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Short communication

Nematode diversity in a soybean-sugarcane production system

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This study was done to investigate the nematode diversity in a soybean-sugarcane production system in a semi-arid region of Zimbabwe .Results indicated that *Pratylenchus, Helicotylenchus* and *Scutellonema* had the highest populations per 100 cubic centimeters of soil before the planting of soybeans. *Pratylenchus* and *Criconemella* were not present after the harvesting of soybeans. *Xiphinema* and *Scutellonema* were absent in the subsequent cane roots. Basically there was a considerable reduction in nematode population in soils after harvesting soybeans

Key words: Nematodes, soybeans, sugarcane.

INTRODUCTION

There is a long history of association between nematodes and sugarcane. Root knot nematode *(Meloidogyne*), cyst nematode (*Heterodera*) and the lesion nematode *(Praty-lenchus*) are common in sugarcane production systems (Mills and Elephantine, 2000; Shoko, 2005; Shoko and Tagwira, 2005). Research done in Australia on Decline in yield venture in sugarcane indicated that nematode population increased with years of continuous sugarcane production (Stirling and Blair, 2001). According to Magarey (1994) annual sugarcane yield losses attributed to nematodes was 0.2% (Australia), 3% in Peru, >5% in South Africa, 6% in USA, 11% in Cote d'Ivoire and 14% in Burkina Faso. Research done in Australia has shown that the use of soybean as a break crop reduced the population of the root knot, lesion and cyst nematodes compared to monoculture sugarcane production (Bell, 2001). The use of soybeans in Cote D'ivore has also decreased nematode populations as compared to the use of artificial nitrogen (Coyne et al., 2003). Berry et al. (2009) found out the use of fallow legume crops like *Mucuna deeringiana* and *Dolichos lablab* in sugarcane rotations can reduce the infestation levels of some sugarcane nematodes. Work done by Rhodes et al. (2009) in Kwazulu Natal showed that monoculture cane increases the nematode populations. She also noted that longer periods of legume fallow cane also lead to an an increase in nematode infestation levels.

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MATERIALS AND METHODS

The overall objective of this research is to assess the dynamics of nematodes in Zimbabwean soils when soybean has been used during fallow periods in sugarcane production systems.

The experiment was done in Block Z4 at the Zimbabwe Sugar Association Experiment Station (ZSAES) in the South Eastern Lowveld of Zimbabwe during 2003 - 2005. ZSAES is 430 m above sea level, at 21°01'S latitude and 31°38'E Longitude. The experi-mental plots were arranged in a Completely Randomized Block Design (RCBD) with three treatments in the first experiment, namely vegetable soybeans *cv. S114*, grain soybeans, *cv storm* and fallow. They were replicated four times. The second experiment had two sugarcane varieties CP72-2086 (nematode resistant) and N14 (susceptible to nematodes) planted after soybeans. Cane planted on fallow plots was used as control crop (monoculture cane. The subsequent cane experiment was replicated four times in a CRBD.

Soil samples were taken for extraction of nematodes before the planting of soybeans and after harvesting soybeans in December, 2003 and April, 2004 respectively. Soil samples were collected using a 50 mm augur. Soil samples were collected at depth of 0 - 30 cm from each plot. Samples were thoroughly mixed to one composite sample for each sampling depth and plot. From each composite sample, a sub-sample of 500 g was stored in a cold room at 4°C. The soils were taken for analysis and extraction of nematodes at the Plant Protection and Research Institute, in Harare. The nematodes were extracted using a combination of sieving and modified flotation method.

