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E-mail: submit@mutagens.co.in
researchsubmission@hotmail.com

Research Paper

EFFICACY OF SOME BOTANICALS IN THE CONTROL OF ROOT-KNOT NEMATODE DISEASE OF COWPEA (*Vigna unguiculata*)

Cookey, Chinaekwu. Odinakachi , Agu, Clifford,Madubuko and Onyishi, Godwin, Chuka

Department of Crop Science and Technology,
Federal University of Technology,
Owerri.

Abstract

Efficacy of some botanicals: *Azadirachta indica, Chromoleana odoratum and Carica papaya* leaves were evaluated for the root-knot nematode disease of cowpea. This was on a sandy loam soil naturally infested by a root-knot nematode, *Meloidogyne incognita*. The experiment was laid out in randomized complete block design with four replications and the botanicals applied at 16,666kg/ha. Results showed that root-knot severity was significantly (p = 0.05) reduced by the botanicals applied. This was in the order: A.indica > C.odoratum >C.papaya. Plant height, vine length, leaf area, shoot weights and number of leaves per plant increased with decreases in root-knot severity. Conversely, fresh root weight increased with increases in root-knot severity.

Key words: Disease, botanicals, root-knot, cowpea, nematode, efficacy.

INTRODUCTION

Cowpea (Vigna unguiculata (L) Walp is of major importance to the livelihoods of millions of relatively poor people in less developed countries of the tropics (1) It is a veritable source of dietary protein, calcium and iron for the teeming population of human and livestock (2).

All parts of the plant are used for food (3).Immature pods and peas are used as vegetables while several snacks and main dishes are prepared from grain (4).

Among the legumes, cowpea is the most extensively grown, distributed and traded food crop (5; 6). Despite the numerous benefits of cowpea, production has remained low due to the problems of pests and diseases (7). Root-knot nematodes have been identified as a bane in cowpea production (8) in which *M.incognita* and *M.javanica* are the major species implicated on a world basis. Root knot nematode accounts for 20-90 % loss in yield of cowpea in Nigeria (9).

Nematode control is necessary in order to reduce crop losses and ensure self-sufficiency in the requirement for food and industrial raw materials. Various control options have been employed for the management of root-knot nematodes. These include the use of synthetic chemicals (10), crop rotation (11), and use of resistant varieties (12), intercrop (13), organic manure (14), biological agents (15) and botanicals (16).

The success and adoption of any one of these methods however depends mainly on the level of expertise and socio-economic conditions of the farmers.

The use of botanicals appears the most feasible especially for low income farmers who constitute about 98% of the farming population. Applications of these botanicals do not constitute a threat to the environment, they are easily affordable, require less skill and above all

increase soil fertility (17).It has been reported that pesticides of plant origin contain pesticidal properties that inhibit egg-hatch and development of *Meloidogyne spp*. (18)
This study was therefore undertaken to evaluate the efficacy of such botanicals as *Azadirachta indica, Chromoleana odoratum and Carica papaya* leaves for the control of root-knot nematode disease of cowpea.

MATERIALS AND METHODS

The study was carried out at the Teaching and Research Farm of the Federal University of Technology, Owerri located on latitude 5º27'50.23'' North and Longitude 7º02'49.33'' East at height above sea level of 55 m (Handheld Global Positioning System). Owerri has a rainforest agro-ecology characterized with more than 2, 500 annual rainfalls, 27- 29ºC annual temperature and 89 – 93% humidity. The soil was loamy sand (91.40% sand, 5.14 clay, 3.46 silt) and naturally infested with root-knot nematode, *Meloidogyne javanica* (19).
The experimental site was cleared manually using machetes and spades. Stumping was also done and this was followed by mapping out and bed/plot making.
The experiment was laid out in a Randomized Complete Block Design with four treatments replicated four times. This gave a total of 16 experimental plots at 4 plots per block.
Each plot measured 1.2 m x 1.5 m with space of 0.3 m. the blocks were separated from each other by 0.5 m furrow.
The treatments include; Paw-paw (*Carica papaya*), Siam weed (*Chromolaena odorata*) leaves, Neem (*Azadiracta indica*) leaves and zero application (control).
3 kg (16, 666 kg/ha) of each of the materials (treatments) were weighed out and randomly allocated to the plots, and then incorporated into the soil.
Planting of cowpea was done during the cropping seasons of 2011and 2012. During planting, the cowpea seeds CV "Ife Brown" was first surface sterilized in 10% commercial sodium hypochlorite (NaOCl) solution for 2 minutes and rinsed three times with tap water for 24 hours before sowing. Two seeds were planted per hole at a depth of 2 – 3 cm at 40 cm x 20 cm spacing. This gave a plant population of 250, 000 plants per ha.
Plant root infection assessment was done by uprooting the plants with adhering soil gently removed from the roots. Root system were individually scored according to (20) in which 0 = no infection (no gall present); 1= rare infection (1-3 galls present); 2 =light infection (4-10 galls present); 3 = moderate infection (11-30 galls present) and 4 = severe infection (> 30 galls present).
The following growth and yield parameters were measured, number of leaves, leaf area, plant height, vine length, fresh shoot weight and fresh root weight. These data were subjected to analysis of variance procedure for RCBD using Genstat 7.2(Discovery Edition 3), mean separation was carried out using Least Significant Difference (LSD) at 5% level of significance.

