incognita* Infected Root System of Groundnut Plant.

Plant extracts	Number of branches (%)
C. fistula	11.85
A. indica	12.95
C. siamea	11.95
Control	11.40
LSD	1.776

3.6 Doses of different leaf extracts on the number of branches produced of *Meloidogyne incognita* infected root system of groundnut plant.

Among the doses, leave extract of *A. indica* at 50g dose had the higher number of branches produce (12.30%) while leave extract of *C. fistula* at 200g had the lowest (10.60%). It was observed that, there was no significant difference (p<0.001) in number of branches produced among the doses as shown in Table 6.

Table 6. Amendment Rate on the Number of Branches Produced of Groundnut Plant

Doses of Leave extracts (g)	*C. fistula* (%)	*A. indica* (%)	*C. siamea* (%)
50	11.60	12.20	11.20
100	10.60	12.30	11.95
150	11.85	11.70	11.20
200	12.10	10.95	11.45
LSD	1.776	1.776	1.776

IV. Discussion

The results of this study showed that amending the soil using some organic materials, namely; leaf powder of *Azadirachta indica*, *Cassia fistula* and *Cassia siamea* reduced the population of *Meloidogyne incognita* with a significant (p<0.001) increase in girth size, shoot height and number of branches produced. The organic amendments have consistently been shown to have beneficial effects on soil nutrients, soil physical conditions, soil biological activity and thereby improving the health of plants and reducing populations of plant parasitic nematodes Oka *et al*. (2000). The maximum girth size per plant was recorded in plant treated with *C. fistula* (2.24) while the control plant was recorded the lowest (2.04). This is in agreement with the work of Aldworth and van Staden, (1987) on seaweed concentration application improves the root and shoots fresh system, the number of leaves, the stem diameter and number of flowers and flower buds produced. Also, there was a significant difference (P<0.001) observed among the doses were the highest girth size was recorded in plant extract of *C. siamea* at 150g dose (2.1388) while the extract of *A. indica* at 100g was recorded the lowest (1.9738). This is in concordance with the work of Chimbekujwo and Modu (2013).

There was no significant difference (p<0.001) observed between the treated and control plant on the shoot height, although the treated plants had higher shoot than the control plant**.** The plant shoot height when treated with soil amendment gave a better shoot height (19.73m) compared to control plant (17.41m). This is in concordance with the findings of Safinaz and Ragaa (2013), Abdel Mawgoud *et al*., (2010) and Currah & Thomas (1979) who reported that the extract of *Laurencia obtusa*, *Jania rubens*, *Corallina elongata* (Rhodophyta) treated with Maize plant to increase the leave number and plant height. Among the doses, the shoot height was recorded higher in plant treated with leave of *C. siamea* at 200g leave extract (19.73) while leave extract of *A. indica* at 50g was recorded lowest (14.06). This is in concordance with the findings of Chimbekujwo and Modu (2013).

The treated plant had a higher number of branches (12.95%) as compared to the control plant (11.40%). This is in line with the work of Abdel Mawgoud *et al*., (2010) who reported that number of branches responded positively and significantly to the application of seaweed extract with a gradual effect relative to the applied concentration. Among the doses, number of branches produced was recorded higher in plant treated with *A. indica* at 50g leave extract (12.30%) while plant treated with *C. fistula* at 100g was recorded the lowest (10.60%). This was supported by the earlier report of Chimbekujwo and Modu (2013).

V. Conclusion

The findings of this study showed that *Cassia siamea, Cassia fistula, Azadirachta indica,* control the population of nematode (*Meloidogyne incognita*) with significant increase in girth size, shoot height and the number of branches produced in groundnut plant.

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1Bamsida, Z,etal." Evaluation of Organic Soil Amendments on Groundnut (Arachis hypogeal L.) Roots Infected by Meloidogyne incognita In Modibbo Adama University of Technology Girei Local Government Area of Adamawa State." *IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)*, 15(2), (2020): pp. 01-05.