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Effects of Cyst Nematode, *Heterodera sacchari* on the Growth and Yield of Two Sugarcane Hybrids

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ABSTRACT

The effects of sugarcane cyst nematode, *Heterodera sacchari*, on the growth and yield of two sugarcane hybrids, Co 1001 and Co 957, were studied in the screenhouse. The fresh top growth, length of stalk and fresh root weights of the two hybrids were significantly reduced at inoculum levels of approximately 2000, 4000, 8000 and 16000. The roots were moderately necrotic. Cyst development on the roots of both cane hybrids were greatly inhibited.

INTRODUCTION

Damage to sugarcane in Nigeria by the cyst nematode, *Heterodera sacchari*, occurred a few years after sugarcane plantation at Bacita was established, particularly on the sandy soil in which imported cane hybrids were grown. At the Bacita Sugar Estate, plant-parasltic nematodes, such as the lesion and cyst nematodes are the major nematode pests. Caveness (1976b) reported that sugarcane roots infected by *Pratylenchus* spp, had brown and severely necrotic cortex. Jerath (1968) observed that cane roots infected by *Heterodera sacchari* bore root hairs resulting in poor cane growth. Odihirin (1976) found that *H. sacchari* infestation of cane fields was responsible for the poor harvest or the total crop failure in the Estate between 1966 and 1975 cropping seasons.

At the Bacita Sugar Estate, sugarcane hybrids Co 1001 and Co 957 are largely cultivated for the production of refined sugar. Although Co 1001 has an average yield of 43 to 58 tonnes of canes per hectare whereas Co 957 has an average yield of 74 tonnes of canes per hectare, these hybrids had previously been reported to be moderately susceptible to *H. sacchari* (Salawu and Adeniji, 1984).

The present work reports on the effects of *H. sacchari* on Co 1001 and Co 957 sugarcane hybrids.

MATERIALS AND METHODS

Sugarcane hybrids used in this investigation were collected from the Bacita Sugar Estate. The hybrids are Co 1001 and Co 957, moderately susceptible to *H. sacchari* (Salawu and Adeniji, 1984).

The second stage larvae used as inoculum were extracted from cyst culture maintained on 0S6 variety of rice. The cysts were extracted from the soil using the modified Fenwick can (Ooestenbrink, 1950), while the second stage larvae were extracted from the cysts by placing the cysts plus organic debris on a facial tissue paper supported by a plastic sieve and a plastic tray, with water added into the tray. The eggs hatch readily in water and after 24 hours larvae are removed

and used for inoculation. This method is similar to the extraction tray method of Whitehead and Hemming (1965).

Each sugarcane hybrid, from a single bud cutting, was surface sterilized in 1.5%sodium hypochlorite (NaOC1) solution for 10 minutes, and sown in steam-sterilized sandy loamtop soil mixed with pure sand in ratio 2 : 1, in perforated 10-litre plastic pots. Two weeks after emergence, the seedlings were inoculated at the root zone with the nematode second stage larvae. The treatment per pot were approximately 2000, 4000, 8000 and 16000. Each pot was replicated thrice. Untreated plants of each variety served as control. The plants were arranged randomly on the screenhouse benches, and irrigated with tap water daily. When the plants were 35 days old 8 grams of NPK fertilizer in ratios 2 : 1 : 1 was added to each pot to provide the plant with added nutrient.

The plants were harvested 285 days after inoculation. The fresh weights of roots and shoots and the stalk length (from ground level to the top visible dewlap, TVD) were recorded. Five gram root samples were randomly taken and macerated in a Waring Blender for 30 seconds. Second stage larvae were extracted from the roots using the extraction tray method. Soil in pots were thoroughly mixed and 250ml samples from each pot were processed for cyst recovery using a Fenwick can.

RESULTS AND DISCUSSION

Effect of *H. sacchari* on Co 957 Sugarcane hybrid : In Co 957 sugarcane hybrid, the result showed that the control plants were taller and had greater fresh shoot weights than the infected

Table 1. Effects of *H. sacchari* on growth of sugarcane hybrid Co 957(mean of 3 replicates).