On 19 February, 2004 soybeans were planted with an interow spacing of 0.75 m and inrow spacing of 0.05 m and a seed rate of 80 kg ha^{-1}. The seed was inoculated with soybean innoculant at the

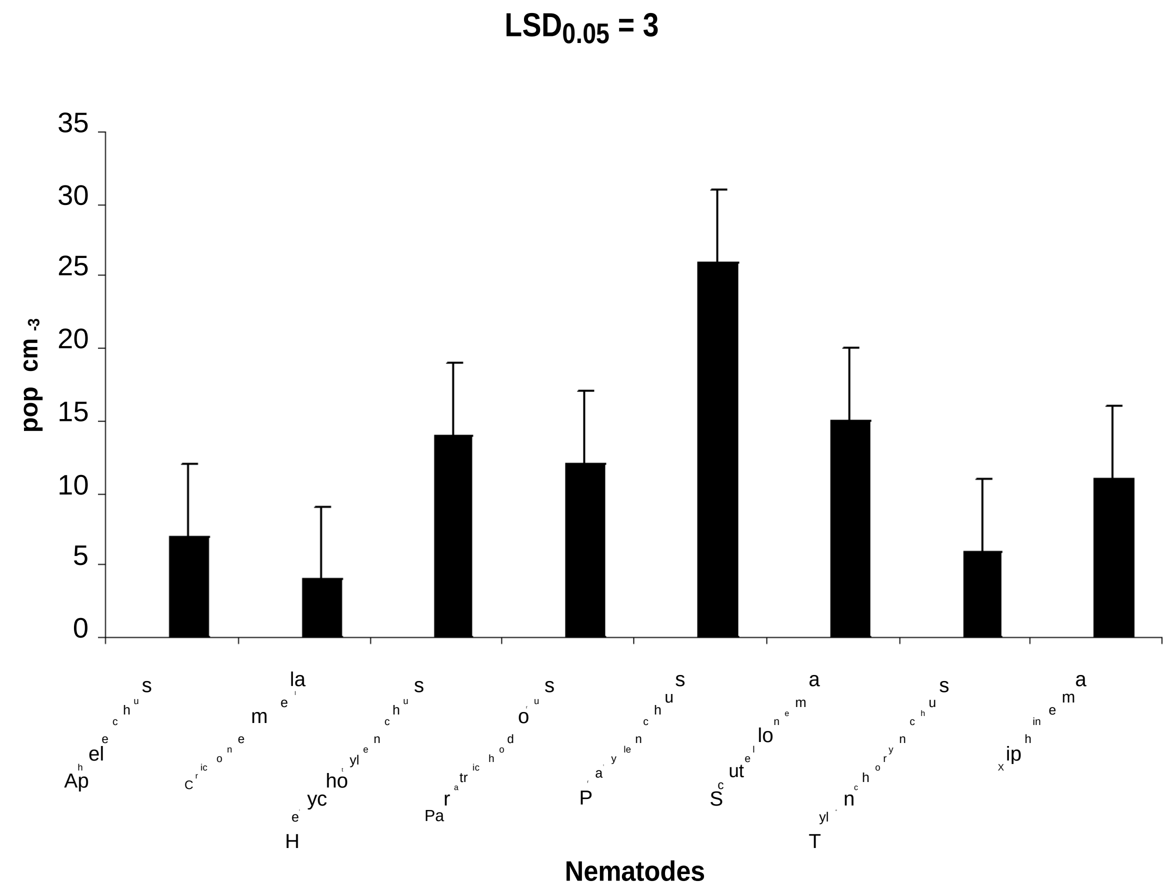

Figure 1. Nematode types and populations extracted from the soils sampled before planting soybeans.

rate of 200 g innoculant to 50 kg seed. Phosphorus was applied to the furrow at 100 kg P_2O_5 ha^{-1} before planting soybeans. Roots of six plants of soybeans per plot, randomly chosen were sampled and came with a composite sample of 50 g. Roots and soil from the rhizosphere were removed using a trowel from a depth of 300 cm. Nematodes were extracted from 100 cm^3 and 5 g fresh root sub samples using the Baermann filter technique. Nematode densities were extracted after 48 h using a stereomicroscope. The nematode suspension was reduced to 10 cm^3 and the population densities estimated from 2 x 1 cm^3 aliquots. Motile nematodes were only assessed.

On 9 and 10 July 2004 sugarcane after soybeans was planted at an interow spacing of 1.5 m, using two, three-eyed-cane setts .Varieties N14 and CP72- 2086. Soil sampling for nematodes was done when the cane was still in the field. The soil sampling was done before planting, at 6 months after planting (8 January, 2005) and after harvesting of cane (10 September, 2005). Root samples were also taken during these dates following the protocol on soybean production. The data was subjected to ANOVA using MSTAT version 4 and means were compared at probability $P < 0.05$.

