

Management of *Meloidogyne incognita* infected tomato plants with agricultural wastes

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Abstract

The strategy employed in the management of *Meloidogyne incognita* on tomato is to use some nematicides. This has however risen environmental and health concerns. In order to maintain environmental and human health protection coupled with the necessity to consume healthy foods, there is essential for an alternative nematode control method which does not leave residuals nor pollute environment in anyway. The influence of agricultural wastes (corn cobs, rice husks and sorghum husk) and a synthetic nematicide carbofuran was evaluated on *Meloidogyne incognita* infected tomato plants. The agricultural wastes significantly ($p=0.05$) reduced nematode population, especially sorghum husk was the most effective to enhance tomato yield to reduced *Meloidogyne incognita* population. The use of agricultural wastes with soil admixing substantially reduces the population of *Meloidogyne incognita*, thus discouraging the application of synthetic nematicides.

Keywords: agricultural wastes, environmental pollution, *Meloidogyne incognita* nematodes, synthetic nematicide, tomato.

Introduction

Tomato (*Solanum lycopersicon*) is a high value vegetable crop, globally cultivated for its fleshy fruit which is widely consumed fresh or processed (Naika *et al.*, 2005). The economic value of tomato has expanded with the increase in area of production worldwide (Bodunde *et al.*, 1993). The largest producer of tomato in tropical Africa is Nigeria with 26,000 ha which yields 879,000 tonnes of fresh fruits annually (FAO, 2004). It also tops the list of canned vegetables with numerous health benefits (Rao *et al.*, 1998). Tomatoes are rich source of essential nutrients including vitamins E, C, A, thiamine, riboflavin and niacin (Kallo, 1991; Janes 1994; Beecher, 1998; Wilcox *et al.*, 2003). A medium sized tomato provides about 40% and 20% of the recommended daily amount (RDA) of vitamins A and C respectively (Kelly and Boyhan, 2010). Tomato is also a source of antioxidants like lycopene and beta-carotene (Sies *et al.*, 1992; Hobson and Grierson 1993; Shi and Manguer, 2000), as well as some minerals like calcium, potassium, sodium and water which are essential for metabolism (Olaniyi *et al.*, 2010). Although tomato is a good source of nutrients, various pests hinder the production and reduce their yield; these are caused by the plant parasitic nematodes (PPN). Reduced yield in tomato has been attributed to the root-knot nematode *Meloidogyne* spp (Udo *et al.*, 2008; Ogwulumba *et al.*, 2011), infested roots are galled, making them vulnerable to wilt inducing pathogens and rot (Williamson and Gleason. 2003). The general

control measure employed by farmers is the use of chemical nematicides. This over reliance on synthetics increases the cost of production, which brings about economic concerns. The adverse effect of synthetic nematicides on the environment is also bringing serious constraint. In view of these economic and environmental issues' alternative nematode management options are gaining acceptance, thus this research seeks to evaluate the use of agricultural wastes (corn cobs, rice husks and sorghum husk) being hitherto discarded as a possible option of *Meloidogyne incognita* control. Because agricultural wastes are natural, abundant renewable and rich sources of chemicals' they are readily available in large quantity for recycle or reuse.

Materials and Methods

Collection of Materials

The agricultural wastes were collected from Oja-gbooro and Ipata markets in Ilorin metropolis, Kwara state, Nigeria. They were air dried in the laboratory for 3 weeks and were t milled into powder with a steel man diesel engine model R175A.

Pot Experiment

Forty eight plastic buckets of 25L capacities were filled with 15kg sterilised sandy loam soil. The experiment was a factorial design incorporated into a randomised complete block design (RCBD), with four treatments at four rates of application and three replicates. Agricultural wastes (corn cobs, rice husks and sorghum husks) were mixed with the sterilised soil at 200g, 300g and 400g. Two weeks old tomato seedlings cv ROMA VF obtained from NIHORT (Nigerian Horticultural Research Institute) were transplanted from the nursery bed in to the experimental buckets. The pots were inoculated with approximately 50 eggs and second stage juveniles of *Meloidogyne incognita* obtained from pure culture of *M. incognita* maintained on *Celosia argentea*. Carbofuran 3G, was applied at the rate of 1.0kg/ai, 1.5kg/ai and 2.0kg/ai as a positive control check, on the other hand untreated pots served as the negative control (0.0kg/ai).

Results

The effect of various levels of application of agricultural wastes was investigated on the vegetative growth of tomato plant under *Meloidogyne incognita* infection' Vegetative growth in the tomato plants increased progressively over the weeks in tomato plants treated with sorghum husk among the agricultural wastes used. Plants treated with sorghum husks were significantly ($p=0.05$) taller than those grown in pots amended with rice husk and corn cobs (Fig.1). Number of leaves was also significantly ($p=0.05$) more in sorghum husk treated with a corresponding number of fruits (Fig. 2 and Fig. 3). Significantly ($p=0.05$) heavier fruits were observed in the sorghum husk amended pots (Fig. 4). Nematode population in root and soil of tomato plants treated with the sorghum husk was significantly ($p=0.05$) lower to compare in carbofuran treated plants (5b). The highest level of soil amendment (400g) was significantly

effective as opposed to the negative control. There was a significant reduction of nematode population in the soil and in the roots of tomato plants grown in pots amended with the highest dose of agricultural waste (Fig. 5b). The effect of inoculation was however obvious in the untreated control pots and on tomato plants amended with lower quantity of agricultural waste, they exhibited higher nematode population in root and soil and reduced vegetative growth and lower fruit production.

