Archives Of Phytopathology And Plant Protection
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/gapp20

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Published online: 17 Feb 2014.

Archives of Phytopathology and Plant Protection, 2014
http://dx.doi.org/10.1080/03235408.2014.882541

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Control of nematode disease of egg plant (*Solanum aethiopicum*) using manure

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(*Received 3 January 2014; accepted 8 January 2014*)

Pot experiment was conducted in the year 2010 and repeated in 2011 to examine the effects of organic manure (poultry, cow dung and domestic waste) and inorganic manure (NPK 15:15:15) on the yield, soil and root population of *Meloidogyne incognita*-infected Ethiopian egg plant *Solanum aethiopicum* in a greenhouse at Kabba college of agriculture, Ahmadu Bello University, Kabba, Nigeria. Each of the organic manure was applied as soil amendment at the rate of 5t/ha and the inorganic fertiliser (NPK) was applied at the rate of 200 kg/ha, while there was an untreated control that acted as standard check. The experimental design was a completely randomised design comprising of five treatments including control and each of the treatments was replicated four times. The result of the experiment showed that all the organic manures considered and NPK fertilisers were effective in suppressing the nematode's negative effects on the plant, as shown by the improved yield, reduced soil and root population as well as reduced gall index of the organic and inorganic manure-treated plant compared with the control. The mean fruit yield of the manure-treated plant was of the range 18 ± 1 fruits and NPK fertiliser had an average of fruit number of 17, while the untreated control recorded an average fruit number of 6.5. The organic and inorganic manure-treated plants recorded bigger fruit size compared with control, and are significantly different from the control. The soil and root population as well as root gall index are reduced in all the manure treatments compared with the control and are significantly different from the control. The result of this experiment confirmed that organic manure can be utilised to manage nematode in soil endemic with root-knot nematode *M. incognita.*

Keywords: Ethiopian egg plant; fruit number; fruit size; organic manures; inorganic manures; *Meloidogyne incognita*

Introduction

Solanum aethiopicum (Ethiopian egg plant) belongs to family Solanaceae that has been described as one of the most intriguing and largest plant families in the world (Bonsu et al. 2000). The family comprises of well-known edible plants such as potatoes, tomato egg plant and pepper, ornamental plants such as nirembergia (*Nirembergia utenscence*) and poisonous species such as jimson weed (*Datura* spp.), Mandrake (*Mandragora officinarum*) and bittersweet night shade (*Solanum dulcamara*) (Bonsu et al. 2002).

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S. aethiopicum is a traditional food plant in Africa, a vegetable that has potential to improve nutrition, boost food security, foster rural development and support sustainable food production and are more nutritive than the fruit. The highly variable fruit is eaten as both raw and cooked and is becoming more popular as cultivated crop.

This plant is affected by a wide range of pests, and prominent among them is root-knot nematode, *Meloidogyne incognita,* which is responsible for serious root damage leading to stunting, chlorosis and drastic yield reduction. The best method of managing the pest is through the use of synthetic chemicals known as nematicides. These synthetic chemicals are highly toxic to humans, very expensive and do not guarantee the safety of the environment.

Application of soil amendment in form of organic manure and plant extracts and other biocides into the soil is an attempt to supplement soil nutrient, and to control or suppress plant diseases and insect pests under the nascent organic agriculture, as Nigeria is used as a vibrant area of research interest. The agricultural sector in Nigeria is facing a new challenge that the conventional farming system is transitioning to organic farming system.

Scarcity, high cost, environmental safety and global restriction on the importation of chemical nematicide have spurred scientist to search for alternative control measures of control against nematode pests of economic food crops (Anonymous 2004). Application of organic manures not only improves plant growth and productivity, but also is a useful tool for pest management. It also guarantees environmental safety (Pakeerathan et al. 2009). Organic manures have been reported to suppress nematode pest in various experiments conducted across the world. The incorporation of organic amendment (with other biocontrol agents) plays an important role in the management of target nematodes via reduction of its population to a low and safe level (Adesiyan et al. 1990; Jatak 2002; Dickson & Lucas 2007; Kaskavala 2007; El-sherif 2008; Ullah et al. 2008; Summer 2011) observed similar trend in their various experiments. The study was conducted to evaluate the effects of organic and inorganic manures on the yield attributes of *M. incognita*-infected Ethiopian egg plant.

Materials and methods

The pot experiment was conducted at the College of Agriculture, Ahmadu Bello University, Kabba in Nigeria. The experiment was carried out twice (2010 and 2011) and the data generated were pooled together for analysis.

Soil sterilisation and experimental design

Top soil (1–10 cm) from the above-mentioned location was mixed, sieved and sterilised for about 10 h at a temperature range of 90–100 °C. Ten kilograms of sterilised soil was filled into a 15-L capacity perforated plastic pot and arranged on the concrete floor of the screen house. The pH of the soil was determined by a pH metre, and it was found to be 6.2. The experiment was done in a complete randomized design comprising of five treatments, control inclusive, and each treatment was replicated four times.

