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Effect of Botanicals in the Control of Meloidogyne incognita (Kofoid and White)Chitwood on Soybean [Glycine max (L) Merr.]

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Abstract: *The effect of two organic amendments viz:-Bitter leaf (BL) and Cashew seed kernel (CSK) used in the control of Meloidogyne incognita on soybean was investigated during the 2009 and 2010 rainy seasons. Soybean cultivar TGS 1019 – N was planted on a 65m^2 plots. Soil at the base of each plant was mixed with 60 g of the two amendments separately two weeks after germination. Plants were inoculated with 1000 juveniles of M.incognita at the base of each plant three weeks after germination. The results of the study indicated that superior growth parameters and better nematode control were obtained in treated plants compared to untreated control. Also CSK amendment was more effective on nematodes than BL. The results further showed that both amendments could be used in nematode control and therefore recommended in soybean fields to control nematodes.*
Key words*: organic amendments, nematodes, Growth parameters, inoculation, soybean*

I. Introduction

Soybean [*Glycine max* (L) Merr.] is one of the most important leguminous crops in the world, which contains about 20% protein. The seed provides an important alternative source of animal protein to humans. It is processed into various forms such as curd, flour and milk. The haulms, leaves and entire plants are used as animal feed. The crop is cultivated on about 52.37 million hectares of land and leading producers include USA 90.6 million metric tons and Brazil 70 million metric ton (Biodiesel, 2010). The annual production of soybean in Nigeria was put at about 480,000 metric tons in 2010 with an average yield at 1.2 metric ton (Biodiesel, 2010).

Root-knot nematodes are cosmopolitan in distribution, attacking several economically important crops, causing several losses resulting in yield reductions. In the tropics, they are one of the most serious pests of many vegetable crops (De Guiran and Ritter, 1979). Crop plants attacked become chlorotic, necrotic, stunted, with reduced size and quality of fruits, fresh and dry weights of shoots and roots leading to wilting and reduced nodulation in legumes (Umar *et al*., 2010). The average yield loss of the world's major crops due to nematodes has been put at 12.3 % (Sasser, 1989). Under green house conditions 90 % yield loss in soybean was reported by Kinlock and Allen (1972).

Several methods have been used for the control of Root–knot nematodes, but the most spectacular of all is the use of chemical nematicides. However, they are not much used by peasant farmers because they are expensive, toxic and persistent, and require skill for their application (Umar *et al*., 2010., Umar and Chubado, 2009). Organic amendments have been suggested and used in the control of root – knot nematodes in crop fields. Amendments such as cow dung, poultry manure and neem leaves have been used in different crop fields to control *Meloidogyne* species (Egunjobi, 1992, Umar and Jada, 2000)). The availability of amendments including bitter leaf and cashew seed kernel form the basis of this research work. The objective of study was to find out the efficacy of bitter leaf and cashew seed kernel in the control of *M. incognita* in soybean fields.

II. Materials And Methods

Two experiments were carried out in the Teaching and Research Farm of the Department of Crop Production and Horticulture, Federal University of Technology, Yola, between the months of July and October 2009 and 2010. Yola is located within latitude 9^0 and 9^1 N and longitude 12^0 $30^{'}$ E, at an altitude of 185.9 m above sea level (Bashir, 2000). The land for the experiment measuring 65m^2 was cleared, ploughed and harrowed. The land was then demarcated into plots measuring 2 m x 2 m. Nematode susceptible Soybean cultivar TGS 1019-N was planted at a spacing of 5 cm within rows and 40 cm between rows at the rates two seeds /hill which was later thinned to one stand/hill.

Bitter leaf and cashew seed kernel were collected from the University Farm. They were then dried in the shade, ground into powder and stored separately in polythene bags in the laboratory. Sixty grams of the amendments were weighed and incorporated at the base of each plant two weeks after germination, untreated plots served as control treatments. The experiment was laid out in randomized complete block design (RCBD) replicated three times.

The inocula for the experiments were the eggs of *M. incognita* obtained from infected *Celosia* plants. The inocula were extracted from roots of *Celosia* plants using the methods described by Hussey and Barker (1973). Soybean plants were inoculated with one thousand eggs of *M. incognita* three weeks after germination. The inocula were applied with a syringe by exposing the roots before application.

Data was collected on shoot length, number of leaves and number of pods on weekly basis up to harvest time. At harvest, data were collected on seed weight, fresh and dry weights of shoots and roots and number of nematodes recovered from soil using the methods of extraction described by Whitehead and Hemming (1965). All data were subjected to analysis of variance and signifant difference between treatment means was separated using the Duncan's Multiple Range Test at P< 0.05.

