

INFLUENCE OF RAINFALL ON SOME PLANTAIN NEMATODES IN JAMAICA [INFLUENCIA DE LA LLUVIA EN ALGUNOS NEMATODOS DEL PLATANO EN JAMAICA]. D.G. Hutton; Plant Protection Division, Ministry of Agriculture, P.O. Box 480, Kingston 6, Jamaica.

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ABSTRACT

Ten genera of potentially important nematodes were associated with plantains on three holdings where the influence of rainfall on plantain nematodes was investigated. Only *Rotylenchulus reniformis* and *Helicotylenchus* spp showed statistically significant responses to rainfall patterns. In heavy clay soils with high water retention, populations of these nematodes increased and decreased with the number of days and/or total rainfall but in a well drained clay loam, there were significant negative correlations between their populations and the number of days of rain and/or total rainfall, but after time lags in either situation. *R. reniformis* and *H. multicinctus* were able to maintain moderate to high soil populations under prolonged drought conditions. Populations of all the nematodes at one location decreased markedly after flood rains. *Key Words: Musa, population dynamics, reniform and spiral nematodes.*

INTRODUCTION

Many different genera of parasitic nematodes are associated with plantains (*Musa acuminata* Colla X *M. balbisiana* Colla, AAB). They adversely affect growth, vigour, stability, production and longevity of this crop (2,3,6,9,10,11,12,13,16). In Jamaica, it is now clear that if nematode control is not practised from the start of plantain crops, the parent crops are unthrifty and ratoon crops generally fail. Seventeen genera of potentially parasitic nematodes have been found associated with plantains on 21 holdings in Jamaica. On many of these holdings, nematode control was never practised and nematode damage was evident.

Under natural conditions, nematode populations are regulated by several factors, soil moisture being one of the most important (14). In Jamaica, fluctuations in the population levels of certain nematodes associated with pineapples were shown to be influenced by rainfall (7,8). Where the influence of climatic or other factors on nematode populations are worked out, especially for long-term crops, it is possible that where post-planting nematicides must be used that, i) applications could be made when nematode populations are low but tending to build up and, ii) concentrations could be reduced when nematode populations are known to be low. Work was done at three plantain growing areas in Jamaica to investigate if associated nematode populations were influenced by rainfall.

MATERIALS AND METHODS

Three locations, Point Hill, Woodhall and Orange River were visited once per month for at least twelve months. At Point Hill, samples were taken from a 0.20ha field; the field at Woodhall was about 0.91ha but samples were taken from a 0.20ha section. At both locations, the "Horse" plantain plants were six-month old at the start of the survey. At Orange River, samples were taken from a 5 x 65m terrace and plants of

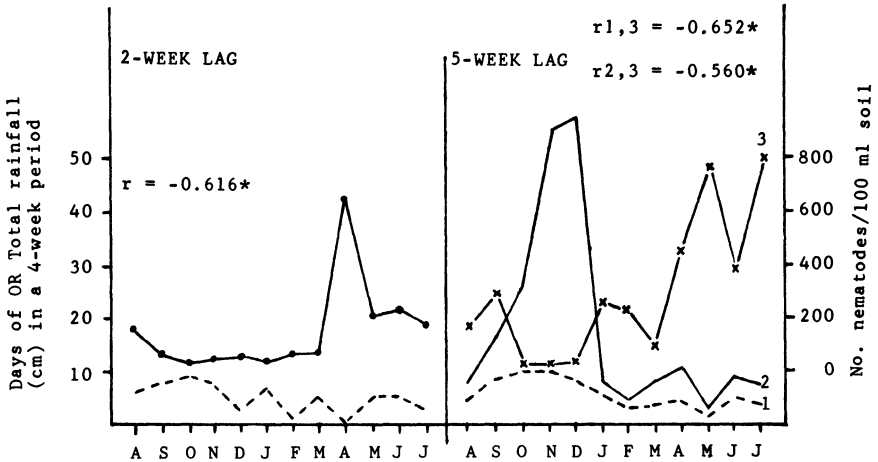


Fig. 1. Relationship between the number of days of rainfall (-----) and/or total rainfall (————) during a four-week period ending two and five weeks before monthly sampling and numbers of *Helicotylenchus multicinctus* (●————●) and *Rotylenchulus reniformis* (x————x) in rhizosphere soil samples from "Horse" plantains at POINT HILL (August 1973-July 1974).

the dwarf variety there, were seven months old when the survey was started. Three or four rhizosphere soil and root samples representative of each survey area were taken monthly.

