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THE INFLUENCE OF FERTILIZER NUTRIENTS ON POPULATION LEVELS OF *SCUTELLONEMA BRADYS* IN THREE YAM SPECIES

by

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Considerable losses in storage of yams (*Dioscorea* spp.) caused by *Scutellonema bradys* (Steiner *et* Le Hew) Andrassy have been reported (Acosta and Ayala, 1976; Adesiyan *et al.*, 1975). The spread of the yam nematodes is mainly through infested planting tubers and soil (Bridge, 1973). Although much is now known about the population increase of *S. bradys* under different storage conditions (Adesiyan, 1977) little has been reported about the factors that may favour the population increase of the nematode in the field. This paper reports the population changes of *S. bradys* in three yam species under different levels of N and P fertilizers commonly applied in yam production in the savannah of Western Nigeria.

Materials and methods

The 1977 experiment was done in a sandy soil (83% sand, 7% silt, 9.7% clay and 1.4% organic matter) following grass. *D. rotundata*, *D. alata* and *D. cayenensis* were planted on 15 March 1977, spaced 90 cm apart on ridges which were 90 cm apart, in 3.6 x 6.4 m plots, with three replicates. The experiment was a split-plot design consisting of the 3 yam species, 4 nitrogen levels (0, 30, 60 and 90 kg N/ha) supplied by ammonium sulphate and 3 phosphorus levels (0, 30 and 60 kg P/ha) supplied by single superphosphate. All plots received 60 kg K_2O/ha

in the form of potassium muriate. All fertilizers were applied three months after planting when most of the plants had germinated. At harvest, in January 1978, it was observed that some tubers were infested with nematodes. Examination of the number of tubers infested by nematodes assessed by thumbing of tubers per treatment plot was recorded.

The experiment was repeated in 1978 on another site in the same locality following a late maize crop. Before planting, yam setts were examined and the nematode population of representative samples of each species as well as in soil samples from the top 15 cm of soil were recorded.

Nematodes were extracted from infested yam tubers using the tray modification of the Baermann funnel method (Whitehead *et al.*, 1963) on aliquots of 50 g of tuber tissue. Four samples for each treatment were processed.

Results

In 1977 there was a steady increase in the percentage of infested tubers of *D. rotundata* with increasing levels of nitrogen fertilizer (Fig. 1 a) but a smaller increase in *D. alata* and *D. cayenensis*. Conversely, there was non appreciable increase in the nematode infestation of the three yam species even at high levels (60 kg/ha) of P (Fig. 1 b). The highest infestation was recorded for *D. rotundata* at the high N and P combinations (Fig. 2a). In *D. alata* and *D. cayenensis*, the combination of the two nutrients stimulated the percent increase of nematode infestation only slightly (Fig. 2 b and 2 c).

The results obtained in the second experiment were generally similar to those obtained in the first. Nitrogen application induced population increases of *S. bradys* in *D. rotundata* and had only a minor effect on the nematode in the other two species (Fig. 3). Again, with the two nutrients in combination, *D. cayenensis* was associated with the lowest population of the nematode even at the highest levels of N P while *D. rotundata* supported the highest population densities (Fig. 4 a-c). The initial nematode counts per 50 g of tuber were 1,440; 1,370 and 1,320 in the species of *D. rotundata*, *D. alata* and *D. cayenensis* respectively while 150 *S. bradys* were extracted from 200 g of soil.

