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The effectiveness of some plant materials used as soil amendments in the control of plant parasitic nematode infection of cowpea

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ABSTRACT: A study was carried out to assess the effectiveness of cassava tuber peel, locust bean husk, and neem leaves in plant parasitic nematode control on cowpea cv. IR48. The two rates (1.5 and 2.0 ton/ha each) of the tested soil amendments gave good nematode control on cowpea cv. IR48 as compared with the control though 1.5 tonne/ha locust bean husk treatment was not as effective as the 2 tonne/ha locust bean husk, 1.5 and 2 tonne/ha each of cassava tuber peel and neem leaf in increasing yield of the treated cowpea. The results indicate that the soil amendments significantly improved growth and yield of cowpea cv. IR48, suppressed plant parasitic nematode population build-up in the soil and reduced the galls on cowpea roots.

Key Words: Cowpea; *Vigna unguiculata*; Parasitic nematodes; Cassava peel; Locust bean husk; Neem.

Introduction

Cowpea is an important food crop in Nigeria which suffers damage and yield reductions as a result of plant parasitic nematode infection (Babatola and Omotade, 1991). The use of synthetic chemical nematicides in the control of parasitic nematodes on food crops has been a point of criticism for some years. This is because synthetic chemical nematicides are very expensive, not always available at the time of need and not always biodegradable thereby becoming sources of pollution in the environment. It becomes imperative to search for alternative methods which are cheaper and environmentally friendly.

Hoan and David (1979) suggested the use of plant materials that have nematicidal properties for the control of parasitic nematodes on food crops. Ismali and Badawi (1998), Youseff and Amin (1997), D'Addabo *et al*., (1997), Goswami (1993), Babatola (1989) and Oyedunmade *et al*., (1995) reported a reduction in the population level of parasitic nematodes of food crops following the incorporation of certain nematotoxic plant materials into the soil.

This study was conducted to evaluate the effectiveness of cassava (*Mannihot esculentus*)tuber peel, locust bean (*Parkia bigiobose*) husk and neem (*Azadirachta indica*) leaf in root-knot nematode control on cowpea *Vigna unguiculata* (L) Walp cv. IR48.

Materials and Methods

The experiment was conducted on root-knot nematode infested field measuring $300m^2$ using a randomized complete block, design. There were 5 blocks and 7 plots per block, with 1m each alley ways left in-between each plot and block in order to prevent treatment interaction. Preplanting field nematode population was estimated from soil samples taken randomly from 1-15cm soil depth. Cowpea (cv.IR48) seeds were sown three seeds per stand and two rows per ridge, at spacing of 25cm within the row. Two weeks after planting (WAP), seedlings were thinned down to two healthy plants per sand.

Cassava tuber peel, locust bean husk, and neem leaves were air dried and ground to a fine power using attrition mills. Each of the three soil amendments were applied at the rates of 1.5 and 2.0 ton/ha by handing method along the ridges 2WAP while the control plots were left untreated thus there were 7 treatments each replicated 5 times in all the plots. Manual weeding and insect control measures using an insecticide (Decis) were carried out promptly and when due.

Data were collected on leaf number and plant height at 8 weeks after planting. Pod number, pod length, 50% flowering data, number of seeds/pod, pod weight, threshing percentage and grain yield were also taken.

At harvest, soil samples were collected for final nematode population count, Root knot nematodes in the soil samples collected at planting and harvesting were extracted by the method described by Southey (1986) using 200g soil samples.

Root-knot nematodes in each sample were counted under a stereo microscope. Also at harvest, the roots of cowpea plants were assessed for galls using a rating scheme of 0.5 where 0=no galls, 1=5% galled roots, 3=26-50% galled roots, 4=51-75% galled roots, 5=76-100% galled roots (Sasser *et al*., 1984).

Data collected were subjected to analysis of variance and means were separated using Duncan's Multiple Range Test.

Results

The effects of cassava tuber peel, locust bean husk, and neem leaf on mean number of leaves/plant, plant height, pod length and 50% flowering date are shown in Table 1.

The cowpea plants on amended soil had better vegetative growth in terms of significantly higher values of number of leaves/plant and plant height than the control plants.

The treated plant also attained 50% flowering earlier than the control while the pods were significantly longer in the treated plants than in the cowpea plants grown on un-amended soil. The different types and rates of soil amendments did not differ significantly among themselves with respect to plant height and 50 flowering date but the number of leaves/plant was significantly lower in 1.5 tonne/ha of both cassava tuber peel and locust bean husk than in other amendments. Similarly, pod length was significantly lower in 1.5 tonne/ha of locust bean husk than in the other types of soil amendments.

Table 2 shows that mean pod number/plant, seed number/pod, threshing percentage and grain yield/ha differ significantly as a result of the different treatments. Treated plants had significantly more pods which were better filled and consequently higher yields than the control. Though the amended plants did not differ significantly among themselves in respect of the pod number/plant and threshing percentage, the mean seed number/pod and grain yield differed significantly. Locust bean husk treatment at 1.5 tonne/ha was not as effective as the other types and rates of amendments.