III. Results And Discussion

There were significant differences between the treated plants and the control plants regarding the length of shoots of soybean plants in both 2009 and 2010 (Tables 1 and 2). The tallest plants were recorded in 2010 in treatments containing CSK (37.2cm). This could be attributed to an enhanced nutrients released by decaying materials of the amendment which enhanced the growth of soybean plants and reduced nematode attack on the plants. Applications of amendments have been reported to be beneficial not only to the plant but also reduce nematode attack and improve the growth of crops (Umar *et al*., 2010). Also the treated plants in both years recorded the highest number of leaves. The control plants in both years recorded the least number of leaves (18.0 in 2010; 15.0 in 2009). This could be attributed to the activity of the nematodes which affected transportation of water and minerals from the roots to the shoots and hence the fewer number of leaves recorded.

Table 1: Effect of botanicals on the control of *M. incognita* on soybean in the field in Yola, in 2009

	Parameter								
Treatment	SL (cm)	NL	NP	FSW (g)	DSW (g)	FRW (g)	DRW (g)	SW (g)	FNP
CN	24.3b	18.0c	22b	70c	28c	45a	18a	60c	1244a
CSK	34.5a	27.8a	43a	205a	97a	20b	9b	300a	364c
BL	35.3a	24.0b	41a	198b	86b	24c	10b	280b	380b

Means in the same column with same letters are not significantly different according to Duncan's multiple range test at P≤0.05.

CN – Control, BL – Bitter leaf, CSK – Cashew seed kernel, SL – Shoot length, NL – Number of leaves, NP – Number of pods, FSW – Fresh shoot weight, DSW – Dry shoot weight, FRW – Fresh root weight, DRW – Dry root weight, SW – Seed weight, FNP – Final nematode population.

Table 2: Effect of botanicals on the control of *M. incognita* on soybean in the field in Yola, Nigeria in 2010

	Parameters								
Treatment	SL (cm)	NL	NP	FSW (g)	DSW (g)	FRW (g)	DRW (g)	SW (g)	FNP
CN	21.9c	15.0c	17c	67c	19c	38a	15a	22c	1345a
CSk	37.2a	30.1a	47a	227a	102a	18b	5c	356a	228c
BL	34.5b	26.0b	44b	210b	90b	20b	8b	320b	258b

Means in the same column with same letters are not significantly different according to Duncan's multiple range test at P≤0.05

CN – Control, BL – Bitter leaf, CSK – Cashew seed kernel, SL – Shoot length, NL – Number of leaves, NP – Number of pods, FSW – Fresh shoot weight, DSW – Dry shoot weight, FRW – Fresh root weight, DRW – Dry root weight, SW – Seed weight, FNP – Final nematode population.

Higher fresh and dry weights of shoots and roots were recorded in the treated plants compared with the control. Plants treated with CSK amendment recorded the highest fresh and dry weights in 2009 (205 and 97 g respectively), and 2010 (227 and 102 g respectively). This could be attributed to the efficacy of the amendments which reduced nematode attack and promoted the accumulation of fresh and dry matter in the plants. The control plants recorded the highest weights of root as compared to the treated plants. This could be due to the development of more galls which brought about biochemical and physiological changes in the roots, which caused reduced root efficiency for water and nutrient absorption (Rodriquez-Kabana *et al*., 1987., Umar *et al*., 2010)

The results further showed that treated plants recorded more number of pods and seed weights than the control (Tables 1 and 2). Amongst the treated plants CSK treatments recorded higher pods and seed weights than BL in both years. This was probably due to the efficacy of the amendments which control the nematodes and resulted in the production of more pods and seeds in the treated plants. This result is in line with that of Chindo and Khan (1986), who reported that incorporation of amendments into the soil reduced nematodes population and improved the yield of crops.

The control plants recorded the highest number of nematodes recovered from soil as compared with other the treatments. This was because of non incorporation of the amendments in the control plants and this resulted in more infection and reproduction of nematodes in soybean roots. All the treated plants recorded fewer nematodes population and this was attributed to the efficacy of the amendments which prevented nematodes from attacking soybean plants, thus preventing their growth and reproduction within the roots. This finding is in line with that of Wiratno *et al*. (2009) who reported that cashew seed extract was effective in killing juveniles of *M. incognita* in the Laboratory at lethal concentration (LC_{50}) of 19.2mg/ml at 24 hrs exposure and that of Umar and Jada (2000), who reported similar results on tomato crop using different amendments.

IV. Conclusion

The results of this study showed that BL and CSK amendments used as soil amendments were effective in the control of *M. incognita* and cause significant improvement on the growth and yield of soybeans. However, cashew seed kernel amendment was most effective than Bitter leaf and is therefore recommended for nematode control in similar conditions.

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