Soil amendment

The pots, except the one set aside for inorganic manure treatment (N.P.K.15:15:15 fertiliser), were separately amended with three types of organic manures (i.e. poultry, cow dung and domestic waste manure) at the rate of 5t/ha a week before planting, while the inorganic fertiliser was applied at the rate of 200 kg/ha three weeks after planting.

Crop establishment

The seeds of *S. aethiopicum* were collected from the Institute of Agricultural Research, ABU, Zaria, Nigeria. The seeds were confirmed to be susceptible to nematode pest in previous experiment (Abolusoro 2006). Three seeds were initially planted into each pot but latter thinned to one healthy and thrifty seedling three weeks after planting.

Extraction and inoculation of plant with nematode: plant-parasitic nematode *M. incogita* juveniles were extracted from previously infected tomato grown in pure culture of *M. incognita* in previous pot experiment using the method stated by (Whitehead & Hemming 1965). Thousand juveniles were introduced into each pot at the base of the standing plant. This was done three weeks after planting (3WAP).

Data collection and analysis

In both experiments, data were collected on yield components (number of fruits per plant and average fruit weight). Data were also collected on number of juvenile in root, soil and gall index from all the treatments. All the data were pooled together and means were analysed. Means separation was done using Duncan's multiple large test at 5% probability level (Duncan 1955).

Results

The number of fruits per egg plant was higher in both organic and inorganic manure-treated plants compared with the untreated control. Poultry manure-treated plants recorded the highest number of fruit among the organic manure followed by cow dung, while domestic waste manure-treated plant recorded the least number of fruit among the organic manure treatment. The fruit productions among the manure treatments are not significantly different from each other but different from the control. The average number of fruits of the organic manure-treated egg plant was of the range 18 ± 1 and NPK fertiliser recorded 17, while the untreated control recorded an average of 6.5 fruits.

Egg plants that were treated with organic manure and NPK fertiliser recorded higher fruit weight compared with the untreated control. The average fruit weight of the egg-plant that were treated with organic manure was in the range 27 ± 2 g and NPK fertiliser treatment recorded an average weight of 28.7 g, while the untreated control recorded the least average weight of 12 g (see Table 1).

At harvest, the final *M. incognita* population for each of the treatment was counted. All the organic and inorganic manure-treated plants recorded reduced number of nematode compared with the control treatment. The population of *M. incogn*ita was lowest in poultry manures compared to other manure utilised in the experiment. The reduction in the population of *M. incognita* in all the organic and inorganic manure treatments is significantly different from the control.

The number of *M. incognita* in 5 g root of infected egg plant is shown in Table 2. Organic and inorganic manure significantly reduced nematode number. The organic manure-treated egg plant had population in the range of 15 ± 1 and NPK fertiliser treatment recorded an average of 17, while the untreated control recorded an average of 35 nematodes (see Table 2).

Table 1. Effects of organic manures and NPK fertiliser of fruit production of *M. incognita*-infected plant.

Treatments	Average number of fruit/plant	Average fruit weight per plant
A (Control)	6.5a	15.3a
B (Poultry manure)	19.3b	29.3b
C (Cow dung)	18.7b	27.8b
D (Domestic waste)	16.9b	25.9b
E (NPK fertiliser)	17.0b	28.7b
SEM	2.3381	3.4110

Note: Means followed by the same letter(s) along the same column are not significantly different according to Duncan's Multiple range test at $p = 0.05$.

Table 2. Effects of organic manure and NPK fertiliser on the soil, root population and gall index of *M. incognita*-infected plant.

Treatments	Initial nematode population	Nematode population after harvest	Nematode population 5G root	Root gall index
A (Control)	1000	2842b	35.3a	4.2
B (Poultry manure)	1000	359a	14.2b	2.0
C (Cow dung)	1000	412a	15.4b	2.4
D (Domestic waste)	1000	429a	16.0b	2.3
E (NPK fertiliser)	1000	450a	17.1b	2.4
SEM		63.371	3.4512	

Note: Means followed in the same letter along the same column are not significantly different according to Duncan's multiple range test at $p = 0.05$.

The root damage expressed as gall index of root-knot nematode-infected egg plant due to treatment with organic and inorganic manure is shown in Table 2.

More damages were recorded in the root of untreated egg plants. The organic manure-treated plant records a root damage in the range of $2.2 \pm .2$ and NPK fertiliser-treated eggplant recorded a gall index of 2.4, while the untreated control recorded 4.2 (see Table 2).