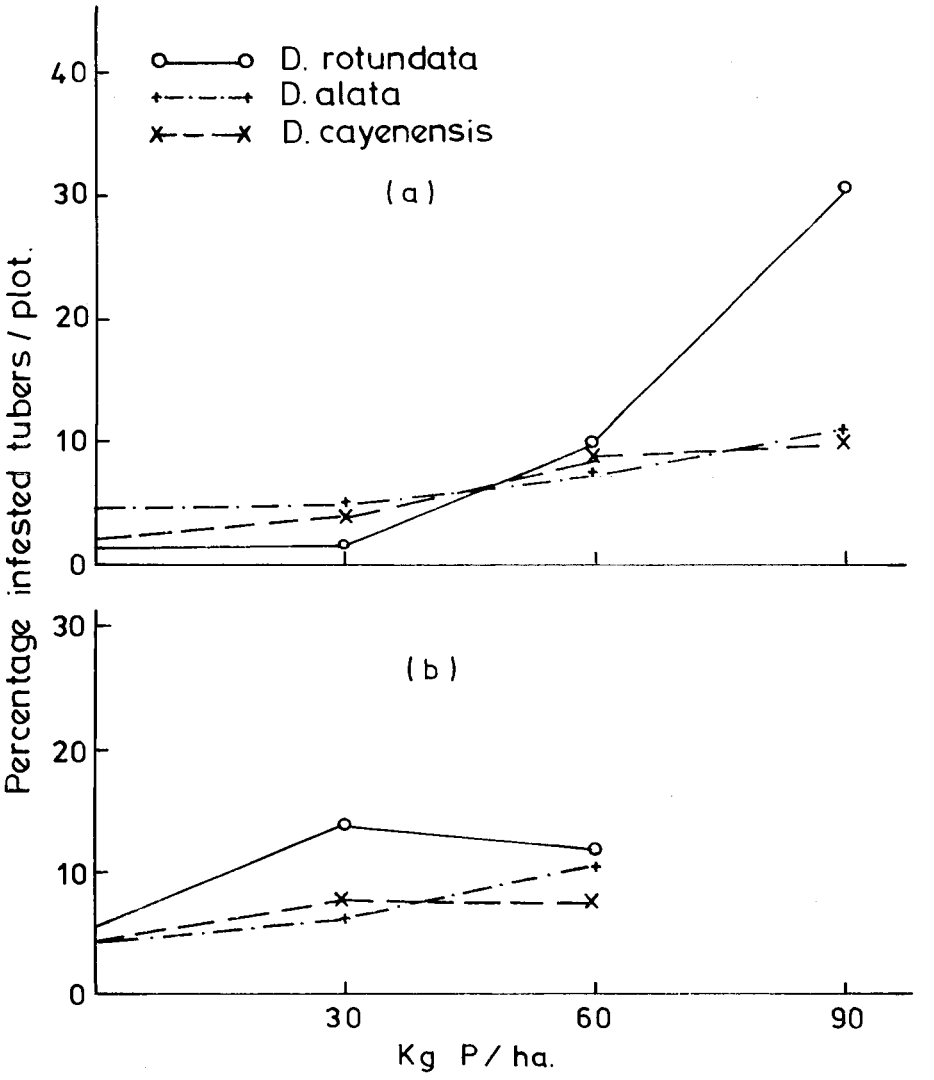

Fig. 1 - Effect of N (a) and P (b) on the percentage of yam tubers infested by *Scutellonema bradys* in 1977.

