IMPACT ASSESSMENT OF NEEM COMPOST AND TRICHODERMA HARZIANUM SOLUTION IN THE CONTROL OF ROOT KNOT NEMATODE DISEASE ON COWPEA.

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A B S T R A C T

Efficacy of neem leaf based compost and *Trichoderma harzianum* solution were assessed on root knot nematode pest of two cowpea varieties at the screen house of the International Institute of Tropical Agriculture (IITA), Ibadan during 2012 planting season. The two cowpea varieties which have been confirmed to be susceptible to root knot nematode, IT96D-610 and IT84S-2246-4 were the test crops. The experimental pots (10kg soil) were inoculated with 5,000 root knot nematode eggs. The treatments were neem compost and *T. harzianum* solution with application rates of 2 ton/ha and 1x10^7 spores respectively. The pots that were not treated served as the control. Each treatment was replicated 4 times while the statistical design was complete randomized design. Data were collected on the growth and yield of cowpea, and also on the nematode populations in the soil and cowpea root. The results indicated that neem compost and *T. harzianum* solution significantly increased the growth and yield of IT96D-610 and IT84S-2246-4 cowpea varieties grown in the root knot nematode inoculated soil. The populations of root knot nematode in the soil and cowpea root were significantly reduced. The level of root damage (root gall) was significantly reduced in the neem compost and *T. harzianum* treated cowpea when compared with the untreated control.

Keywords: *Trichoderma harzianum*, root knot nematode, neem compost, cowpea, control.

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp) is an important food legume and essential component of cropping system in the drier region of the tropics and subtropics (Singh *et al.*, 2003), and it is important livelihood of millions of people (Quin, 1997). The grain contains between 20-25% proteins (Kay, 1979). Cowpea is also a valuable and dependable commodity that produces income for many smallholder farmers and traders in sub-saharan Africa (Langyintuo, 2003). It is a deep rooted crop and does well in sandy soil and more tolerant to drought than soybean (Dadson *et al.*, 2003). It forms a major component of the tropical farming system because of its ability to improve soil fertility through nitrogen fixation (Abayomi *et al.*, 2008). Cowpea can fix about 240 kg ha^-1^ atmosphere nitrogen and makes available about 60-70 kg ha^-1^ nitrogen for succeeding crops grown in rotation (Aikins and Afuakwa, 2008).

Plant parasitic nematodes is a serious pest and constitutes a major production constraint to cowpea in most growing areas of the world (Sikora *et al.*, 2005; Sikora and Geco, 1990). Symptoms of nematode on cowpea include stunted growth, yellowing, presence of galls, excessive branching of roots and reduced functioning of root systems. Poor germination and death of seedlings may be observed in case of heavy infestations (Mishra, 1992). Several species of nematode are known to cause losses to cowpea throughout the world. Caveness and Ogunfowora (1985) listed 55 species of plant parasitic nematode associated with cowpea production. The root knot nematode *Meloidogyne incognita* and *M. javanica*, are documented to cause major losses, with *M. incognita* indicated to be the most detrimental species to cowpea (Sarmah and Sinha, 1995). Sometimes ago, an estimated 59% cowpea yield loss, caused by *M. incognita* was reported in Nigeria (Ogunfowora, 1976). Olowe (1978) also found 80% cowpea seedling mortality in a soil with *M. incognita* population density of 1300 second stage
juveniles (J2). Comprehensive survey of cowpea growing areas in Nigeria revealed root knot nematode present in all the 248 farms; with *M. incognita*, *M. javanica* and *M. arenaria* present in 52%, 44% and 4% of the soil samples respectively (Oloue, 2004).

In recent past the concern for the environment, high cost of nematicides, the nonavailability of nematicides in time of need and the hazard they bring as well as the fear of nematodes developing resistance to synthetic nematicides have motivated researchers to exploit alternative way of controlling nematode infection. It is in this regard that nematologists especially in the developing world tend to look for indigenous, non-expensive but effective method of nematode control and with less or no hazard to plant, soil and livestock (Jada, 1993; Umar et al., 2010). Adegbite and Adesiyan (2005) had advocated for the need to develop naturally occurring nematicide which are harmless to man and livestock, but effectively controlled nematodes.

