DISTRIBUTION OF NEMATODES, SOIL FACTORS AND WITHIN-FIELD VARIATION IN SUGARCANE GROWTH

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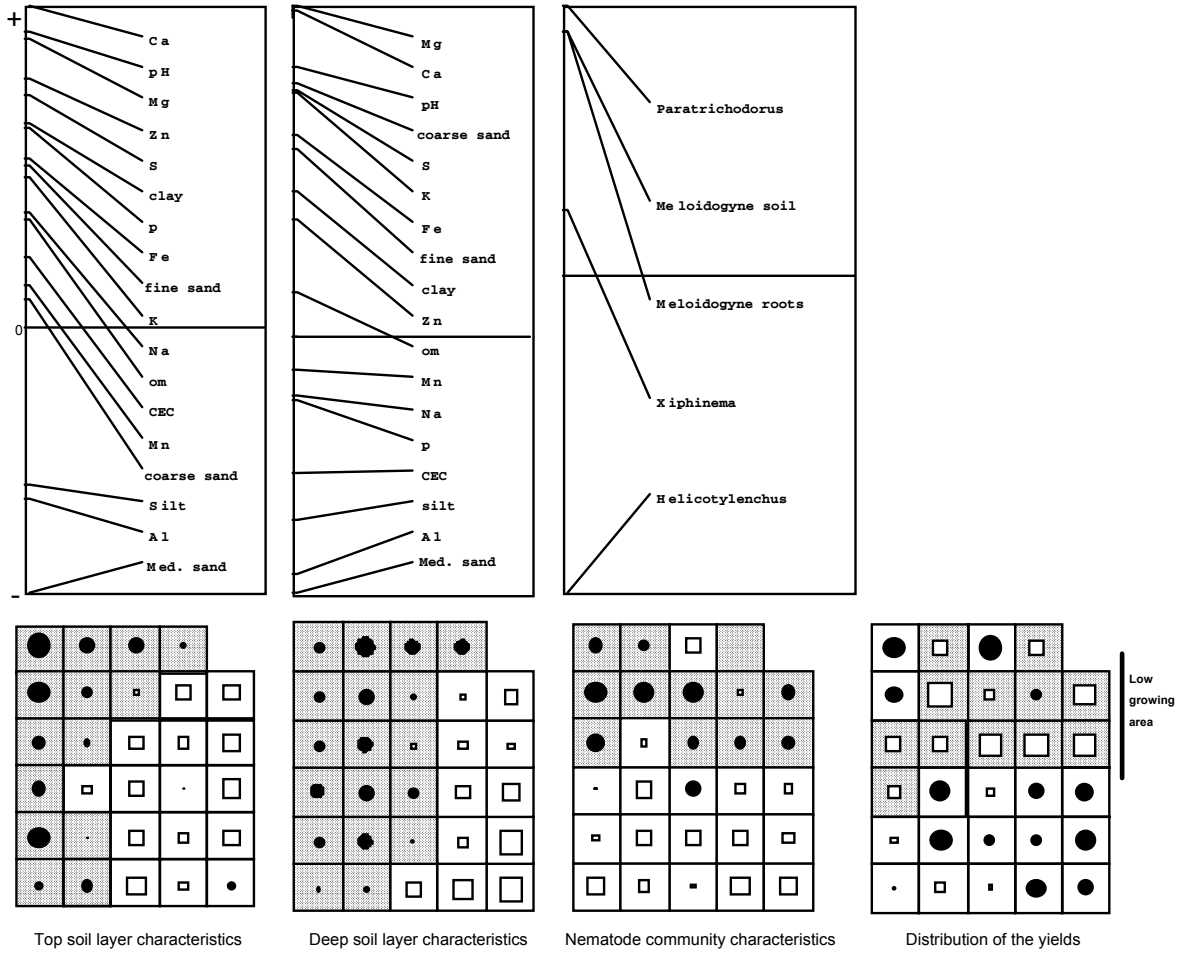
A common feature of plant-parasitic nematodes on annual crops is that they have an uneven distribution within a field and the symptoms of damage, normally associated with high population densities, occur in patches (McSorley,1998). Where a susceptible annual crop is replanted year after year the nematodes spread and the patches increase in size and eventually coalesce (Brown, 1987; Swarup and Sosa-Moss, 1990). Monocropping for decades, as is common in sugarcane agriculture, will enhance the horizontal spread of the common nematodes and lead to their more uniform distribution (Delaville *et al*., 1996). One factor likely to interfere with the uniform spread of the nematodes is soil texture as this can influence their abundance and distribution (Cadet *et al*., 1994; Norton, 1989; Upadhyay *et al*., 1972). For example, species of *Meloidogyne* are frequently more numerous and more pathogenic in light textured soils, giving rise to greater symptom expression in the sandier areas within the field (Kincaid, 1946; Prot and van Gundy, 1981).

If, after years of monocropping, patches of poor growth are seen in a field, these could reasonably be ascribed to soil differences. Thus when, in a sugarcane nematicide trial, an area of poor growth was observed that extended across both nematicide treated and untreated plots, it was initially assumed to be due to a difference in soil. However there were no obvious soil textural differences on the surface or at depth. Plant parasitic nematodes were numerous throughout the trial and were represented by the same species in the good and poor growth areas. Apart from the occasional white grub larvae (Coleoptera, Scarabaeidae), no insects were observed in the soil samples collected from the trial site. Similarly there were no widespread symptoms of disease within the trial area. Sugarcane had been grown in the field for 30 years, with a cropping system usually comprising a plant crop plus two ratoons and with a 2 to 3 month period between ploughing out the old crop and replanting. The three crops of cane on the trial site had been fertilised but the amount applied was based on the average requirement for the field and not on the need of localised areas.

The objective of this work was to identify the most likely cause or causes of the uneven growth of the sugarcane within the field trial – attention being given to the abiotic edaphic factors and the nematodes.

Soil samples were collected from each of the plots within the trial to determine soil texture, pH, organic matter content and the levels of various soil chemical elements, as well as the numbers of the common and abundant plant parasitic nematodes. These were *Meloidogyne* sp, *Pratylenchus zeae, Helicotylenchus dihystera*, *Xiphinema elongatum* and *Paratrichodorus* sp. To identify the factors associated with the areas of well grown and poorly grown sugarcane the soil and nematode data were subjected to principal component analysis (PCA). The yield data were centred and normalised separately for the treated and control plots and the values projected on the trial map to study spatial distribution. Plots with above-average yields, whether treated or untreated, occurred in

the lower part of the trial site. The PCA factorial values were also projected onto the map of the trial. According to the first factor of the analysis of the abiotic soil characteristics in the 0-20 cm surface layer, the trial site could be divided into two areas, one on the left and one on the right. PCA of the soil data from the 0-20 cm and 20-40 cm layers showed that there was little or no difference between the two that might explain the two growth areas. However, analysis of the nematode community distinguished two main areas that largely corresponded to the distribution of the plots of low and high yielding cane. Correlation analysis confirmed the relationship between nematodes and yield. *H. dihystera* was strongly, positively, correlated with yield of cane whereas the reverse was true for the *Meloidogyne* species.



Circles represent values above average and squares values below average. Size of the square or circle is proportionnal to the absolute value of the data. The corresponding charcateristics for topsoil and deepsoil layers and the nematode community are given by the variables correlated with the positive or the negative values of the first factor of the corresponding PCA.
The yield of the treated and control plot were projected separately on the trial map.

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