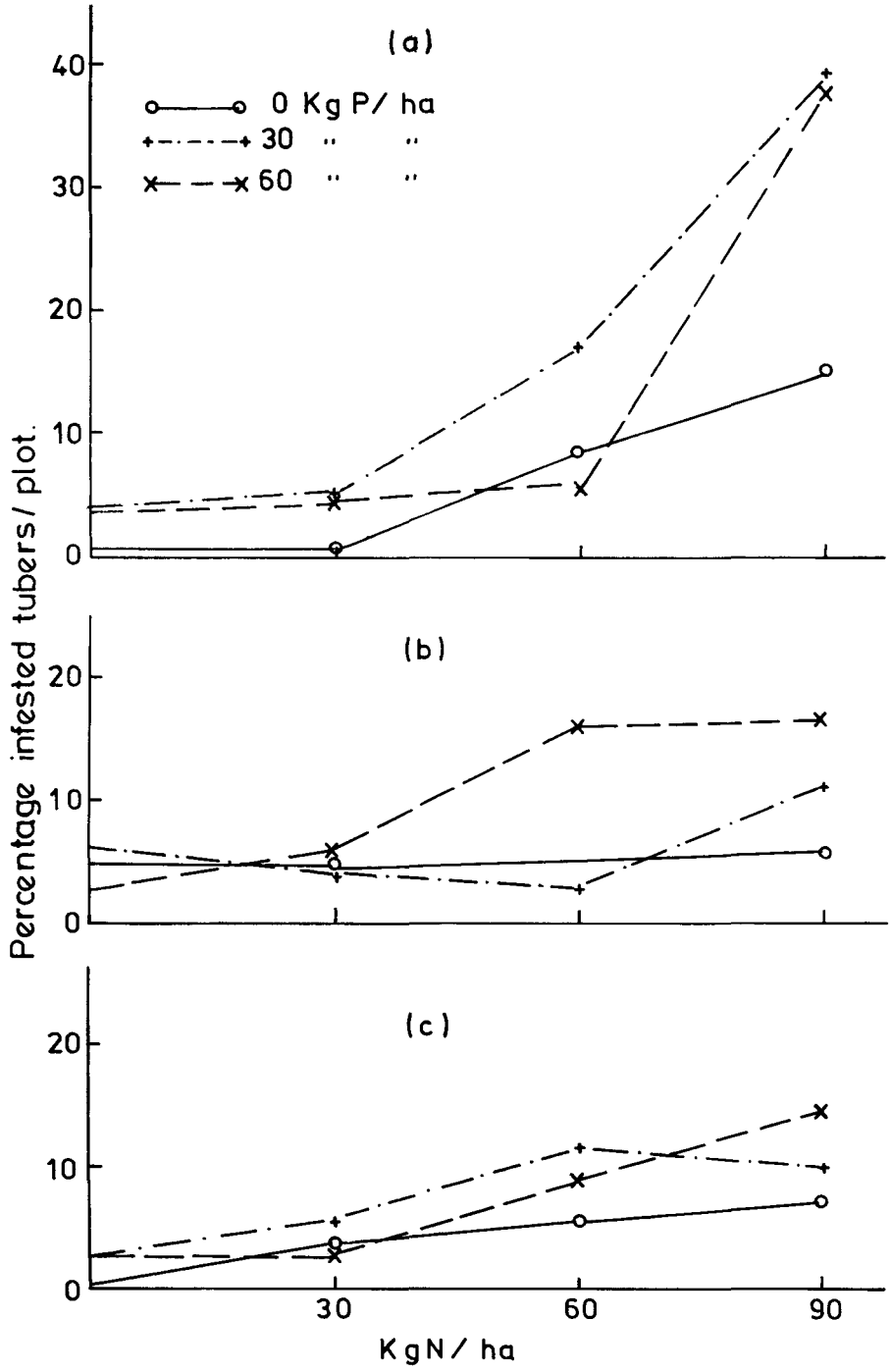

Fig. 2 - Effect of N and P combinations on infestation of yam tubers by *S. bradys* in 1977: (a) *D. rotundata* (b) *D. alata* and (c) *D. cayenensis.*