The objective of this research work was therefore to determine the efficacy of neem compost and *Trichoderma harzianum* solution in the control of root knot nematode on cowpea.

**MATERIALS AND METHODS**

The research was conducted in the screen house at the International Institute of Tropical Agriculture (IITA), Ibadan, Oyo State, Nigeria during 2012 cropping season. Sandy loamy soil was collected from a depth of 01-25cm from IITA farm, the soil collected was sieved with 2 mm sieve to avoid plant debris and stones, steam sterilized and filled into plastic bucket of 30cm diameter. The inoculum was root-knot nematode egg which was extracted from infected Celosia root in the laboratory using the method described by Hussey and Barker (1973).

The two cowpea varieties which have been confirmed to be susceptible to root knot nematode, IT96D-610 and IT84S-2246-4 were planted. Three (3) seeds were planted per pot and later thinned to one healthy plant per pot. The experimental plastic pots with 10 kg steam sterilized soil were inoculated with approximately 5000 root knot nematode egg, within the cowpea rhizosphere, using 5 ml syringe at three weeks after planting. The treatments, neem compost and *T. harzianum* solution, were applied at the rates of 2 ton/ha and 1x10⁷ spores respectively, at four weeks after planting. The pots that were not treated served as the control. Each treatment was replicated 4 times while the statistical design was complete randomized design. Watering, manual weeding and insect control using Cypermethrin 10% EC were done whenever necessary.

Data were collected on plant height, number of leaves, seed weight, fresh and dry root weights, gall index, initial nematode population and final nematode populations. Gall index was determined using standard rating scheme (Sasser, 1984). At final harvest of the two cowpea varieties, the nematode populations in the root (10 g) were extracted and counted following the method described by Hussey and Barker (1973), while the nematode population in the soil (200 ml) were assessed using pie-pan extraction method as described by Whitehead and Hemming (1965). All data collected were subjected to analysis of variance and differences between the means were separated using Duncan’s multiple range test at 5% probability level.

**RESULTS**

The efficacy of neem compost and *Trichoderma harzianum* on the growth of two cowpea varieties, IT96D-610 and IT84S-2246-4, planted on root knot nematode infested soil was shown on Table 1. There was significant difference between the treated pot and untreated pot (control). The cowpea varieties treated with neem compost have higher plant height and number of leaves this was closely followed by those treated by *Trichoderma harzianum*, IT96D-610 cowpea variety that were treated with *Trichoderma harzianum* had the highest number of leaves followed by those treated with neem compost while the least plant height and number of leaves per plant were recorded in cowpea that were not treated control.

**Table 1. Efficacy of neem compost and *T. harzianum* on the growth of cowpea varieties planted in root knot nematode infested soil.**

| Treatment       | Plant height | Number of leaves |
|-----------------|--------------|-----------------|
|                 | IT96D-610    | IT84S-2246-4    | IT96D-610    | IT84S-2246-4    |
| Neem compost    | 40.3a        | 45.7a           | 50a          | 57a             |
| T. Harzianum    | 36.6a        | 38.4c           | 51a          | 53a             |
| Control         | 23.4b        | 24.2c           | 34b          | 35b             |
The efficacy of neem compost and *Trichoderma harzianum* on the yield of cowpea varieties (IT96D-610 and IT84S-2246-4) were shown in Table 2. The results obtained from the application of treatments (neem compost and *T. harzianum*) showed some significant differences from the untreated (control). The plant treated with neem compost have higher number of pod followed by the cowpea plant treated with *T. harzianum* while the lowest number of pod per plant were obtained from plants that were not treated (control). Cowpea variety (IT96D-610) that were treated with neem compost had the highest number of seed per pod while cowpea untreated plant (control) as compared with treated plants. Nematode population in the soil and root were significantly lower in the treated plant. Cowpea variety (IT96D-610) treated with neem compost and cowpea variety (IT24S-2246-4) treated with *T. harzianum* have the least population of nematode. The control plants have higher nematode population in both the soil and root. The result of the reproduction factors showed that there was significant decreased in the nematode reproduction potentials in all the treated plants.

