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SEASONAL VARIATION IN NUTRIENT CONCENTRATIONS OF FOLIAR TISSUES OF OIL PALM

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ABSTRACT

To study the seasonal changes in the nutrient concentration in leaf tissue of oil palm, an investigation was undertaken on six year old palms at the plantations of the Oil Palm India Ltd., Kerala, for two years from 1978. The design of the experiment was $3^3 \times 2^2$ confounded split plot, testing three levels each of nitrogen, phosphorus and potassium and two levels each of calcium and magnesium. There was a reduction in nitrogen concentration in foliar tissues during summer months and increase during rainy season. But a reverse trend was noticed in phosphorus, potassium and calcium concentrations and magnesium concentration in leaf did not show any definite pattern.

INTRODUCTION

The effect of graded doses of N, P, K, Ca and Mg on oil palm under Kerala conditions was reported by Nair and Sreedharan (1982). The climatic factors indirectly affect the nutritional balance in oil palm which is indicated by foliar status. The variations in foliar concentration influence the reproduction, growth and yield of palms (Broeshart, 1957; Smilde and Chapas, 1963; Smilde and Leyritz, 1965). This information is vital for diagnosing nutrient deficiencies and suggesting fertiliser schedule during different growth phases.

MATERIALS AND METHODS

The investigations were carried out in the plantations of the Oil Palm India Limited, Bharatheepuram, Quilon District, Kerala State. The trial was undertaken in *Tenera* variety planted during 1972. The fertiliser treatments consisting of three levels each of nitrogen (400, 800 and 1200g N/palm/year), phosphorus (200, 400 and 600g P_2O_5/palm/year), potassium (600, 1200 and 1800g K_2O/palm/year) and two levels each of calcium and magnesium given at zero and 500g per palm per year respectively were superimposed from 1975.

The design of experiment was a $3^3 \times 2^2$ confounded split plot with three blocks per replication. Leaf 17 was collected for sampling (Hartley, 1977). Composite leaf samples were taken from the entire treatments during September, 1978, January, April and September 1979 and January and April 1980. The sampling procedure

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has been described in an earlier publication (Nair and Sreedharan, 1982). The foliar nitrogen and phosphorus were determined by the colorimetric method. Potassium was determined by flame photometry and calcium was estimated by deducting Mg from the total Ca and Mg determined by EDTA titration (Jackson, 1967).

RESULTS AND DISCUSSION

The results of the investigation conducted to study the seasonal variation of different nutrients in leaf tissues are presented in Figures 1–3.

It is noted that there is a reduction in N concentration of foliar tissue during January and increase during September and April months (Fig. 1). It was further noted that between the different levels of N, N_3 level showed the highest N concentration during all seasons and the concentration of N reduced when other nutrient levels increased. This variation of N in foliage can be attributed to the variation in soil moisture during the different seasons (Ng, 1970). It was also observed that the rainfall was least in January and abundant during September and April. During January the microbial activity in the soil gets reduced due to the low soil moisture availability and hence less mineralisation occurs. After the onset of rains, the soil becomes biologically active, resulting in increased mineral nutrient availability. Such effects of seasonal variation on mineral nutrient content were recorded by Smilde and Chapas (1963) in oil palm. Decreased leaf N with reduced soil moisture has also been reported by Clements (1964).

Contrary to the results obtained above, it could be observed (Fig. 2) that there was an increase of phosphorus concentration in foliar tissues during January and decrease during September and April. The increased P concentration in leaf during summer months might be due to the moisture loss from the plant.

The potassium concentration of leaves also showed a trend similar to that of phosphorus (Fig. 3). Seasonal variation in the leaf level of K can again be explained in terms of increased foliar concentration during periods of restricted respiration. Richards and Wadleigh (1952) showed that an increase in soil moisture decreased leaf potassium. Decreased K concentration during September could also be attributed to the flowering and fruiting of oil palm which coincides with this period (Emmert, 1959). Similar results were also reported by Coulter (1958).