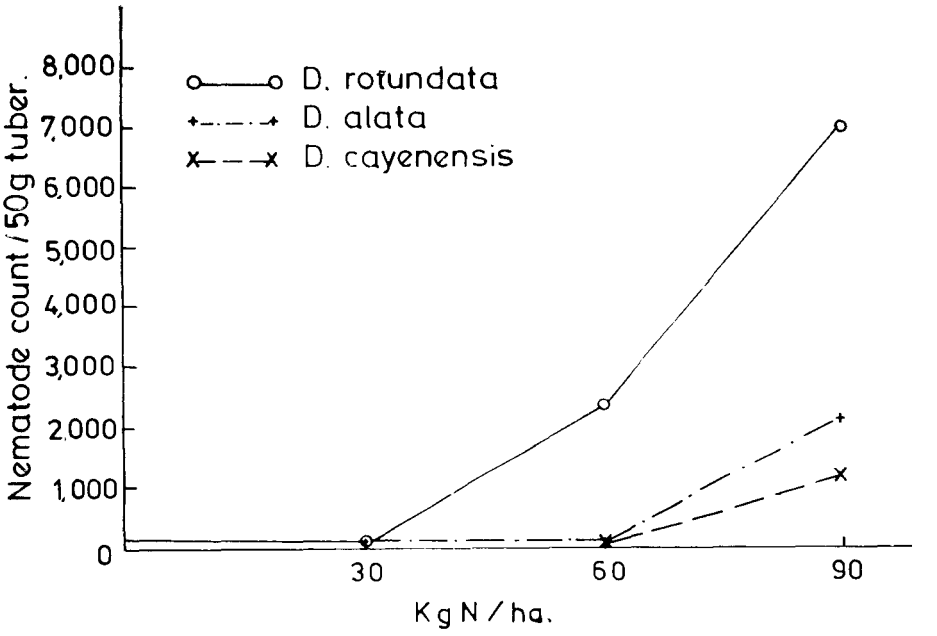

Fig. 3 - Effect of N on the population of *S. bradys* in tubers of yams in 1978.

Discussion

Results of previous studies dealing with the influence of inorganic fertilizers on nematodes tend to indicate that nitrogen in particular was detrimental to nematodes under laboratory conditions (Walker and Mavrodineanu, 1967; Walker, 1971). In some of the reports, nitrogen was thought to act indirectly on nematodes by increasing the incidence of fungi which attack nematodes (Nematode trapping fungi) (Duddington, 1960; Cooke, 1962). Because most of these studies were conducted in the laboratory, they could only help to formulate hypotheses but could hardly reveal what might be occurring in the field.

These results indicate that the influence of inorganic fertilizers on populations of *S. bradys* varies with different yam species. In all cases the level of nitrogen alone or in combination with phosphorus was positively correlated with population densities of the nematode in tubers of *D. rotundata*. The effect of these nutrients on *S. bradys* was only modest in tubers of *D. alata* and *D. cayenensis*.

