Bangladesh J. Sugarcane, 8 : 36 - 41. July, 1986

Efficacy of Cassava peeling and Siam Leaf amendments in controlling *Meloidogyne incognita* on sugarcane

E.O. Salawu,
Sugar Research Institute,
P.M.B. 1515,
University of Ilorin,
Ilorin, Nigeria,

ABSTRACT

Investigation on the effectiveness of Cassava (*Manihot utilisima* L.) root peelings and Siam (*Eupatorium odoratum* . L.) leaves, used as soil amendments singly and in combination in controlling the root-knot nematode *Meloidogyne incognita* on sugarcane variety Co1001, was carried out in a screenhouse. The amendments were not toxic to sugarcane plants, rather the growth and yield of plants with amendments were signficantly higher than the control. Development of root-knot and nematode population in the rhizosphere were significantly reduced in soil amended with Cassava peeling than soil amended with Siam leaves singly and in combination with Cassava peelings. Soil pH had no significant inhibitory effect on nematode penetration and development.

INTRODUCTION

In Nigeria, root-knot nematode (*Meloidogyne* spp) causes one of the major problems of sugarcane (*Saccharum* spp.), particularly in the Nigeria Sugar Estates. *Meloidogyne incognita* and *M. javanica* were most commonly associated with the crop (Caveness, 1967). Salawu (1984, 1985) through pot experiments reported sugarcane varieties D47/15, BR6225, Co 396, Co 453, Co 443, Dacca Co 957, Co 1001, B 5992, B 57175, B60267, B 41227, B 59162, B 62163, B 61110, B 60163 and B 4360 to be suseptible to *M. incognita*.

He showed that the growth and yield of thesugarcane varieties Co1001 and Co 957 two most popular commercial varieties in the Sugar Estates, were affected by the nematode. Histopathological studies revealed also that the nematode readily entered the roots of these sugarcane, developed into adult females, induced terminal galling of the roots and caused destruction of the root tissues (Salawu, 1985). Between 1966 and 1975 there was a severe decline in yield of sugarcane in one of the Sugar Estates located at Bacita, in Kwara State. The decline in yield was largely attributed to the damage caused by plant-parasitic namatodes (Odihirin, 1976), nevertheless information is scanty on the control of these nematode pests in Nigeria.

Organic amendments were effective in controlling some important parasitic nematodes affecting many crops (Singh and Sitaramaiah, 1970 ; Sayre, 1971 ; Alam, *et. al.* 1980). In Nigeria, Egunjobi and Afolami (1976) showed that Neem(*Pratylenchus indica* A. Juss) leaf extract was effective in reducing the population of *Pratylenchus brachyrus* in the rhizosphere of maize (*Zea mays* L)resulting in a significant increase in the growth and the yield of the crop. Egunjobi and Ekundare (1981) reported that

cassava peelings, used as amendment, considerably reduced the population of the same nematode in the soil cropped with maize. Amosu (1981) observed that the root extracts of Siam and castor (*Ricinus communis*) ingibited hatching of eggs of *M. incognita*. This probably led him to suggest that the root extracts of these plants were suitable for controlling the nematode population in the soil.

Although cassava peelings are considered to be a waste agricultural bye-product in Nigeria, while Siam is a noxious weed which grows extensively in the southern parts of Nigeria, their effectiveness as pest repellant has not been fully exployed. The present study investigates the effects of cassava root peelings and Siam leaf amendments singly and in combination on *M. incognita* and on the growth and yield of sugarcane.

MATERIALS AND METHODS

Fresh cassava root peelings and Siam leaves used in this investigation were collected at Odo-Oba, near Ogbomosho. Both materials were carefully washed in tap water, and dried in the oven (Model-Gallenkamp 2BS) at 40°C for approximately two weeks. The dry peelings and leaves were separately grounded to small particles in a blender and later preserved in polyethylene bags.

Sugarcane variety Co 1001, known to be highly susceptible to *M. incognita* (Salawu, 1984) was used as the planting material. Sugarcane setts, from single bud cuttings, were surface-sterilized in 1.5% sodium hypochlorite (NaOCl) solution for ten minutes and were later established in steam-sterilized sandy loam top soil mixed with pure sand in a 2:1 ratio, in perforated 5-litre plastic pots. Immediately after planting, certain quantites of cassava root peeling particles (CRPP) and Siam leaf particles (SLP) singly and combined were gently spread and buried approximately 3 centimetres below the soil surface. Pots containing the sugarcanes were later irrigated with tap water.

Two weeks after emergence, each sugarcane seedling was inoculated with approximately 5000 second stage larvae of *M. incognita* extracted from eggmasses on tomato CV. Ife 1, using the modified extraction tray method of Whitehead and Hemming (1965). The treatments were :

1. Test plant + 100g CRPP + nematode,
2. Test plant + 100g SLP + nematode.
3. Test plant + 50g CRPP + 50g SLP + nematode.

