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Evaluation of Farmyard Manure (FYM) and Compost Manure for the Control of Root Knot Nematode (*Meloidogyne spp.*) in Tomato (*Lycopersicon esculentus* Mill.) in the Sudan Savanna of Nigeria

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ABSTRACT: Field experiment was carried out on the Teaching and Research Farm, Faculty of Agriculture, University of Maiduguri, during the cropping season of 1997 to evaluate the effectiveness of farmyard manure (FYM) and compost manure for the control of root knot nematode (*Meloidogyne spp.*) in tomato. There were five treatments viz: cowdung, poultry manure, sheep + goat manure, compost manure and control. 100kg/ha of each of this treatments were incorporated into the soil per plot measuring 2m x 2m four weeks before the start of the experiment and replicated three time in a randomized complete block design (RCBD). Results showed that the initial and final population of nematodes were non significant and significantly different respectively. Nematode number per 5g of root was observed under control and lowest in treated plots with FYM and compost manure. Root length, shoot length and shoot weight were highest in treated plots and lowest in the control. Root weight and root knot galls, however, were highest under control compared to treated plots. The yield was non-significant. However, higher yields were recorded in treated plots and lowest in the control.

Key words: Farm yard manure, compost, nematode control, tomato.

Introduction

Plant parasitic nematodes are recognized as potentially serious constraint to crop productivity. They transmit virus diseases to plants in which considerable damages are caused resulting to food scarcity (19).

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Nematode damage goes unnoticed all around us and yield losses may equal those associated with more severe and easily identifiable plant diseases (8). In Northern Nigeria savanna it was estimated that about 40% yield reduction (14), 70% losses in yield in India (15) and 30-40% losses in yield in Senegal (9) respectively were due to nematodes. Root knot nematodes (*Meloidogyne spp.*) are very significant group of plant parasitic nematodes limiting world agricultural productivity. Of the four species of the genus *Meloidogyne, M. incognita* and *M. javanica* are prevalent in northern Nigerian savanna (2).Commonest symptoms of nematode attack are gall formation, necrosis or lesions on the roots, irregular root growth or stubby roots, lateral roots and whisker root hairs. Their aerial plant parts becomes wilted, stunted, distorted and the leaves appear rolled, wrinkled and twisted bringing about disturbance of mineral and water uptake leading to weakness and finally death of the plant (4 & 2). Tomato (*Lycopersicon esculentus* Mill) is an important vegetable crop which is believed to have originated from central and south America (18). It is eaten raw, as salad and it can be made into soups, pickles, ketchups, sauces and other products. It is served raw, baked, stewed, fried and as a sauce with various foods. Tomato paste is used for cooking, marketed fresh, and can be sun dried during the dry season. It also provides vitamins and minerals as well as carbohydrates. With all these contributions to food supply and security however, tomato is very susceptible to root knot nematode (*Meloidogyne spp.*) (10 & 11). This has resulted into a lot of research to find a solution for their control at a cheaper rate compared to the chemical control (nematicides) which is very expensive. Organic materials and amendments have been found to be effective in the management and or control of root knot nematodes (5 & 17). Poultry manure and cowdung were found to be superior to other organic manures in terms of growth, vigour and nyield; population of all nematodes fall immediately after application of soil amendments but increased gradually thereafter (1). Because of the importance of tomato in the human diet, the control of its major pest, root knot nematode (*Meloidogyne spp.*) cannot be over emphasized. The objective of this study therefore was to evaluate a cheaper method of control of root knot nematodes in tomato using FYM and compost manure to obtain optimum yields.