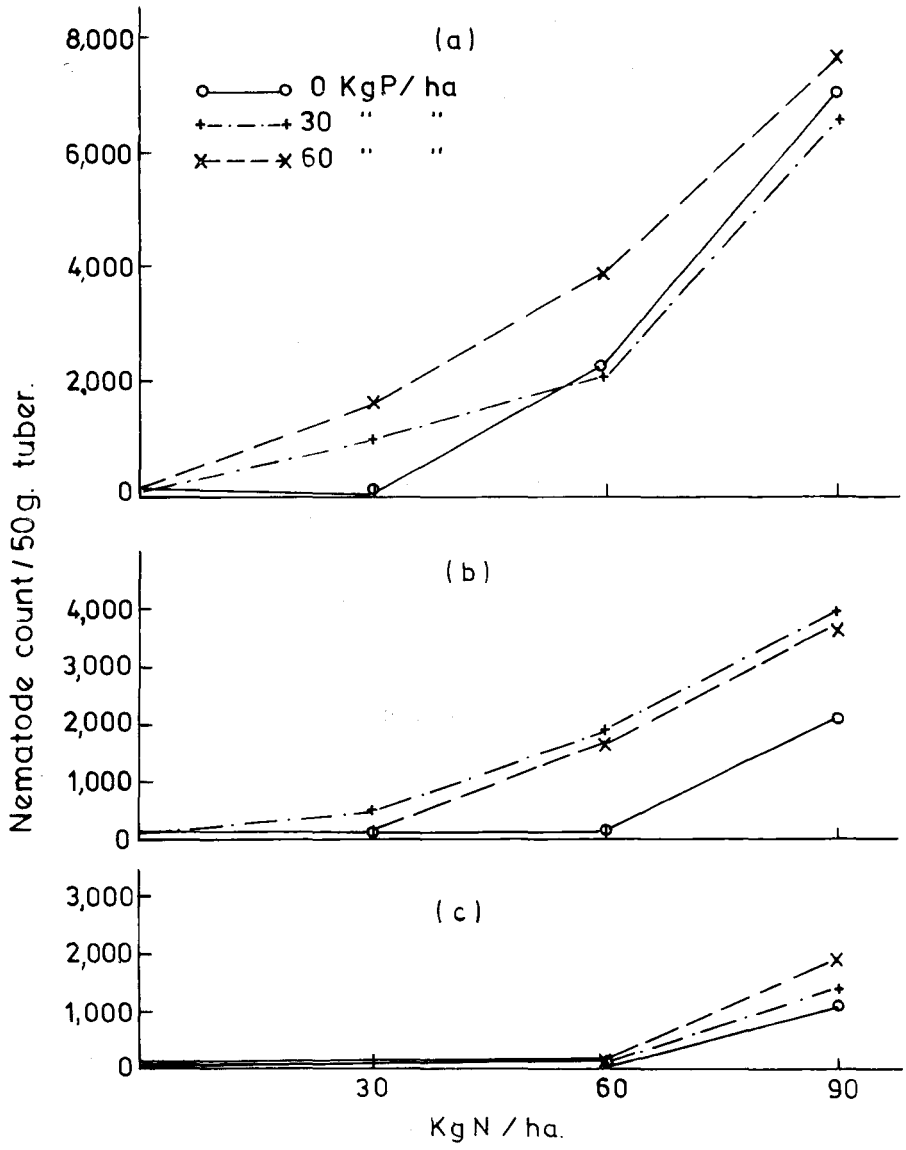

Fig. 4 - Effect of N and P combinations on infestation of yam tubers by *S. bradys* in 1978: (a) *D. rotundata* (b) *D. alata* and (c) *D. cayenensis.*

Nematode infestation is a serious storage problem. The results of our investigation lend support to earlier observations by farmers in certain yam growing areas of Nigeria that yams fertilized with N alone did not store well. Recent investigations (Kpeglo, 1979) on *D. rotundata* showed that yams fertilized with nutrient combinations which contained P stored better (longer) by delaying the sprouting of the stored tubers.

Since nitrogen is a key nutrient element responsible for development of photosynthetic apparatus (leaves and stems), dry matter accumulation and subsequent tuber yields, its application is indispensable in yam production. Thus yams fertilized with N must be processed early. This work also emphasises the importance of application of balanced nutrients in yam production. It is note-worthy that currently recommended fertilizer combinations for yam production in the savannah area of West Africa range between 50-60 kg N plus 25-30 kg P/ha (Obigbesan, in press). These are levels which, from the results of this work, do not favour the build up of nematode population.

SUMMARY

Two separate fertilizer trials conducted during two years in a savannah location of Western Nigeria showed that high rates of nitrogen combined with phosphorus resulted in substantial increases in the population of the yam nematode. *Scutellonema bradys* (Steiner *et* Le Hew), Andrassy in the tubers of the white yam (*Dioscorea rotundata*). Similar increases were not recorded with *D. alata* (water yam) and *D. cayenensis* (yellow yam). Application of nitrogen alone also led to a significant increase in nematode numbers, especially in *D. rotundata*, while phosphorus alone did not favour nematode build up in the tubers of the three yam species.

RIASSUNTO

Influenza delle concimazioni sui livelli di popolazione di Scutellonema bradys *in tre specie di* Dioscorea.

Due diversi esperimenti condotti in due anni in una località della savana nella Nigeria occidentale hanno indicato che abbondanti concimazioni azotate, in combinazione a somministrazioni di fosforo, hanno incrementato le densità di popolazione del nematode *Scutellonema bradys* (Steiner *et* Le Hew) Andrassy in tuberi di *Dioscorea rotundata*. Gli stessi incrementi non sono invece stati osservati in tuberi di *D. alata* e *D. cavenensis*. Somministrazioni di azoto da solo, hanno anche incrementato le cariche del nematode, specialmente in tuberi di *D. rotundata*, mentre il fosforo da solo non ha favorito la riproduzione del parassita in alcuna delle tre specie di *Dioscorea* saggiate.

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