RESULTS AND DISCUSSIONS

The effect of some botanicals on galling incidence of cowpea roots is shown in table 1. The degree of root-gall nematode damage incurred cowpea plants treated with neem leaves had significantly (p=0.05) the least root galls, followed by Siam weed and paw-paw leaves. The plants with no treatment (control) recorded the highest root galls. This is in agreement with (21) who reported that application of water extract of neem leaves, Siam weed leaves and roots delayed development and consequently reduced population of *M. incognita.* This could be attributed to the nematicidal properties of these plant materials. Also, the use of different botanicals has been reported by (22) to control of root-knot nematode disease. (23) reported that organic soil amendments help to stimulate complex predatory microbes that keep potential pests and pathogens under control.
The different botanicals also showed a positive response in the number of leaves as well as leaf area which differed significantly (p = 0.05) from the control (Table 1). Plants treated with Neem leaves also had the highest number of leaves followed by Siam weed leaves. The effect on the leaf area followed the same trend with Neem leaves significantly (p=0.05) recording superior leaf area.

This result supports a similar report by (24); (25) which indicated that *M. incognita* infection on sweet potato significantly reduced number of leaves per plant as well as the tuber yields. The reduction in leaf area of the control could be due to the consequence of the nematode development and giant cell formation in the stem which leads to malformation of the xylem element and the inhibition of secondary growth of the xylem and phloem tissues (26).

Results obtained on the effect of different botanicals on plant height and vine length showed significant (p = 0.05) differences. Those treated with different botanicals had higher plant height and vine length when compared with the control. This could be attributed to the chemical composition (nematicidal properties) of these plant materials incorporated into the soil which reduced the damaging effect of the nematodes in the soil. Cowpea plant treated with neem leaves and pawpaw leaves had the highest plant height of 25.65 cm and 22.55cm respectively which differed significantly (p = 0.05) from the control (4.70 cm). Results obtained from the vine length followed similar trend. This could be attribute to the higher number of galls obtained from plots without any treatment, which disrupted the translocation of adequate water and nutrient to the vegetative parts (27). Release of toxic compounds from plant tissues were also reported to reduce plant parasitic nematode infection, several plant terpenoids and phenolic compounds are known to have nematicidal properties (28).

Results on the fresh shoot weight of cowpea plants showed significant difference among the treatments, with Neem leaves, Siam weed leaves and pawpaw leaves significantly superior to the control in that order. This suggests that the application of these botanicals was able to suppress the root-knot damage on the cowpea and also improved the growth of the cowpea plants.

On the other hand, fresh root weight of infected plants (control) had significantly higher fresh root weight from the treated plants. This result may be attributed to the formation of galls or giant cells .(29) reported that galling and proliferation of lateral roots by infected plants might be attributed to abnormal secretion of growth hormones induced by root-knot nematode. This explains the relative higher root weight of infected plant.

These galls/giant cells are adapted to provide nutrient sink from which the nematode is able to feed resulting in higher root weight.

Table 1: Effect of some botanicals on galling incidence ,plant height, vine length, number of leaves , leaf area, shoot weight and root weight of cowpea as affected by *M. incognita*

Botanicals	No of galls per plant	Plant height/plant (cm)	Vine length/plant (cm)	No. of leaves/plot	Leaf area (cm^2)	Shoot weight/plot	Root weight/plot
Neem leaves	0.85	25.65	128.20	136.80	85.80	826.91	212.50
Paw-paw leaves	10.35	22.55	111.43	109.50	47.80	455.30	422.30
Siam weed leaves	1.70	19.70	113.45	125.00	61.68	614.85	276.25
No treatment(Control)	48.00	14.55	65.50	65.95	34.80	304.05	702.00
$LSD_{0.05}$	19.10	4.70	42.23	3.11	5.69	90.63	129.60

CONCLUSION

The use of botanicals and extracts from many plant species in plant disease control has been found to be effective against many phyto-pathogenic organisms. Plant materials contain anti-

microbial compounds that can be used as alternative to synthetic pesticides. These plant materials are environmentally safe, less risky for developing resistance in pest, less hazardous to non-target organisms and pest resurgence, has less adverse effect on plant growth and above all, less expensive.

The results from this study revealed that the botanicals, Neem leaves, Siam weed leaves, Paw-paw leaves were significantly effective in the control of root-knot nematode disease of cowpea. The results suggest that Neem leaves have more potential to control root-knot nematode disease thereby improving the growth of the cowpea than Siam weed and Paw-paw leaves.

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