Soil samples were extracted by a modified Baermann funnel technique (15) using 150ml aliquots. A known weight of roots was comminuted in a blender for 40 seconds, the debris separated on 1mm over 0.25mm sieves then the nematodes collected by passing the filtrate through a 0.044mm sieve seven times. Nematodes from soil and root samples were identified and counted. Rainfall records were collected from each locality. The number of days of rainfall and total rainfall in a four-week period ending one, two, three, four, five and six weeks before the monthly sampling dates were correlated with nematode population levels.

RESULTS

POINT HILL: The nematodes associated with plantains here were *Radopholus similis* (Cobb, 1893) Thorne, 1949, *Rotylenchulus reniformis* Linford and Oliveira, 1940, *Helicotylenchus multicinctus* (Cobb, 1893) Golden, 1956, *Meloidogyne* sp., *Pratylenchus* sp., *Paratylenchus* sp., *Xiphinema*, sp., *Longidorus* sp., and *Cacopaurus* sp. There were significant negative correlations between population levels of: (i) *R. reniformis* in the soil and the number of days of rainfall and total rainfall in the four-week period ending five weeks before sampling ($r : -0.652^*$ and -0.560^* respectively) and, (ii) *H. multicinctus* in soil and the number of days of rainfall in the four-week period ending two weeks before sampling ($r : -0.616^*$) (Fig. 1).

WOODHALL: *Radopholus similis*, *Rotylenchulus reniformis*, *Helicotylenchus melancholicus* (Lordello, 1955) Andrassy, 1958, *Pratylenchus* sp., *Meloidogyne* sp., *Paratylenchus* sp. and *Cacopaurus* sp. were found here. There were significant

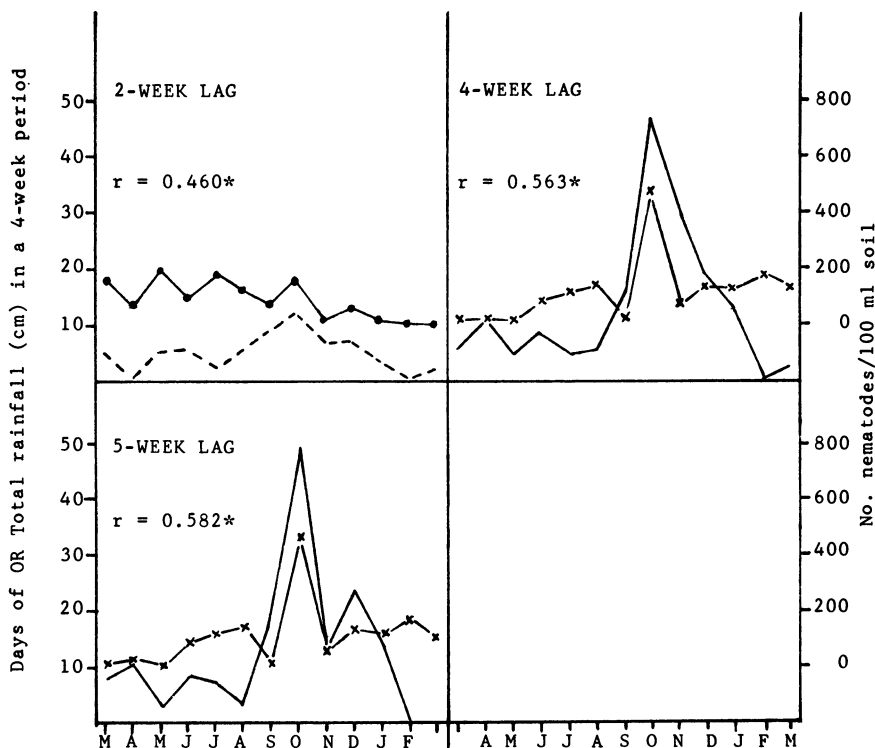


Fig. 2. Relationship between the number of days of rainfall (-----) or total rainfall (————) during a four-week period ending two, four and five weeks before monthly sampling and numbers of *Helicotylenchus melancholicus* (●—●) and *Rotylenchulus reniformis* (x—x) in rhizosphere soil samples from "Horse" plantains at WOODHALL (March 1974-March 1975).

positive correlations between population levels of: (i) *R. reniformis* in the soil and total rainfall in the four-week period ending four and five weeks before sampling ($r : 0.563^*$ and 0.582^* respectively) and, (ii) *H. melancholicus* in the soil and the number of days of rainfall in the four-week period ending two weeks before sampling ($r : 0.460^*$) (Fig. 2).