Inoculum Level	289 Days after inoculation			
	FRESH WEIGHTS		** Length of Stalk (cm)	Mean Cyst/250 ml per pot
	Shoot (g)	Root (g)		
0	859.66 ± 0.88	300.00 ± 1.00	162.66 ± 0.17	0
2000	825.00 ± 1.00*	303.33 ± 3.85	159.66 ± 0.17*	11 ± 3
4000	811.33 ± 1.66*	296.66 ± 3.34	144.33 ± 1.20*	10 ± 3
8000	762.33 ± 1.20*	278.33 ± 1.20*	145.33 ± 1.45*	10 ± 3
16000	724.00 ± 2.00*	252.33 ± 2.34*	143.00 ± 1.16*	10 ± 3
LSD, 5%	4.60	8.41	2.97	NS

** From gruound level to the top visible dew lap (TVD). ± Standard Error of Mean.

* Inoculum levels at which differences between control plants and infected plants are significant (P = 0.05).

plants. Differences between the control and infected plants were statistically significant (P=0.05). The root weight of the control plants was significantly greater than the infected plants that received 8000 and 16000 larvae per plant (Table 1). The average number of cysts per 250ml soil per pot, at the end of experiment, was low. Differences in cyst development, between treatments were statistically insignificant. The roots of infected plants were moderately necrotic.

Effect of *H. sacchari* on Co 1001 Sugarcane hybrid : In Co 1001 sugarcane hybrid the control plants were taller (except in those infected plant that received 2000 larvae per plant), had highly proliferated healthy roots, and greater shoot weights than the infected plants. Differences in fresh roots and shoot weights, as well as the reduction in plant heights of those that received 4000 larvae and above per plant were statistically significant (P=0.05). There was no significant difference between the fresh shoot weights of infected plants that received 4000 and 8000 larvae per plant (Table 2).

The roots of infected plants were moderately necrotic. The average number of cysts per 250 ml soil per pot at the end of the experiment was low, but treatment with highest inoculum level had the lowest number of cysts.

Table 2. Effects of *H. sacchari* on growth of sugarcane hybrid Co 1001 (mean of 3 replicates).

Inoculum Level	289 Days after inoculation			
	FRESH WEIGHTS		** Length of Stalk (cm)	Mean Cysts/250 ml Soil per pot
	Shoot (g)	Root (g)		
0	977 ± 2.08	348.33 ± 1.67	199.67 ± 3.18	0
2000	838.33 ± 0.88*	268.33 ± 2.73*	199.33 ± 1.86	51 ± 14
4000	807.66 ± 1.33*	295.33 ± 2.61*	188.00 ± 1.53*	48 ± 7
8000	807.33 ± 2.19*	273.33 ± 1.76*	178.33 ± 1.66*	53 ± 14
16000	821 ± 2.08*	250.33 ± 1.15*	190.33 ± 0.33*	45 ± 7
LSD. 5%	4.52	2.23	4.91	5.19

** From ground level to the top visible dew lap (TVD)

* Inoculum levels at which differences between control plants and infected plants are significant (P=0.05).

±, Standard Error of Mean.

The results of this investigation showed a significant inhibition of growth and reduction in yield of Co 1001 and Co 957 cane hybrids. The hybrids which were infected with *H. sacchari* and allowed to grow for a period of approximately nine months in pots in the screenhouse showed significant reduction in fresh shoot weights at 2000 nematodes and above per plant. The root weights of Co 1001 was significantly reduced at 2000 nematodes per plant, while reduction in root weight of Co 957 occurred at 8000 nematodes per plant. Reduction in length of cane was evident in Co 1001 at 4000 nematodes per plant whereas the stalk length of Co 957 was reduced at 2000 nematodes per plant. Similar studies by other workers have shown that reduction in the growth and yield of sugarcane has been a result of damage caused by plant-parasitic nematodes. For example, *Helicotylenchus nannus* and *H. dihystera* have been found pathogenic to sugarcane (Apt and Koike,1962 ; Rao and Swarup,1974). Caveness (1967b) and Jerath (1968) observed that *Pratylenchus* sp and *Heterodera sacchari* were responsible for the poor growth of sugarcane in Nigeria, although both workers did not indicate which hybrids of sugarcane were affected.

Although Co 1001 and Co 957 sugarcane hybrids did not support *H. sacchari* population build-up in the rhizosphere, damage to sugarcane roots by the nematode was evident. Salawu and Adeniji (1984) had previously shown that these hybrids of sugarcane were moderately susceptible to the nematode. Thus the injury caused to the cane roots by the infective larvae was probably responsible for ineffective nutrient uptake, resulting in poor growth.

Poor cyst development on both Co 1001 and Co 957 sugarcane hybrids was evident in this investigation. It is possible that after the infective larvae had penetrated the roots, many failed to develop into adult females. This is in accordance with Jones (1954) and Shepherd (1959) who showed that in potato plants which are partially resistant to *H. schachtii* larvae normally mature but females are reduced in numbers and are not very prolific. This phenomenon may need further investigation.

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