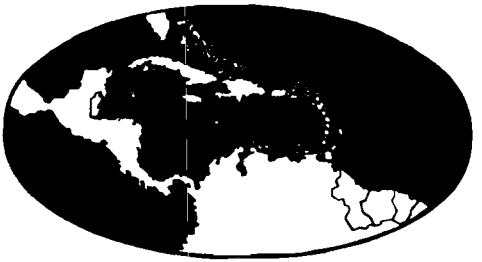
CARIBBEAN FOOD CROPS SOCIETY



THIRTEENTH ANNUAL MEETING
ST. AUGUSTINE TRINIDAD, W. I.
JULY 6-12, 1975

PUBLISHED WITH THE COOPERATION
OF THE
UNIVERSITY OF PUERTO RICO
MAYAGUEZ CAMPUS
1980

VOLUME XIII

PLANT PARASITIC NEMATODES ASSOCIATED WITH COWPEA (*Vigna unguiculata* (L.) WALP.) AND THE RELATION OF THEIR POPULATION DENSITY TO CROP YIELD

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Species of *Vigna* are grown widely in the Caribbean where they are consumed either in the green snap stage, e.g. bodie bean or as a dry bean, e.g. cowpea or blackeye. A wide variety of pests and disease attacks cowpea in the field. Although plant parasitic nematodes have been reported to affect the crop in various parts of the world, their importance in local crop production has not been evaluated. The objective of this preliminary study was to determine whether plant parasitic nematodes were associated with cowpea at the University of the West Indies Field Station and if so, to evaluate their effects on crop yield.

MATERIALS AND METHODS

Soil samples were collected from six cultivars of cowpea which were planted at the University of the West Indies Field Station for observation and agronomic evaluation by Dr. T.U. Ferguson, Agronomist. The trial was a complete randomised block with four replicates and was planted on River Estate loam. Soil samples (approximately 1000 cc of soil) were collected from the rhizosphere of plants from each plot with a 1 cm diameter soil sampler. The samples were mixed thoroughly and passed through a 22-mesh seive to remove stones and large soil particles.

The nematodes in a 100 cc aliquot from each mixed sample were extracted by the Baermann method using locally made extraction pans constructed and arranged as described by Gowen and Edmunds (1973). The number of nematodes in the sample was determined by examining the suspensions obtained from the pans after 24 hr. with a stereoscopic microscope.

In order to determine whether there was a selective build up of nematodes in the presence of cowpea, an area of land which was previously an weed fallow was ploughed and harrowed. The land was then

divided into 24 micro-plots each 4.57 x 1.22 m. The nematode population of each plot was determined by collecting a soil sample and extracting nematodes as previously described. Eight adjacent plots were then either planted with cowpea (California No. 5), corn (x 304) or left fallow. No fertilizer was applied to any of the plots but at 2 weekly intervals all plots were hand-weeded. Three months after planting soil samples were collected from the rhizosphere of cowpea and corn and from fallow plots. The nematode populations in these samples were determined as previously described.

To evaluate the effect of nematode populations on crop yield, the same 24 plots which were previously planted with cowpea, corn or left fallow in the previous experiment were used. In this case however, 4 plots of each previous treatment were treated with a nematicide (10% granular Nemacur (Phenamiphos)) at the rate of 6.25 g a.i. per plot. The nematode population of treated and untreated plots were determined and one day later, the entire 24 plots were planted with cowpea. At 10 weeks (1st harvest) and 12 weeks (2nd harvest) after planting, the pods were harvested from each plot, shelled and seed weight was determined. The relationship between seed weight and initial nematode population was evaluated. An analysis of the results by a split plot design allowing for the systematic arrangement as described by Le Clerg, Leonard and Clark (1966) was used.

RESULTS

Nine genera of plant parasitic nematodes and a variety of saprophytes occurred in the rhizosphere of six cultivars of cowpea (Table 1). Among the plant parasites, reniform nematode (*Rotylenchulus reniformis* Linford and Oliviera, 1940) was the most abundant. It comprised about 78.2% of the total plant parasitic nematode population and occurred at high population density in the rhizosphere of all cultivars. Root knot nematode, *Meloidogyne* spp. comprised 12.2% of the population and was also present in the rhizosphere of all cultivars. Other genera were less abundant and sometimes occurred in the rhizosphere of only a few cultivars.