ORANGE RIVER: The nematodes here were *Rotylenchulus reniformis*, *Helicotylenchus multicinctus*, *Meloidogyne* sp., *Pratylenchus* sp. and *Tylenchorhynchus* sp. There were significant positive correlations between population levels of: (i) *R. reniformis* in the soil and the number of days of rainfall and total rainfall in the four-week period ending two weeks before sampling ($r : 0.762^{**}$, and 0.651^* respectively), (ii) *R. reniformis* in the soil and total rainfall in the four-week period ending three weeks before sampling ($r : 0.613^*$) and, (iii) *H. multicinctus* in roots and total rainfall in the four-week period ending four weeks before sampling ($r : 0.582^*$) (Fig. 3).

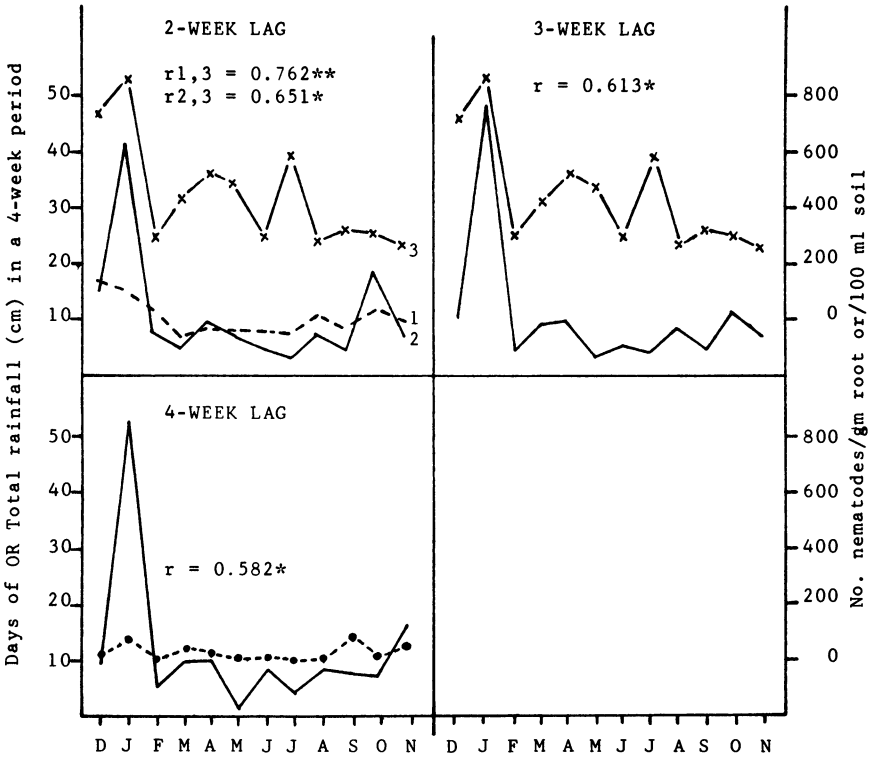


Fig. 3. Relationship between the number of days of rainfall (-----) and/or total rainfall (——) during a four-week period ending two, three and four weeks before monthly samplings and numbers of *Helicotylenchus multicinctus* in root (●-----●) and *Rotylenchulus reniformis* in rhizosphere soil (x——x) samples from dwarf plantains at ORANGE RIVER (Dec. 1974-Nov. 1975).

DISCUSSION

Of the nematodes found associated with plantains at the three holdings, *Rotylenchulus reniformis* and *Helicotylenchus* spp showed statistically significant responses to rainfall patterns but *Radopholus similis*, the nematode shown to do greatest damage to plantains and bananas in Jamaica and many other countries (2,3, 9,11,12,13,16), did not. High populations of *R. similis* are generally not found in soil; this nematode appears to be of greater importance in roots. High populations of *R. reniformis* are generally found in the soil under plantains and many other crops in Jamaica (4). In the soil, this nematode would be subject to fluctuations in moisture levels. At Point Hill, it did survive and maintain high populations when rainfall was minimal. It has been demonstrated that this nematode can survive in fallow (5) and even in air-dried soil (1) for several months. Its behaviour at Point Hill confirms its drought resistance. At Woodhall and Orange River however, populations of *R.*

reniformis fluctuated regularly with rainfall (but with a 4-5 week lag at Woodhall and a 2-3 week lag at Orange River). The disparity in the behaviour of *R. reniformis* at Point Hill as against at Woodhall and Orange River might be due to differences in soil texture. The clay loam at Point Hill would be expected to dry out more readily than the heavy clays at Woodhall and Orange River.