Discussion

The result of this research work shows that nematicidal components are available in manures as indicated in the result of this work. Application of manure organic and inorganic caused a significant decline in population of *M. incognita* both in the root and soil; hence, reducing the root damage (Gall index) of manure-treated plant compared with the untreated control and subsequently improved the yield attributes (fruit number and fruit weight of Ethiopian egg plant). Similarly, organic manure is a useful tool for nematode pests control as demonstrated by researchers. For example, Summer (2011) reported that organic manure amendment stimulates the multiplication of micro-organisms like fungi and bacteria. Some of the micro-organisms are parasites of nematodes. The micro-organisms will cause the suppressions of parasitic nematodes in the soil and promoting growth and development of the plant. Mohammed and Alan (2003) reported that organic manures incorporated into the soil improved the performance of nematode-infected plant. This improvement is due to direct stimulation of predators and parasitic nematodes, leading to reduction in soil pathogen and consequent increase in the fruit yield. Adesiyan et al. (1990) reported the efficiency of organic manures such as poultry domestic waste and cow dung in suppressing nematode population; hence, accelerating the fruit yield. Jatak (2002) reported that manure amendment reduced the population of soil and root-knot nematode (*M. incognita*) by populating predatory micro-organism on nematode. This micro-organism will compete with root-knot nematode for space, water, food, etc. The toxin produced by the micro-organism will have adverse effect on the root-knot nematode's speed of activities, nematode survival and population density, hence increasing the plant yield. Poultry and other organic and inorganic manures were significantly more effective in bringing down nematode population with consequent yield improvement

Conclusion

The result of this study showed that poultry manure, domestic waste, cow dung and inorganic fertiliser (NPK 15:15:15) have the potential to suppress nematode population with a resultant increase in yield output. Inorganic fertiliser is equally effective in this direction but emphasis is not on inorganic manure since the focus of the research work is to promote organic farming because of its associated merits. The present study confirms the potency of organic manures as root-knot nematode suppressant with resultant yield improvement. Domestic waste and other types of manure may easily be disposed by recycling them into the soil as organic manure, hence converting waste to wealth. This practice will assist in reducing environmental pollution.

Recommendation

The result of this study shows that organic manures (poultry cow dung, domestic) is endowed with potential to suppress the root and soil population of *M. incognita* hence reducing the root damage level and other negative effects on infected plant with resultant yield increase. The author intends to repeat the experiment under field conditions.

References

Abolusoro SA. 2006. Nematicidal activities of some selected Botanical on a root-knot nematode (*Meloidogyne incognita*) on tomato (*Lycopersicon esculentum*) (L.) Mill [PhD thesis]. Department of Crop Protection University of Ilorin Nigeria; p. 203.

Adesiyan SO, Caveness FE, Adeniji MO, Fawolo B. 1990. Nematode pests of tropical crops. Ibadan: Heinman educational books (Nig).

Anonymous. 2004. Intergovernmental forum on Chemical Safety information circular (IFCS). Pest Altern. 23:2–3.

Bonsu KO, Shipper RR, Nkasah GO, Owosu EO, Orchard JE. 2000. Gboma eggplant a potential new export crop for Ghana. Book of Abstract fifth international Solanaceae conference. Botanical garden of Nijonegan, 2000 July 23–29; p. 14.

Bonsu KO, Fontem DA, Nkasa GO, Iroume RR. 2002. Diversity within the Gboma egg plant (*Solanum macrocarpon*) an indigenous vegetable from West Africa, Ghana. J Hort. 1:50–58e.

Dickson KU, Lucas S. 2007. Control of root-knot nematode in organic farming system by organic amendment and soil solarization Crop Protection for schools and collese. 3rd ed.; pp. 71–73.

Duncan DB. 1955. Multiple range and multiple F. tests. Biometrics. 11:1–42.

El-Sherif AG. 2008. Nematode and diseases suppression demonstrated with composited municipal. J Crop Prot. 11:177–181.

Jatak S. 2002. Use of animal manure for the control of root-knot nematode of cowpea. J Agric Environ. 1:23–26.

Kaskavala G. 2007. Effects of soil solarization and organic amendments treatments for controlling *Meloidogyne incognita* on tomato cultivars in western Anatolia. Turk Agric For. 31:159–167.
Mohammed A, Alan MM. 2003. Utilization of waste material in nematode control. Algar Muslim University, India. J Phytopathol. 156:264–267.
Pakeerathan K, Mikutan G, Tharsshani N. 2009. Effects of different animal manure on *Meloidogyne incognita* on tomato IDOSI publication. World J Agric Sci. 5:432–435.
Summer H. 2011. Effects of organic manure on Nematode control. J Dis Control Trop. 7:190–191.
Ullah MS, Islam MS, Islam MA, Haque T. 2008. Effects of organic manure and chemical fertilizer on the yield of Brinjal and soil properties. J Bangladesh Agric. 6:271–276.
Whitehead AG, Hemming JR. 1965. A comparison of some quantitative methods of extracting small vermiform nematode from soil. Ann Appl Biol. 55:25–38.