As previously reported (Brathwaite 1974) cropping had a signigicant effect on reniform nematode populations (Table 2). When the nematode populations of soil in which cowpea or corn was grown were

TABLE 1. Populations /1 of Nematodes in the rhizosphere of six cultivars of cowpea at the University of the West Indies Field Station

Cultivar Number	Cultivar Name /2	Total Nematodes	Sapro-phytes	Plant Parasites	DISTRIBUTION OF PLANT PARASITES AMONG VARIOUS GENERA 3/								
					Aph.	Cric.	Hel.	Mel.	Praty.	Rotyln.	Tylen.	Tylench.	Xiph.
1	PR-V-71-10R-1	618	71	547	28	4	3	55	-	438	1	18	-
2	PR-V-71-10R-3	815	70	745	12	4	6	96	-	585	24	13	4
3	PR-V-71-10R-58	770	85	685	30	9	1	126	-	490	19	10	-
4	PR-V-71-10R-61	551	71	480	26	5	4	53	9	371	4	8	-
5	Cowpea (Philippines)	917	39	878	16	21	3	61	4	743	4	21	5
6	California No. 5	535	53	482	16	6	3	73	-	358	3	23	
	Mean	701	64.8	636.2	21.5	6.2	3.3	77.3	2.2	497.5	9.2	15.5	1.5
	Percentage Distribution of plant Parasitic genera				3.4	1.0	.5	12.2	.4	78.2	1.5	2.5	.3

/1 No. of nematodes per 100 cc of soil. All figures are the mean of 4 replicates.

/2 Cultivars 1-4 were obtained from Puerto Rico and were bred for resistance to a wide range of diseases. Cultivar 5 was obtained from the Philippines and is susceptible to *Cercospora* leaf spot while cultivar 6 is commonly planted in the Caribbean.

3/ Aph. = *Aphelenchus;* Cric. = *Criconemoides;* Hel. = *Helicotylenchus;* Mel. = *Meloidogyne;* Praty. = *Pratylenchus;* Rotyln. = *Rotylenchulus;* Tylen. = *Tylenchus;* Tylench. = *Tylenchorynchus;* Xiph. = *Xiphinema.*

TABLE 2. Populations [1] of Plant Parasitic Nematodes in the rhizosphere of cowpea or corn or in fallow plots after 3 months.

	Total	Aph.	Cric.	Hel.	Long.	Praty.	Rotyln.	Tylen.	Tylench.
Initial population	281	34^b	2^a	46^a	2^a	13^a	79^a	92^a	13^a
After cowpea	1367	26^b	6^a	62^a	10^a	69^b	1076^b	75^a	43^a
After Corn	566	25^b	8^a	118^a	10^a	182^c	30^a	174^a	10^a
After Fallow	388	7^a	8^a	128^a	10^a	26^a	81^a	120^a	8^a

[1] No. of nematodes per 100 cc of soil. Mean of 8 determinations. For any genus, means followed by the same superscript are not significantly different at the 5% level (Duncan Multiple Range Test).

For legend to abbreviations of nematode generic names see Table 1.

compared with fallow soil, the initial populations of various plant parasitic nematode genera showed different responses. While there was no significant difference in the populations of *R. reniformis* in fallow plots or those planted to corn, a considerable increase in reniform nematode population occurred in plots planted with cowpea. Other genera showed only small changes in average population density among the various treatments. When cowpea was grown on plots with different initial nematode population density, there was considerable variation in yield. Generally, plots with low initial nematode population density had high seed yield and vice versa (Table 3). While other facotrs associated with the previous crop may be associated with this response, an analysis of the relationship between initial nematode population density and yield revealed a high negative correlation ($r = -0.82$), which suggests initial nematode population density was a major determinant of seed yield.

TABLE . 3. Nematode populations and yield of cowpea from Nemacur treated and untreated plots previously planted with either cowpea or corn or left fallow

			Total initial nematode populations	Yield at 1st Harvest	Yield at 2nd Harvest
			No./100 cc soil	gm/plot	gm/plot
Cowpea	(1)	treated	317[b]	1006[b]	182[b]
	(2)	untreated	1110[b]	813[a]	74[a]
Fallow	(1)	treated	51[a]	1829[a]	227[a]
	(2)	untreated	97[a]	1839[a]	239[a]
Corn	(1)	treated	30[a]	2176[a]	182[a]
	(2)	untreated	105[a]	2090[a]	237[a]

Results for treated or untreated plots in any one of cowpea, corn or fallow treatments are only significantly different at the 5% level if they are followed by a different superscript.

DISCUSSION

Rotylenchulus reniformis was first described from roots of cowpea in Hawaii by Linford and Oliveira in 1940. Subsequently the nematode has been associated with crops in most tropical and sub-tropical regions of the American tropics (Steiner and Buhrer, 1964). In this study the nematode was the dominant species in the rhizosphere of six cultivars of cowpea and its population in soil increased several fold when this crop was planted. Moreover, substantial increases in yield were recorded when soil, in which *R. reniformis* was the dominant species, was treated with a nematicide and there was a strong negative correlation between nematode population and seed yield.

These data suggest that reniform nematode population density of soil may be a yield determinant in the production of cowpea. Further studies on this relationship are being carried out in which pure cultures of reniform nematode will be employed.

ACKNOWLEDGEMENTS

The author acknowledges the assistance given by Miss Ann Soo Ting, Technical Assistant and Mrs. J. Sanchez of the Biometrics Unit, CARDI, St. Augustine.

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