Nematode types and populations extracted from the soils sampled before planting soybeans are shown on Figure 1. This data represents the dynamics of nematodes after sugarcane monoculture production system. The *Pratylenchus*, *Helicotylenchus* and *Scutellonema* had the highest populations per 100 cm of soil. These species of nematodes are of economic importance to sugar-cane production world over (Stirling and Blair, 2001). This para-graph should go in result and discussion section.

RESULTS AND DISCUSSIONS

Nematode types and populations in soil

Table 1 shows the nematode types and populations in soil after harvesting soybeans [vegetable and grain] and on monoculture cane plots [fallow/control] or before planting of the subsequent cane crop. There were significant differences ($P < 0.05$) between treatments with soybean plots showing a decline in all the nematodes of sugarcane. *Tylenchorynchus and Criconemella* were not found in the soil where soybeans were grown.

Nematode types and populations in soybean roots

Nematode types and populations in soybean roots are shown in Table 2. There were significant differences ($P < 0.05$) between the soybean treatments. The *Pratylenchus* was the highest in both cases.

Nematode dynamics in roots

The nematode dynamics in roots of subsequent sugarcane cv, CP72 - 2086 and N14 as well monoculture cane

Table 1. Nematode types and populations in soil after harvesting soybeans and on monoculture cane plots 100 cm^{-3} of soil. Figures followed by the same letter in a row are not significant at P = 0.05. This was before the planting of the subsequent cane crop.

Nematodes	Monoculture cane	Vegetable soybean	Grain soybean
Aphelechus	9c	4b	2a
Helychotylenchus	15b	9a	9a
Paratrichodorus	16c	4b	1a
Pratylenchus	32c	14b	10a
Scutellonema	14c	6a	8b
Xiphinema	15c	5b	3a

Table 2. Nematode types and populations in soybean roots. Figures followed by the same letter in a row are not significant at P = 0.05.

Nematodes	Vegetable soybean	Grain soybean
Aphelechus	5b	3a
Helychotylenchus	6b	3a
Paratrichodorus	7b	3a
Pratylenchus	10a	9a
Scutellonema	5b	2a

Table 3. Nematode types and populations in subsequent sugarcane roots and monoculture cane. Figures followed by the same letter in a row are not significant at P = 0.05.

Nematodes	Monoculture cane	CP 72- 2086	N14
Aphelechus	10c	5b	3a
Helychotylenchus	16c	6b	3a
Paratrichodorus	12c	7b	3a
Pratylenchus	28c	10a	9a
Tylenchorynchus	13c	5b	2a

Table 4. Nematode types and populations in soil after harvesting sugarcane 100cm^{-3} of soil. Figures followed by the same letter in a row are not significant at P = 0.05. This was before the planting of the subsequent cane crop.

Nematodes	Monoculture cane	CP 72-2086 plots	N14 plots
Aphelechus	8c	5b	3a
Helychotylenchus	13c	6b	4a
Paratrichodorus	14c	7b	2a
Pratylenchus	26c	9a	5a
Tylenchorynchus	21c	5b	3a

are shown in Table 3. *Xiphinema* and *Scutellonema* were absent in the sampled roots. This may imply that they these are soil nematodes and immobile unlike others like *Pratylenchus* (Mills and Elephantine 2000; Shoko, 2005; Shoko and Tagwira, 2005).

Nematode dynamics after the harvesting

The nematode dynamics after the harvesting of subsequent cane and monoculture cane in shown in Table 4. There were significant differences ($P < 0.05$) between treatments. Soil from the subsequent cane crop had low number of nematodes. CP72-2086 had the least numbers thus confirming it resistance to infestation by nematodes, unlike N 14 which is susceptible (Shoko, 2005).

This study showed that soybeans as a soil fertility ameliorant can equally reduce the populations of some of the economic nematodes of sugarcane.

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