Test plant plus nematode alone served as control. Each treatment was replicated five times, randomly arranged on wooden benches, and irrigated with tap water daily.

The plants were harvested from the pots 120 days after inoculation. The fresh root and shoot weights, the cane heights (from gruond level to the topmost visible dewlap, (TVD), the number of tillers and internodes per plant were recorded.

The roots were carefully washed tap water to remove adhering soil particles and mopped with cloth towel. Root-knot per whole root system were counted and

recorded. Later, five gram roots were randomly taken from each plant and macerated for 30 sceonds in a blender, and the second stage larvae were extracted from the roots as described before. Soil in each pot was thoroughly mixed and 100 cm^3 soil sample was taken and processed for nematode extraction.

Phytotoxicity of the organic amendments to sugarcane was determined by counting the number of seedlings that sprouted and by recording development of the seedlings. Soil pH after harvest, was determined in 0.01M $CaCl_2$ solution (Juo, 1978).

RESULTS AND DISCUSSION

The results of the investigation showed that there was a significant decrease in root-knot development on sugarcane root systems due to addition of CRPP and SLP organic amendments,resulting in significant increase in the yield of the crop (Tables 1 & 2). Root-knot nematode had previously been reported to affect the growth of sugarcane in Nigeria by Salawu (1984,1985) who indicated also that two sugarcane varieties,Co 957 and Co 1001 were reduced in growth and yield as a result of the nematode infestation.

Although both CRPP and SLP organic amendments were found to appreciably reduce the number of gall on sugarcane roots, CRPP amendment was more effective. The growth and yield of sugarcane were significantly greater in the treated ones than in the control.There was also a significant decrease in the population of the nematode both in the soil and in the roots. Cassava roots have been reported to contain a large amount of prussic acid (HCN), with greater concentration in the phelloderm Wood, 1956). This probably led him to suggest that the function of the glucosides (precursor of HCN) in cassava was to liberate hydrogen cyanide, which was effective in repelling insect pests

Table 1. The effect of CRPP and SLP singly and In combination on the growth and yield of sugarcane variety Co1001 Infected with root-knot nematode.

Treatment	120 Days after inoculation				
	Fresh Weights		Stalk Length (cm)	Number* of Internodes	Number* of Tillers
	Shoot (g)	Root (g)			
Co 1001 + Nema (Control)	434.69	215.77	96.20	3.10 (10)	2.13 (5)
Co 1001 + 100g CRPP + Nema	497.10	247.57	105.80	3.03 (9)	2.48 (6)
Co 1001 + 100gSLP + Nema	458.65	184.28	89.20	3.10 (10)	2.13 (5)
Co 1001 + 50gCRPP + 50gSLP + Nema	476.22	181.15	100.80	3.10 (10)	2.40 (6)
LSD 5%	62.31	62.52	11.24	NS	0.30
1%	50.95	51.13	9.05	NS	0.25

*$\sqrt{}$transformation, untransformed data in parentheses.

CRPP = Cassava Root Peeling Particles; SLP = Siam Leaf Particles

Each value is a mean of five replicates.

Table 2. Effect of CRPP and SLP soil amendments on root gall, nematode population and soil pH.

Treatment	Number of root galls per plant	Nematode Larvae*		Soil** pH
		Soil (100ml)	Root (5g)	
Co 1001 + Nema (Control)	100 - 300	131.40 (18,127)	44.58 (19,998)	5.33 (5.1-5.5)
Co 1001+100g CRPP + Nema	3 - 5	16.81 (287)	7.81 (35)	5.63 (5.5 - 5.9)
Co 1001+ 100g SLP + Nema	10 - 30	25.46 (653)	36.05 (1336)	5.73 (5.6 - 5.8)
Co 1001 + 50g CRPP + 50g SLP + Nema	10 - 20	30.75 (950)	42.50 (1,807)	5.65 (5.6 - 5.8)
LSD 5%	-	33.76	7.60	0.37
1%	-	26.81	6.04	0.29

*$\sqrt{}$ transformation, untransformed data in parentheses.
CRPP = Cassava Root Peeling Particles; SLP = Siam Leaf Particles.
** Soil pH range in parentheses.

attacking the plant. In this investigation, it appears that the chemicals released from CRPP into the soil around sugarcane roots was effective in killing infective second stage larvae of *M. incognita.* Consequently, a significant improvement in the growth and yield of the plant occured. Amosu (1981) reported that the root extracts of the weed Siam was effective in inhibiting the hatching of eggs of *M. incognita* and this probably led him to suggest that the extracts from the roots could be effective in controlling *M. incognita.* In this investigation, dried leaf particles of *Siam* were used as soil amendment and caused considerable reduction in root-knot development on sugarcane roots (Table 2). It is shown in Table 2 also, that infective second stage larvae appre ciably penetrated the roots and induced root galls.Nevertheless,fewer second stage larvae were extracted from the soil, and to a greater extent, more larvae occured in the root. This suggests that certain

chemicals in the decomposed *Siam* inhibited hatching of eggs of *M. incognita* (Amous, 1981). There was a slight reduction in roots of sugarcane in this treatment, which may have been the result of root decay through which other micro-organisms gained entry into the roots and caused added damage.