Materials and Methods

Field experiment was conducted during the 1997 cropping season on the Teaching and Research Farm, University of Maiduguri (11°51'N; 13°15'E) in the Sudan savanna characterized by single rainy season from June to September followed by dry season from November to May. The texture of the soil was sandy loam with 70.0% sand, 17.0% silt and 10.0% clay (12). The field was previously cropped with millet, onion, okra, garden egg and tomato which were highly susceptible to *Meloidogyne spp.* infestation (6). The experimental site was cleared, ploughed and plots were marked out. Four weeks before transplanting, 100kg/ha of each of the treatment effects were incorporated into the plots measuring 2m x 2m laid out in a randomized complete block design (RCBD) and replicated three times and watered to facilitate release of nutrients from the decomposing FYM and compost manure. Just before transplanting, they were ploughed and watered and transplanting done in the evening. Weeding was done manually at intervals throughout the research period. Harvesting was done by picking riped fruits every three days. The extraction technique for recovery of nematodes in soil was the Whitehead and Hemming Method (20). In this, two thin layer tissue papers were placed in a wire netted plastic bucket. The soil sample were thinly spread on the tissue paper and water poured gently to saturate it. Samples were left over night (24 hrs) to allow the active nematodes to crawl from the moist soil into the tissue paper placed over a tray containing water. The suspension was collected into 200 ml baker to allow for nematodes to settle for few hours. Excess water was poured off to a level of 50ml. Three aliquots of 5ml were each pipetted out from the suspension after agitation and the suspension poured into 3 counting petridishes separately. Nematodes were counted with the aid of microscope and averages taken. For nematode recovery from roots, infected roots of tomato were washed properly and cut into pieces with a razor. The roots were rinsed in clean water and drained properly and transferred to a 50ml beaker containing tap water. 1ml stock acid fuchsin stain solution was added and boiled for 30 seconds on a hot plate. The solution was cooled, drained and roots rinsed in running tap water. The roots were placed in 30ml glycerin acidified with few drops of 5N HCl and heated for destaining. The roots were brightly stained and cleared. The stained endo-parasitic nematodes were counted directly under a microscope and recorded. Data taken included initial and final population of nematodes before treatment application and at harvest; nematode number per 5g of root at harvest; number of root knot galls; root length and weight; shoot length and weight. The experimental data were then subjected to analysis of variance (ANOVA) appropriate to RCBD and difference between treatment means were compared using the Least Significant Difference (LSD) at 5% level of probability.

Results

The effect of FYM and compost manure on nematode population recovered from 1000cm3 of soil and 5g of root of tomato is presented in Table 1. There was significant differences observed in the final population of nematodes and nematode population per 5g of root. The initial population of nematodes was however non-significant. No significant differences in final population of nematodes were observed between cowdung and poultry manure and between sheep + goat manure and compost manure, control and sheep + goat manure; compost manure and sheep + goat manure; poultry manure and cowdung respectively. Highest final population of nematodes was observed in the control (310.0) followed by sheep + goat manure (190.0) and lowest (133.3) under poultry manure. Also significant differences were observed between control and all the rest of the treatments. There was no significant difference between cowdung and poultry manure, and between sheep + goat manure and compost. Highest nematode number per 5g of root (293.0) was observed in the control and lowest (43.3) in poultry manure. Table 2 shows the effect of FYM and compost manure on growth parameters and yield of tomato. Root length was not significantly different to control, compost manure, sheep + goat manure. Poultry manure was not also significantly different from cowdung but poultry manure and cowdung were both significantly different to the rest of the treatments. Highest root length (39.6cm) was observed with poultry manure and lowest (27.9cm) with the control. Root weight was not significantly different between poultry manure and cowdung and between sheep + goat manure and compost manure. However, the control was significantly different to all the rest of the treatments. Highest root weight (90.0g) was recorded in the control and the lowest (70.7g) with sheep + goat manure. Number of root knot galls were not significantly different between sheep + goat manure, cowdung and poultry manure. Compost manure was significantly different from control, and the control significantly different to all the rest of the treatments. Highest number of galls (27.7) was recorded under control and the lowest (7.0) with poultry manure. Significant differences in shoot heaight was observed between control and poultry manure; sheep + goat manure and cowdung. There was no significant differences between control and compost manure. Highest shoot length (55.5cm) was observed with poultry manure and lowest (28.9cm) with the control. Shoot weight recorded significant differences. The control was significantly different from sheep + goat manure, poultry manure and cowdung. There was no significant differences between control and compost manure. Highest shoot weight (87.4g) was recorded with poultry manure but was not significantly different to cowdung, and lowest (46.7g) with the control but also not significantly different to compost manure. The yield was non-significant, though treated plots recorded higher yields compared to the control.

