

Effects of Organic and Inorganic Manures on the Growth Attributes of Root-knot Nematode (*Meloidogyne Incognita*) Infected Ethiopian Egg Plant (*Solanum Aethiopicum*)

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Received July 31, 2013; Revised August 28, 2013; Accepted October 15, 2013

Abstract Pot experiment was conducted twice with a sterilized soil to evaluate the effects of organic manures (poultry, cow dung, domestic waste) and inorganic manure (NPK 15 : 15 : 15) on the growth attributes of root-knot nematode infected Ethiopian egg plant *Solanum aethiopicum* in a screen house at Kabba College of Agriculture, Ahmadu Bello University Kabba, Nigeria. Each of the organic manure was applied at the rate of 5t/ha and the NPK fertilizer was applied at the rate of 200kg/ha, while there was an uncreated control which acted as standard check. The experiment was designed in a completely randomized design comprising of five treatments as earlier mentioned and each treatment was replicated four times. The result of the experiment shows that all the manures were effective in suppressing nematode activities as manifested in enhanced growth observed in both organic and inorganic manure treatments compared with the control. The mean plant height, number of leaves, stem girth and number of branches in organic and inorganic manure root-knot nematode infected Ethiopian egg plant was of the range 46.5 ± 3.18 , 19 ± 3 , 1.24 ± 6 and 6 ± 1 respectively at the twelve week of the experiment while the order of 16.83, 11.33, 0.80 and 2.67 respectively were observed in control plants. Egg plants in control treatment were heavily galled by *Meloidogyne incognita* resulting in poor growth while the organic and inorganic manure treated egg plant recorded better growth and were significantly different from the control. This result suggests the use of organic manure as soil amendment for the control of root-knot nematode in the endemic soil where susceptible crop are to be grown.

Keywords: Ethiopian egg plant, root-knot nematode, organic manures, growth parameters

Cite This Article: S. A. Abolusoro, P. F. Abolusoro, F. O. Mathew, and N .B Izuoguo, "Effects of Organic and Inorganic Manures on the Growth Attributes of Root-knot Nematode (*Meloidogyne Incognita*) Infected Ethiopian Egg Plant (*Solanum Aethiopicum*)." *World Journal of Agricultural Research* 1, no. 6 (2013): 104-107. doi: 10.12691/wjar-1-6-2.

1. Introduction

Ethiopian Egg plant, Nakati or *Solanum aethiopicum* is a fruiting plant of the genus *Solanum* mainly found in Asia and tropical Africa. It is known as Mock tomato which is also from *Solanum*. Infact, the Ethiopian egg plant was much confused with the ordinary egg plant. The leaves of *S. aethiopicum* are eaten raw as a vegetable and are equally more nutritive and more consumed than the fruit. The fruit is eaten both raw and cooked and becoming more popular as a cultivated crop. The fruits are usually harvested while still green before the skin becomes thick. The bitterness depends on the saponin content.

This vegetable has potentials to improve nutrition, boost food security and foster rural development and support sustainable land care. The crop is affected by wide

range of biotic challenges, prominent among them is the root-knot nematode *Meloidogyne incognita*. Other pests that are associated with this crop are *Empoasca flavescens* (leafhopper), *Heliothis armigera* (army worm), *Trialeurodes vaporariorum* (white fly), cercospora leaf spot, bacterial wilt, vascular wilt and leaf curl [1]. The attack on root-knot nematode on this crop leads to galling on the root, vascular damage which disturbs water and mineral uptake resulting in serious yield reduction.

The use of organic manure in nematode management on susceptible crop in Nigeria is desirable because of low cost and technology involvement vis-à-vis environment and crop safety [2]. Organic agriculture stresses agricultural production without application of synthetic chemicals (Fertilizer, pesticides, herbicides and anti-biotic). Many research works have really confirmed the efficacy of organic manure in the management of soil pathogens

including root-knot nematode with resultant growth and yield improvement [5,6,8-16]. This study was therefore conducted to determine the effect of organic manure on the growth attributes of root-knot nematode infected Ethiopian egg plant at College of Agriculture, Ahmadu Bello University, Kabba, Kogi State, Nigeria.