Table 2. Efficacy of neem compost and *T. harzianum* on the yield of cowpea varieties planted in root knot nematode infested soil.

| Treatment          | Number of pod per plant | Number of seed per plant | Weight of seed per plant |
|--------------------|-------------------------|--------------------------|--------------------------|
| Neem compost       | IT96D-610               | IT84S-2246-4             | IT96D-610                |
|                    | 9a                      | 11a                      | 8a                       |
| T. harzianum       | IT96D-610               | IT84S-2246-4             | IT96D-610                |
|                    | 6b                      | 8b                       | 8a                       |
| Control            | IT96D-610               | IT84S-2246-4             | IT96D-610                |
|                    | 1c                      | 2c                       | 2b                       |

The efficacy of neem compost and *T. harzianum* on the soil root-knot nematode population and root damage on two cowpea varieties (IT96D-610 and IT84S-2246-4) were shown in Table 3. There were significant differences between the treated plant and control on fresh and dry root weight in both varieties (Table 3). The control plants have higher root weight and dry matter weight. The cowpea plants that were treated with neem compost and *T. harzianum* have lower root weight. There was a higher gall on the cowpea roots in the untreated plant (control) as compared with treated plants. Nematode population in the soil and root were significantly lower in the treated plant. Cowpea variety (IT96D-610) treated with neem compost and cowpea variety (IT24S-2246-4) treated with *T. harzianum* have the least population of nematode. The control plants have higher nematode population in both the soil and root. The result of the reproduction factors showed that there was significant decreased in the nematode reproduction potentials in all the treated plants.

Table 3. Efficacy of neem compost and *T. harzianum* on the soil root knot nematode population and root damage.

| Treatment          | Initial Population | Fresh root weight (g) | Dry root weight (g) | Gall Index | Final nematode Population | Root extraction | Reproduction factor |
|--------------------|--------------------|-----------------------|---------------------|------------|----------------------------|-----------------|--------------------|
|                    | IT96D-610          | IT84S-2246-4          | IT96D-610           | IT84S-2246-4 | IT96D-610                  | IT84S-2246-4    | IT96D-610          | IT84S-2246-4       |
| Neem compost       | 5000               | 5000                  | 0.38c               | 0.27b      | 0.14b                      | 0.09b           | 1b                 | 2b                 |
| T. Harzianum       | 5000               | 5000                  | 0.63b               | 0.86b      | 0.18b                      | 0.10b           | 1b                 | 1b                 |
| Control            | 5000               | 5000                  | 4.58a               | 3.47a      | 2.41a                      | 1.86a           | 5a                 | 4a                 |

**DISCUSSION**

Many fungi and bacterial agents have been examined over a period of time for their potential as bio-control agents (Sharma and Pandey, 2009). Direct pathogenicity of fungi as bio control agents is one of the main mechanisms responsible for plant parasitic nematode control. However, secondary metabolic from fungi also contain compounds which are toxic to plant parasitic nematodes (Dabata and Sikora, 2007). Also several attempts have been made to use *Trichoderma* species to control plant parasitic nematode (Windham et al., 1989). The reproduction of eggs produced by the root knot nematode *M. incognita* following soil treatment with a *Trichoderma* conida suspension.
Trichoderma spp have been used as a bio control agent plant parasitic nematode and this fungus may also promote plant and have the ability to colonize root surface and the cortex (Sharon et al., 2001). Trichoderma spp led to inhibition of the nematode activities and movement. Trichoderma vinde in combination with organic amendment was also known to produce growth hormones, which have observed to have added response in boosting the plant vigour. It has been reported that Trichoderma has not only been produced to parasitize nematode and inactive pathogen enzymes but also help in tolerance to stress condition by enhanced root development.

CONCLUSION

In conclusion neem compost and T. harzianum (2.0t/ha and 1x10^7 spores respectively) were effective promising measure for controlling root-knot nematode on cowpea. It is therefore recommended the farmers’ use in root knot-nematode endemic areas.

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