The final nematode population and gall index were significantly reduced in the treated cowpea plants than in the control (Table 3). However, it was observed that1.5 tonne/ha locust bean husk amendment was not as effective as the other amendments treatments while the 2 tonne/ha neem treatment resulted in the significantly lowest root fall index.

Table 1: Effects of Cassava Tuber Peel, Locust Bean Husk and Neem Leaf Treatments on some Growth Parameters of Cowpea cv. IR48.

Treatment	Mean number of leaves/plant at 8 WAP	Mean plant height (cm) at 8 WAP	Mean pod length (cm)	50% flowering date (days after planting
1.5 ton/ha cassava tuber peel	121b	39.5a	18.5a	46a
2.0 ton/ha cassava tuber peel	145a	40.1a	19.2a	45a
1.5 ton/ha locust bean husk	130b	38.7a	16.1b	46a
2.0 ton/ha locust bean husk	142a	38.8a	18.3a	46a
1.5 ton/ha neem leaves	148a	36.9a	18.1a	46a
2.0 ton/ha neem leaves	149a	37.6a	19.4a	45a
Control	74c	31.1b	11.0c	51b

Means followed by the same letter along the same column are not significantly different at 5% probability level.

Table 2: Effects of cassava tuber peel, locust bean husk and neem leaf treatments on yield parameters of cowpea cv. IR48.

Treatment	Mean pod number/plant	Mean seed number per pod	Threshing %	Grain yield/ha (tonne)
1.5 ton/ha cassava tuber peel	27a	16.6a	69.6a	1.2a
2.0 ton/ha cassava tuber peel	28a	16.9a	71.1a	1.3a
1.5 ton/ha locust bean husk	26a	14.1b	69.5a	0.9b
2.0 ton/ha locust bean husk	27a	16.6a	69.0a	1.3a
1.5 ton/ha neem leaves	27a	16.1a	69.2a	1.2a
2.0 ton/ha neem leaves	29a	19.9a	72.0a	1.4a
Control	18b	9.7c	60.7b	0.6c

Means followed by the same letter along the same column are not significantly different at 5% probability level.

Table 3: Effects of cassava tuber peel, locust bean husk and neem leaf treatments on parasitic nematode population/200g soil and gall index cowpea plants.

Treatments	Initial nematode population 200g soil sample	Final nematode population 200g soil sample	Gall Index
1.5 ton/ha cassava tuber peel	866	568a	1.2b
2.0ton/ha cassava tuber peel	871	560a	1.0b
1.5 ton/ha locust bean husk	851	671b	1.7b
2.0 ton/ha locust bean husk	911	503a	0.9b
1.5 ton/ha neem leaves	857	495a	0.8b
2.0 ton/ha neem leaves	881	410a	0.4a
Control	889	1520c	3.8d

Means followed by the same letter along the same column are not significantly different at 5% probability level.

Discussion

The observed poor growth and yield of the control plants show the adverse effects of the parasitic activities of the nematodes on cowpea. Earlier investigations carried out by Ismail and Badawi (1998) and Oyedunmade *et al*., (1995) support this finding of stunted growth and low yield in nematode infected crops. The improved growth and yield of cowpea on the amended soil could be due to the presence of nematotoxic residues left in the soil as a result of the decomposition of the cassava tuber peel, parkia husk and neem leaves.

Addition of organic amendments to the soil has been reported to increase the population of antagonistic micro-organisms and nematophagous fungi which reduce plant parasitic nematode population in the soil (D'Addobbo *et al*., 1997; Umara and Goswani, 1996). The lower root gall index of the treated cowpea plants support this claim. In addition, the decomposed amendments may also add organic matter to the soil which is likely to further encourage better growth and development of the treated cowpea plants.

Neem has been reported to contain active components including Nimbine, Nimbidine, Nimbinine, Thionemone, Margosine-0 (Hussain *et al*., 1984) while parkia husk has been reported to contain alkaloids, saponins, tannins and cardiac glycosides (Achidi, 1987). Cassava tuber peel has been reported to contain a large amount of parasitic acid (Hydrocyanide) with greater concentration in the phelloderm. Other breakdown products like ammonia and toxic chemicals from microbial decomposition of cassava tuber peel are also nematotoxic (Egunjobi and Larinde, 1975). All these reported chemical components may be responsible for the observed nematotoxic effects of the plant materials used as organic amendments.

In conclusion, the results indicate that cassava tuber peel, locust bean husk and neem leaf as soil amendments at either 1.5 or 2 tonne/ha can provide an effective control of plant parasitic nematodes in cowpea cultivation though applying locust bean husk at the higher rate is more beneficial than the lower rate in increasing cowpea yield.

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