NEMATODES AND NUTRIENTS: ASSOCIATION BETWEEN PLANT-PARASITIC NEMATODES AND SOIL CHEMICALS

VW SPAULL[1] AND P CADET[2]

[1]South African Sugar Association Experiment Station / [2]Institute of Research for Development, Private Bag X02, Mount Edgecombe, 4300, South Africa

The damage caused by plant parasitic nematodes reduces the efficiency of the plant's root system. This damage can, to some extent, be prevented by applying a nematicide to the soil. Most nematicides are very poisonous and indiscriminate. Cheaper, and safer, alternative methods of nematode control are needed. One possibility is to manipulate the nematode populations in favour of those that are less pathogenic. This might be achieved if the nematode species respond to changes in edaphic factors. A change in the ion balance of the soil solution can modify the nematodes' perception of root exudates in such a way that they are unable to locate their food source. Also, such a change may disrupt mating by preventing males from locating females, thus affecting the relative importance of the species within the community. Here we investigate the relationship between numbers of nematodes and certain soil chemical factors to identify those which, when manipulated, could increase or decrease targeted nematode species within the community. This was investigated in sugarcane fields in South Africa.

Soil samples were collected from more than 470 small and large scale farms in several localities in KwaZulu-Natal and Mpumalanga. Each sample was assayed for the numbers of the various genera of nematodes, for pH and for levels of Al, Ca, Fe, K, Mg, Mn, Na, P and Zn. Differences between the various localities and the two farming systems were identified by principal component analysis using ADE4 software. This showed that, according to the nematode and soil characteristics, the sites in Mpumalanga were different to those in KwaZulu-Natal. As a result of this an overall study of all sites together would simply relate differences in soil characteristics to differences in nematode characteristics between Mpumalanga and KwaZulu-Natal. To prevent this the relationship between soil and nematodes was identified, by coinertia analysis, for the KwaZulu-Natal sites only and separately for small and large scale farms. This showed that certain combinations of nematodes and soil factors were strongly associated, but the nature of the relationship was not consistent in the two farming systems. However for certain chemicals and certain nematodes the type of relationship was the same in both small and large scale farms (Tables 1 and 2). Thus, in both farming systems the abundance of *Pratylenchus, Helicotylenchus* and *Paratrichodorus* was inversely related to soil pH and positively related to Fe levels. In contrast numbers of *Meloidogyne* were positively related to pH and inversely related to Fe in the two systems. Consistent but weaker relationships occurred between both Al and Mn and the four nematode genera in the two farming systems. Numbers of *Xiphinema* showed no association with any of the soil characters in either the small or large scale farms.

Table 1. Soil factors that show relationships with nematode genera in large and small scale farms of KwaZulu-Natal.

	Soil factors		Nematodes	
	Large scale farms	Small scale farms	Large scale farms	Small scale farms
Strong relationships	Zn pH Al Fe	Fe pH Mn	*Helicotylenchus* *Pratylenchus* *Criconemella*	*Helicotylenchus* *Pratylenchus* *Meloidogyne* *Paratrichodorus* *Scutellonema*
Weaker relationships	Mn	Ca Al	*Paratrichodorus* *Neodolichodorus* *Tylenchorhynchus*	*Rotylenchulus*

Table 2. Relationships between levels of iron or pH and nematode densities (No/200 cm³) for *Pratylenchus zeae, Helicotylenchus dihystera* and *Meloidogyne* sp in large and small scale farms in KwaZulu-Natal. (SE = standard error).

Large Scale Farms							
Fe (ppm)	SE	*Pratylenchus*	SE	*Helicotylenchus*	SE	*Meloidogyne*	SE
261	19	469	130	1676	375	1	1
158	8	118	21	876	118	15	5
82	5	22	7	332	180	43	22
Small Scale Farms							
Fe (ppm)	SE	*Pratylenchus*	SE	*Helicotylenchus*	SE	*Meloidogyne*	SE
175	16	479	112	961	230	48	25
158	9	329	45	539	98	49	33
111	20	297	108	151	67	84	78
Large Scale Farms							
pH	SE	*Pratylenchus*	SE	*Helicotylenchus*	SE	*Meloidogyne*	SE
4,4	0,04	469	130	1676	375	1	1
5,1	0,03	118	21	876	118	15	6
6,0	0,08	22	8	332	180	43	23
Small Scale Farms							
pH	SE	*Pratylenchus*	SE	*Helicotylenchus*	SE	*Meloidogyne*	SE
4,8	0,03	479	113	961	231	48	25
5,3	0,03	329	46	539	98	49	34
5,8	0,03	297	108	151	67	84	79