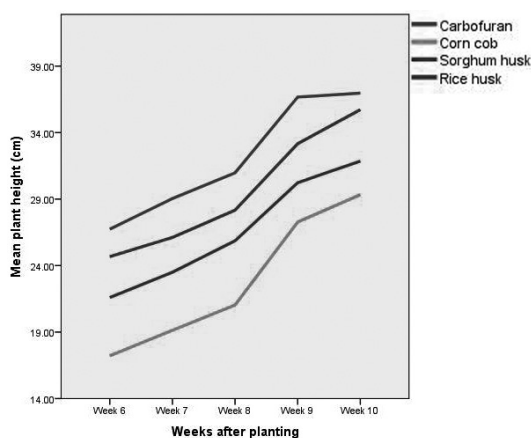


Fig. 1a. Effect of treatments on tomato plant heights

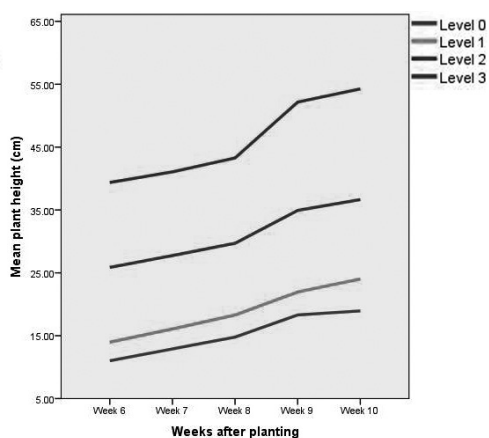


Fig. 1b. Effect of dosage of application on tomato plant heights

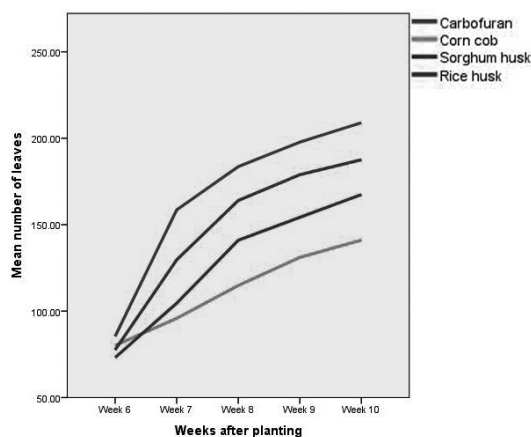


Fig. 2a. Effect of treatments on tomato leaf number

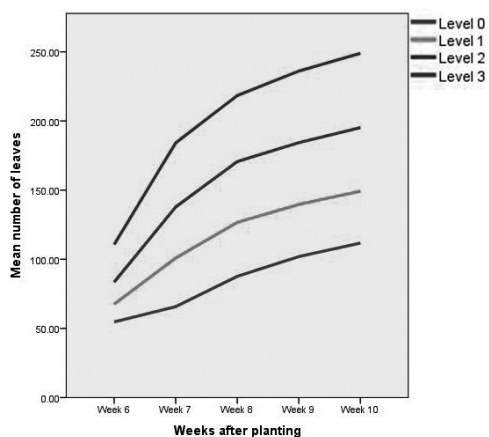


Fig. 2b. Effect of dosage of application on tomato leaf number

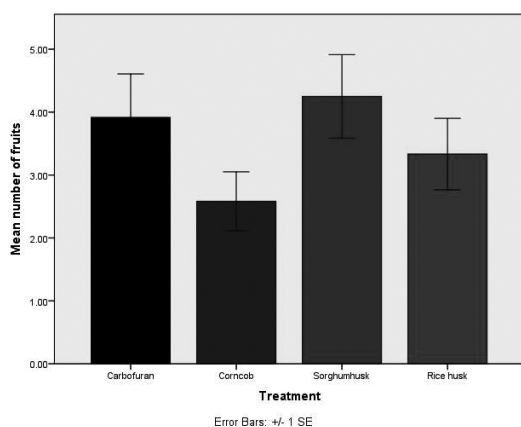


Fig. 3a. Effect of treatments on tomato fruit number

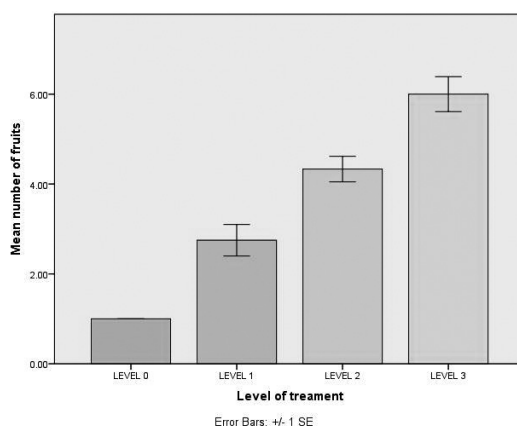


Fig. 3b. Effect of dosage of application on tomato fruit number

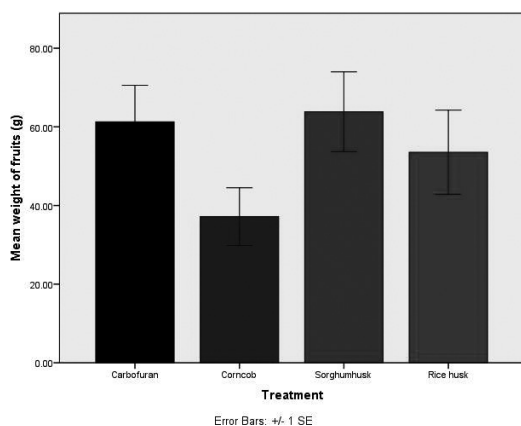


Fig. 4a. Effect of treatments on tomato fruit weight

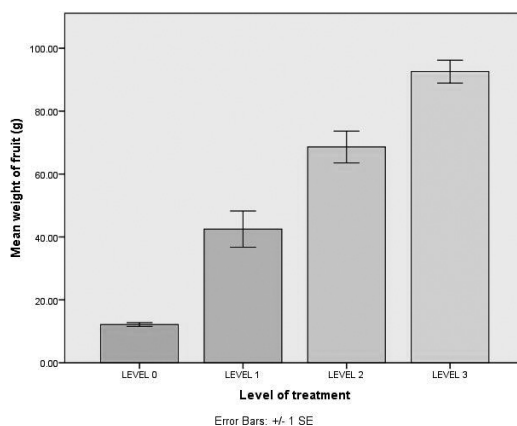


Fig. 4b. Effect of dosage of application on tomato fruit weight

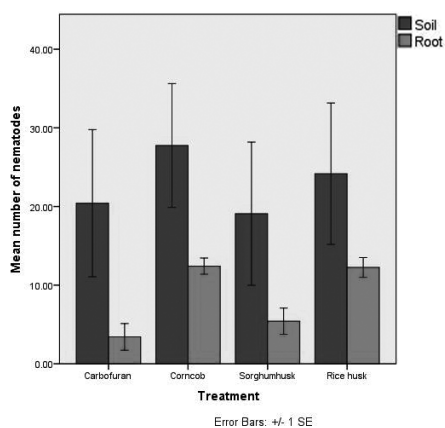


Fig. 5a. Effect of treatments on nematode population

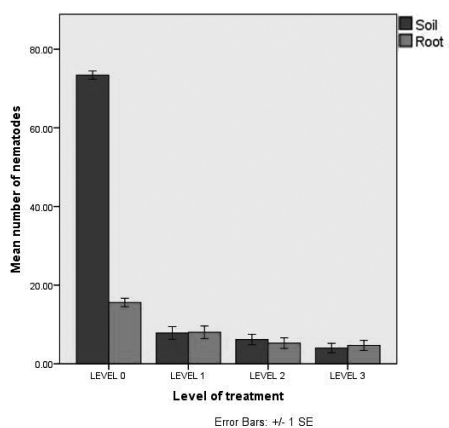


Fig. 5b. Effect of dosage of application on nematode population

Discussion

The suppression of root-knot nematode with composited agricultural wastes has been documented by several authors (Oka and Yerumiyahu, 2002). Agricultural wastes applied in this research have suppressed nematode population, thus improving tomato growth and vigour. Significant variations were observed among the different agricultural wastes employed on their effect on growth parameters of tomato and reduction in root-knot nematode population. This observation is in consonance with the reports of Brown and Kelly (1989), which was also corroborated by Hoiting and Boehm (1999), to use agricultural and industrial wastes for the management of soil borne diseases. Agricultural wastes are very effective in the control of plant parasitic nematodes (Oka and Yerumiyahu, 2002). A significant reduction of root galling and final population of *Meloidogyne incognita* race 1 and *M. javanica* on tomato and olive plant by using rice husk, dry cork, dry grape marc and dry olive marc was reported by Andres *et al.*, (2004). Similarly, the effectiveness of application of rice husk, saw dust and refuse dump on the population reduction of *Meloidogyne* spp infecting tomato was documented by Hassan *et al.*, (2010). Agricultural waste materials release toxic products into the soil after decomposition (Bello *et al.*, 2006), which directly affects plant parasitic nematodes in soil. Furthermore the decomposed materials increase soil fertility which is to the advantage of the growing crop (Boehm *et al.*, 1993). By suppressing the effect of nematodes, the physicochemical properties of the soil are also altered (Huang and Huang, 1993) against the advantage of the growing crop.

Conclusion

The use of agricultural wastes will provide a new dimensional method for nematode control in tomato plants, thus emphasising the importance of conserving agricultural wastes for renewable purposes.

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