In Jamaica, *Helicotylenchus* spp have been found in high numbers in soil and root samples from plantains and many other crops (4,9), appear to thrive in both media and *H. multicinctus* has been observed to survive and even maintain high populations in very dry soils. In a nematode control trial on plantains carried out from 1969-1972, *H. multicinctus* and *R. reniformis* survived and maintained high soil populations (200-400 adults and larvae/100ml soil) although there was no rainfall at the trial site for at least three months during 1971. At Point Hill, high populations of *H. multicinctus* were found in the soil even when rainfall was minimal but at Woodhall and Orange River, populations in soil and/or roots fluctuated regularly with rainfall but with different time lags, 2 weeks vs 4-5 weeks. This difference in behaviour must again be due to the differences in soil texture at the various locations.

In October 1973, heavy rains fell in Jamaica causing wide-spread flooding. From October 16-19, 53.4cm of rain fell in the Point Hill area with 19.3cm falling on October 16. This flooding must have adversely affected the nematodes associated with plantains there accounting for the sudden drop in populations of *R. reniformis* in late 1973. Populations of *H. multicinctus* remained low until well into 1974.

It seems that there is an optimum level of rainfall supporting nematode population increases. At Point Hill, very heavy rains were followed by decreases in nematode population levels while at Woodhall and Orange River, although nematode populations increased following increased days or amounts of rainfall, the highest monthly rainfall was not always followed by the highest nematode populations. It is also clear that different nematodes respond differently to rainfall patterns.

RESUMEN

Diez generos de nematodos potencialmente importantes se encontraron en plátanos de tres propiedades bajo investigación sobre la influencia de la lluvia en nematodos de plátano. Sólo *Rotylenchulus reniformis* y *Helicotylenchus* spp reaccionaron de una manera significativa a las normas de la lluvia. En suelos arcillosos retenedores de agua, las poblaciones de estos nematodos aumentaron y disminuyeron según el número de días y/o la cantidad total de lluvia pero en un limo arcilloso con buen desagüe, hubo correlaciones negativas importantes entre poblaciones y el número de días de lluvia y/o la cantidad total de lluvia, aunque después de cierto tiempo en cada caso. *R. reniformis* y *H. multicinctus* mantuvieron poblaciones del suelo desde niveles moderados hasta altos en condiciones de sequía prolongada. Las poblaciones de nematodos de cada localidad disminuyeron significativamente después de las inundaciones.

Claves: *Musa*, *dinámica poblacional*, *nematodos reniformes* y *espiraliformes*.

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RESPONSE OF PINEAPPLE PLANTS GROWING IN NEMATODE-INFESTED SOIL TO AFTER-PLANTING NEMATICIDAL TREATMENTS [RESPUESTA DE LA PIÑA EN SUELO INFESTADO CON NEMATODOS A TRATAMIENTOS CON NEMATICIDAS DESPUES DE PLANTAR]. D.G. Hutton, Plant Protection Division, Ministry of Agriculture, P.O. Box 480, Kingston 6, Jamaica.

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ABSTRACT

Cvs Red Spanish, Smooth Cayenne and Sugar Loaf pineapple plants in nematode-infested plots which were fumigated before planting then received after-planting nematicidal treatments, grew faster, produced better root systems, showed less symptoms of nutrient deficiency and produced significantly higher yields than plants in plots which received the first nematicidal treatment 4, 8 or 12 months after planting than at 4-monthly intervals. There was little difference in the performance of the plants receiving the various after-planting treatments only or no treatment. For cv. Smooth Cayenne, plots receiving the before and after-planting treatments produced significantly more slips and suckers than the other plots. For all varieties, the benefits of the pre-planting treatment carried over to the ratoon crop. It appears that once pineapple plants have been damaged by nematodes, they derive little benefit from nematicidal treatments.

Key Words: Control, *Ananas comosus*, *Pratylenchus*, *Helicotylenchus*, DD, DBCP, *Phenamiphos*, *Nemacur*.

INTRODUCTION

Parasitic nematodes are considered to be the major limiting factor to production of pineapples, *Ananas comosus* (L.) Merr., in Jamaica (6,7). Nematode-damaged plants are recognised by their slow development, sparsity or lack of roots, general unthriftness for which no cause is readily identified, lateness of production which is poor and the need for early replanting of the infested field. These plants also show nutrient deficiency symptoms such as yellowing or reddening of leaves, drying of leaves starting