2. Materials and Methods

2.1. Soil Sterilization and Experimental Design

The trial was conducted in a screen house at Kabba College of Agriculture, Ahmadu Bello University, Kogi State Nigeria in the year 2010 and repeated in 2011. The Ethiopian egg plant (*Solanum aethiopicum* L). was obtained from Institute of Agricultural Research (IAR), Ahmadu Bello University Zaria Nigeria. The seedling was raised from a properly sterilized top soil. Sterilization was done to rid the soil of pathogen or other biological factor that can influence the result of the experiment. Top soil (1-10cm) was mixed thoroughly with sieved (2mm aperture) and sterilized (6 hours, 90-100°C). Ten kilograms of steam sterilized top soil was measured into 15 liters perforated black plastic pot and arranged on the concrete floor in the screen house of the college. The soil acidity/alkalinity was tested using a Ph meter and was determined to be 6.0. The experimental design was completely randomized design in which there were five treatments (control inclusive) each replicated four times.

2.2. Soil Amendment

Each of the pots was filled with 15kg top soil (sandy loam). The pots except the one set aside for inorganic manure and control was amended with already prepared organic manures (poultry manure, cow dung, domestic waste) at 2 weeks before planting at the rate of 5t/ha while the inorganic fertilizer was applied at the rate of 200kg/ha at 3 weeks after planting.

2.3. Crop Establishment

The seeds of *Solanum aethiopicum* were collected at Institute of Agricultural Research (IAR) Zaria, Nigeria. The seeds had been confirmed to be susceptible to nematode pest in an earlier experiment (12). Three seeds were planted into each of the experimental pots and later thinned to one healthy thrifty crop at 3 weeks after planting (3 WAP).

2.4. Extraction and Inoculation of Tomato with Nematode

Plant parasitic nematodes were extracted from previously infected tomato grown on pure culture of *Meloidogyne incognita* in previous experiment using the method of [3]. The initial population of *M. incognita* was about 2000 juveniles per plant stand. Inoculation was done at 3 weeks after planting (3 WAP).

2.5. Data Collection and Analysis

In both trial experiments, data were collected on plant height, number of leaves, average stem girth and number

of branches at 100% flowering. All the data was pulled together and mean values were analyzed. Data collected were subjected to analysis of variance (ANOVA) and means were separated using Duncan's multiple range test at 5% probability level ($P = 0.05$) [17].

3. Results

Effects of different organic manures and inorganic fertilizer on the growth attribute of *S. aethiopicum* (Ethiopian egg plant).

The effects of different organic manures and inorganic manure (NPK 15 : 15 : 15) on the mean height of egg plant are presented in Table 1. Egg plant treated with organic and inorganic manures recorded greater height than that of the untreated control. There was no significant difference in the height recorded by various treatments at 6 weeks after planting but significant differences were observed as from week 8. The organic and inorganic manure treated plants were significantly different from the untreated control plant effective from week 8 to week 12 of the experiment. At week 12 of the experiment, the untreated control plant recorded an average height of 16.83cm while poultry manure recorded an average height of 49.17cm which is the highest among the treatments (Table 1).

Table 1. Effects of organic and inorganic manure on plant height of *M. incognita* infected Ethiopian egg plant

Treatments	Plant height (cm)			
	6WAP	8WAP	10WAP	12WAP
Control	7.77	10.37 ^b	13.17 ^b	16.83 ^b
Poultry manure	6.80	41.06 ^a	44.23 ^a	49.17 ^a
Cow dung	6.37	40.80 ^a	40.80 ^a	43.52 ^a
Domestic waste	5.90	33.87 ^a	33.87 ^a	42.73 ^a
NPK 15:15:15	6.07	34.67 ^a	34.67 ^a	43.67 ^a
SEM	0.7321	4.1996	5.5758	4.8315

WAP Weeks after planting

Means followed by the same letter(s) are not statistically different at 5% probability level.

Table 2 shows the effects of organic and inorganic manures on infected egg plants treated with manures. Both the organic and inorganic treatments produced more leaves compared with untreated control. The leaf production by various treatments under investigation followed the same pattern as plant height recorded in Table 1. There were significant differences among the various treatments. Organic manure treatments produced more leaves compared with untreated control. Inorganic manure (NPK) treated plants also recorded more leaves compared with control and are not significantly different from organic treatment in most cases (Table 2).

Table 2. Effects of organic and inorganic manure on the number of leaves produced by *M. incognita* infected egg plant

Treatments	Number of leaves produced			
	6WAP	8WAP	10WAP	12WAP
Control	3.34 ^a	8.91 ^b	7.00 ^a	11.33 ^b
Poultry manure	7.33 ^a	11.67 ^a	19.67 ^a	22.00 ^a
Cow dung	5.33 ^{ab}	8.06 ^b	13.66 ^b	17.67 ^a
Domestic waste	5.34 ^{ab}	8.08 ^b	10.67 ^b	16.86 ^a
NPK 15:15:15	6.33 ^a	8.12 ^b	12.66 ^b	19.66 ^a
SEM	6.6667	1.0328	1.9551	1.7522

WAP Weeks after plant

Means followed by the same letter(s) are not statistically different at 5% probability level.