Table 1: Effect of FYM and compost manure on nematode population recovered from 1000cm^3 of soil and 5g root of tomato.

Treatment	Initial Population of nematode (Nos)	Final Population of nematode (Nos)	Nematode per 5g of root (Nos)
Cowdung	216.7	176.7	55.3
Poultry manure	220.0	133.3	43.3
Sheep + goat manure	213.3	190.0	80.0
Compost manure	216.7	180.0	90.0
Control	193.3	310.0	293.3
SE	20.39	26.16	6.58
LDS (P = 0.05)	NS	51.10	15.18

Table 2: Effect of FYM and compost manure on growth parameters and yield of tomato.

Treatment	Root length (cm)	Root weight (g)	Root knot galls (Nos)	Shoot length (cm)	Shoot weight (g)	Yield (t/ha)
Cowdung	37.7	75.5	10.3	41.3	82.2	9.5
Poultry manure	39.6	81.9	7.0	55.5	87.4	14.6
Sheep + goat manure	30.6	70.7	12.7	36.7	58.4	7.8
Compost manure	30.5	68.4	16.7	33.3	48.9	7.5
Control	27.9	90.0	27.7	28.9	46.7	5.3
SE	2.16	2.79	1.87	3.26	3.31	1.21
LDS(P=0.05)	4.98	6.45	4.32	7.51	7.62	NS

Discussion

Table I recorded initial population of nematodes as non-significant. The reason for the non-significant could be due to the fact that the decomposition of FYM and compost manure did not start to release nematicidal compounds to effect the decrease in nematode population. This agrees with (13) who reported that the addition of organic amendments suppressed population of nematodes by releasing nematicides in the soil after a longer period of time and not at initial stages. In the final population of nematodes, however, significant differences were observed and the control recorded the highest number of nematodes (310.0) compared to the rest of the treatments. The reason for this high population of nematodes in the control could be as a result of the absence of FYM and compost manure which did not release nematicides that could have suppressed the number of nematodes (13). The number of nematicides per 5g of root was highest with the control compared to treated plots. This is in agreement with (13) and (7) who reported suppressive effects of organic amendments on nematode population and increased population in control plots. Table II shows significant effects of FYM and compost manure on growth parameters only. The yield was non-significant. Longest roots (39.6cm) were observed in treated plots and shortest roots (27.9cm) in the control because of the activities of plant parasitic nematodes that were suppressed in treated plots due to addition of FYM and compost manure and not suppressed in the control. This agrees with (16) who reported that activities of nematodes in the soil treated with organic amendments reduce population of nematodes thus allowing root growth and development but no growth in the control. Root weight showed significant differences. Highest root weight (98g) was observed in the control and lowest (68.4g) in treated plots. The reason for this highest root weight in the control was because of galling effect which induced lateral roots and added to the weight of roots in the control. This agrees with (3) who reported highest root knot galls in control plot and lowest in treated plots. Root knot galls were also highest (27.7) in the control which agrees with (3). Significant effect on shoot length and shoot weight were observed between treated and control plots. Treated plots recorded rapid plant growth with well developed stem and foliage which gave tall shoots and heavy roots, while control appeared stunted, thrifty and which gave short shoots and also weighed less. This is in agreement with (5) and (7) who observed more vegetative growth in treated plots and least growth in the control. The yield data was non-significant. However, treated plots recorded higher yields than control. The reason for higher yields in treated plots could be because FYM and compost manure suppressed activity of nematodes and on the other hand FYM and compost manure supplied the sil with more nitrogen which enhanced growth and yield in tomato (7 & 13). Lowest yield was recorded in the control suggesting that tomato plants suffered the effects of nematode infestation as well as nitrogen deficiency conforming to the findings of (3) that losses in tomato yield was as a result of infestation by *M. incognita.*

Conclusion

FYM and compost manure was found to be effective in reducing final population and number of nematodes per 5g of soil; plant growth parameters like shoot height and weight and root length were higher in treated plots and even in the yield, while control recorded lowest values. Since FYM and compost has proved effective in controlling *Meloidogyne spp.* in tomato and is cheaper than using nematicides, they can therefore be recommended for adoption, especially to the farmers.

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