The results of the effectiveness of the combination of CRPP and SLP amendments in controlling the nematode were similar to those plants which received SLP amendment alone. It is, however, not known whether there was interaction among the chemicals released seperately byCRPP and SLP. the end-products of which may have been less effective in killing the infective second stage larvae of the nematode in the soil, or inhibiting the hatching of the nematode eggs.

Soil hydrogen ion concentration was slightly lower in soils with organic amendments than the control, but there was no corresponding decrease in nematode population to ascertain their effects on the pest although several workers (Wallace, 1966; Morgan and MacLean, 1968; Burns, 1971) contented that there exist evidence of a correlation between soil pH and nematode numbers. In this investigation, the decrease in the nematode population both in the soil and the roots was due to toxic chemicals released into the soil by the organic amendments.

Apart from the high cost of nematicides in controlling parasitic nematodeson sugarcane in Nigeria, sugarcane growers are confronted with the hazards associated with their application. Thus the alternative method could be the use of organic materials which have been tested to have nematicidal functions, and are less harmful to man. Further research is necessary to prepare a package of information for use by the growers.

ACKNOWLEDGEMENT

I wish to acknowledge the invaluable assistance of Mr. O. A. Oyewumi in carrying-out this work, and Dr. J. O. Amosu of the Deparment of Plant Science, University of I fe, for his useful suggestions.

REFERENCES

Alam,M.M; Ahmad, M. and Khan, A.M. 1980. Effect of organic amendments on the growth and chemical composition of tomato, eggplant and chilli and their seceptibility to attck by *Meloidogyne incognita*. Plant and Soil, 57 : 231-236.

Amosu,J.O. 1981. Control of root-knot nematode by cultural practices. *In* : Proceedings of the 3rd Research Planning Conference on Root-knot Nematodes, *Meloidogyne* spp. Nov. 16-20, 1981. Ibadan Nigeria. 259-263.

Burns, N.C.1971. Soil pH effects on nematode populations associated with Soybean. *J. Nematology*, 3 : 238-242.

Caveness,F.E. 1967. Nematology studies, 1960-1967. End of tour progress report on Nematology-Lagos; Ministry of Agriculture and Natural Resources, Western Region Nigeria, and U.S.A. Agency for international Development Mimeo. 135 p.

Egunjobi, O.A. and Afolami, S.O. 1976. Effect of neem (*Azadirachta indica. Juss.*) leaf extracts on populations of *Pratylenchus brachyurus* and on the growth and yield of maize. *Nematologica*, **22** : 125-132.

Egunjobi, O.A.; Afolami, S.O. and Ekundare, G.O. 1981. Cassava peeling as a soil amendment and its effects on maize yield in soil infested with *Pratylenchus brachyurus*. Niger. J. Pl. Prot. **5** : 80-87.

Juo, A.S.R. 1978. Selected methods for soil and plant analysis. Manual series 1, International Institute of Tropical Agriculture, Ibadan, Nigeria. 52p.

Morgan, G.T, and MacLea, A.A. 1968. Influence of soil pH on an introduced population of *Pratylenchus penetrans. Nematologica*, **14** : 311-315.

Odihirin, R.A. 1976. Irrigation water as a means for dissemination of the sugarcane cyst nematode, *Heterodera sacchari* at Bacita Sugar Estate. NSPP 7th Annual Conference Proceedings. Occasional Publication 2 of the Nigeria Society for Plant Protection. 1977 (abstr).

Salawu, E.O. 1984. Selection of sugarcane hybrids for resistance against root-knot nematodes. *In* : Annual Report 1983/84. Sugar Research Institute, University of Ilorin, Ilorin. pp. 28-34.

Salawu, E.O. 1985. Root-knot resistance in sugarcane varieties and histological changes in the infested roots. *Bangladesh J. Sugarcane,* **7** : 5-12.

Sayre, R.M. 1971. Biotic influence in soil environment . *In* Plant Parasitic Nematodes Vol. 1. B.M. Zukermann, W.F. Mai and R.A. Rhode, (eds). Academic Press, New York and London. pp. 235-256.

Singh, R.S. and Sitaramaiah, K. 1970. Control of plant parasitic nematodes with organic soil amendments. PANS, **16** : 287-297.

Wallace, H.R. 1966. Factors influencing the infectivity of plant parasitic nematodes. Proc. Roy. Soc. B. Lond , **164** : 592-596.

Whitehead, A.G. and Hemming, J.R. 1965. A comparison of some quantitative methods of extracting small vermiform nematodes from soil. *Ann. Appl. Biol.*, **55** : 25-38.

Wood, T. 1965. The cyanogenic content of cassava and cassava products. *J.Sci. Food Agr.* **16** : 300-305.