Table 3 shows the effects of organic and inorganic manures on the stem girth of egg plant. Observation of stem girth was taken from week 6 of the experiment. There was no significant difference in the stem girth of egg plant at week 6 of the experiment. Significant differences were observed from week 8. The organic and inorganic manure treated plants recorded significantly higher value of girth compared with the untreated control. The organic and inorganic manure treated plants were not significantly different from each other from week 8 of the experiment but different from the control (Table 3).

Table 3. Effects of organic and inorganic manure on stem girth of *M. incognita* infected egg plant

Treatments	Stem girth (cm)			
	6WAP	8WAP	10WAP	12WAP
Control	0.43	0.51	0.73	0.80 ^b
Poultry manure	0.82	0.93	1.17	1.30 ^a
Cow dung	0.57	0.80	1.03	1.03 ^a
Domestic waste	0.50	0.67	1.97	1.97 ^a
NPK 15:15:15	0.57	0.77	1.10	1.23 ^a
SEM	N.S	N.S	N.S	.1211

WAP Weeks after plant

Means followed by the same letters are not statistically different at 5% probability level

Table 4 shows the effect of organic and inorganic manures on the average number of branches, Produced by root-knot nematode infected egg plant. There were significant differences in the number of branches produced by various treatments. Organic and inorganic treated plants recorded more branches compared with the control treatment and are significantly different from the control with the exception of domestic waste that was not significantly different from the untreated control (Table 4).

Table 4. Effects of organic and inorganic manure on number of branches of *M. incognita* infected egg plant at 100% flowering

Treatments	Number of branches at 100% flowering
A(control)	2.67 ^b
B(Poultry manure)	7.00 ^a
C(Cowdung)	6.00 ^a
D (Domestic waste)	5.00 ^a
E(N P K Fertilizer)	5.67 ^a
SEM	0.8692

Means followed by the same letters are not statistically different at 5% probability level.

4. Discussion

Application of different organic manures caused a significant decline in soil population of root-knot nematode *M. incognita* pest and subsequently improved growth parameter of egg plant. Similarly, the use of organic manure in the control of nematode pests of some crop has been demonstrated by many researchers. [4] reported that organic manure amendment stimulates the multiplication of micro-organisms like fungi and bacteria. Some of these micro-organisms are parasites of nematode. This will bring about biological suppression of parasitic nematodes in soil hence promoting growth and development of plants. [9,15] reported that organic manure incorporated into the soil improves the performance of nematode infected plant. This improvement is due to direct stimulation of predators and

parasites of plant parasitic nematodes leading to reduction in soil pathogen population and consequent increase in growth and plant yield. [13] showed that application of poultry composts other organic and inorganic manure was significantly more effective in bringing down nematode population and consequently brought about improved growth and yield of the tested plant compared with control. [10] reported the efficacy of organic manures such as cow dung, domestic waste, poultry manure in suppressing nematode population hence accelerating the growth and yield of crop raised in the medium. [5,7] reported that organic manure amendment on soil reduces the root and soil population of root-knot nematode (*M. incognita*). Populating predatory micro organisms will also compete with root-knot nematode for space, water, food e.t.c. The toxins produced by the micro-organisms will have adverse effects on root-knot nematode hence reducing its speed of activities, nematode survival and population density hence reducing the negative impact of the organism on the growing plant.

5. Conclusion

The result of this study showed that poultry manure, domestic waste, cow dung and inorganic fertilizer have potential to suppress nematode population with a resultant enhanced growth of egg plant. Inorganic fertilizer is equally effective in this direction but emphasis is not on inorganic manure but on organic and that is why the author is silent about the performance of inorganic fertilizer treatment in the discussion. The author will continue this experiment under field condition with the view of confirming the present result. The significance of this study thus underscores the potency of organic manure as root-knot nematode suppressor. This suppressive action tends to stimulate increase growth of egg plant. Domestic waste may be easily disposed off as organic manure which needs to be properly recycled to be useful because of the glass metal component and non decomposing objects like nylon. Both poultry manure and cow dung are readily available and their use as manure will help in environmental protection.

Acknowledgement

The assistance of Mr. J. F ogunremi in some of the laboratory work is gratefully acknowledged.

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