Calcium concentration of foliar tissue also increased during January and decreased during September. The reasons attributed for the change in leaf phosphrous could also explain the changes in leaf calcium. Magnesium concentration in tissue did not show definite trend. However, it is to be noted that N, P and K fertilisation recorded a decreased value of magnesium concentration of leaf, as the level of magnesium increased during different seasons.

FIG. 1. EFFECT OF FERTILISERS ON THE TISSUE NITROGEN CONTENT IN DIFFERENT SEASONS

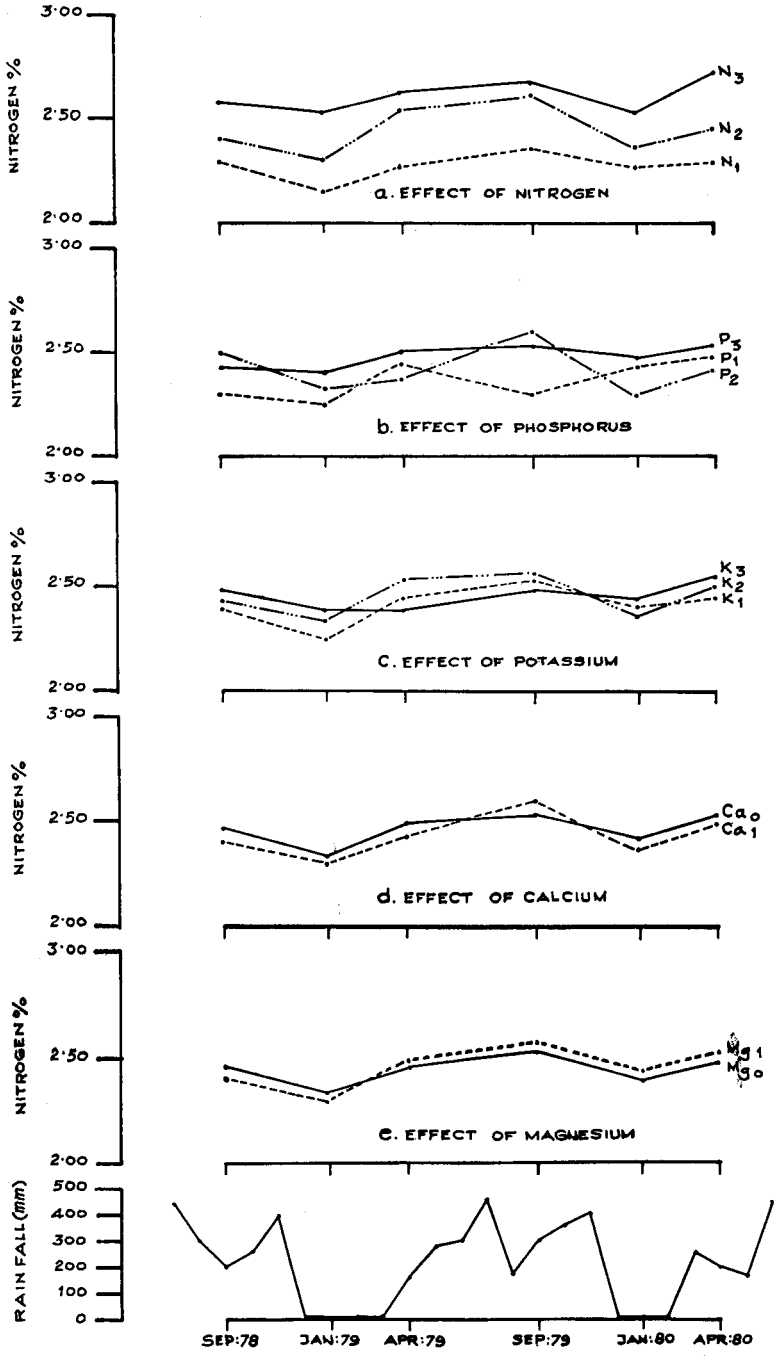


FIG. 2. EFFECT OF FERTILISERS ON THE TISSUE PHOSPHORUS CONTENT IN DIFFERENT SEASONS

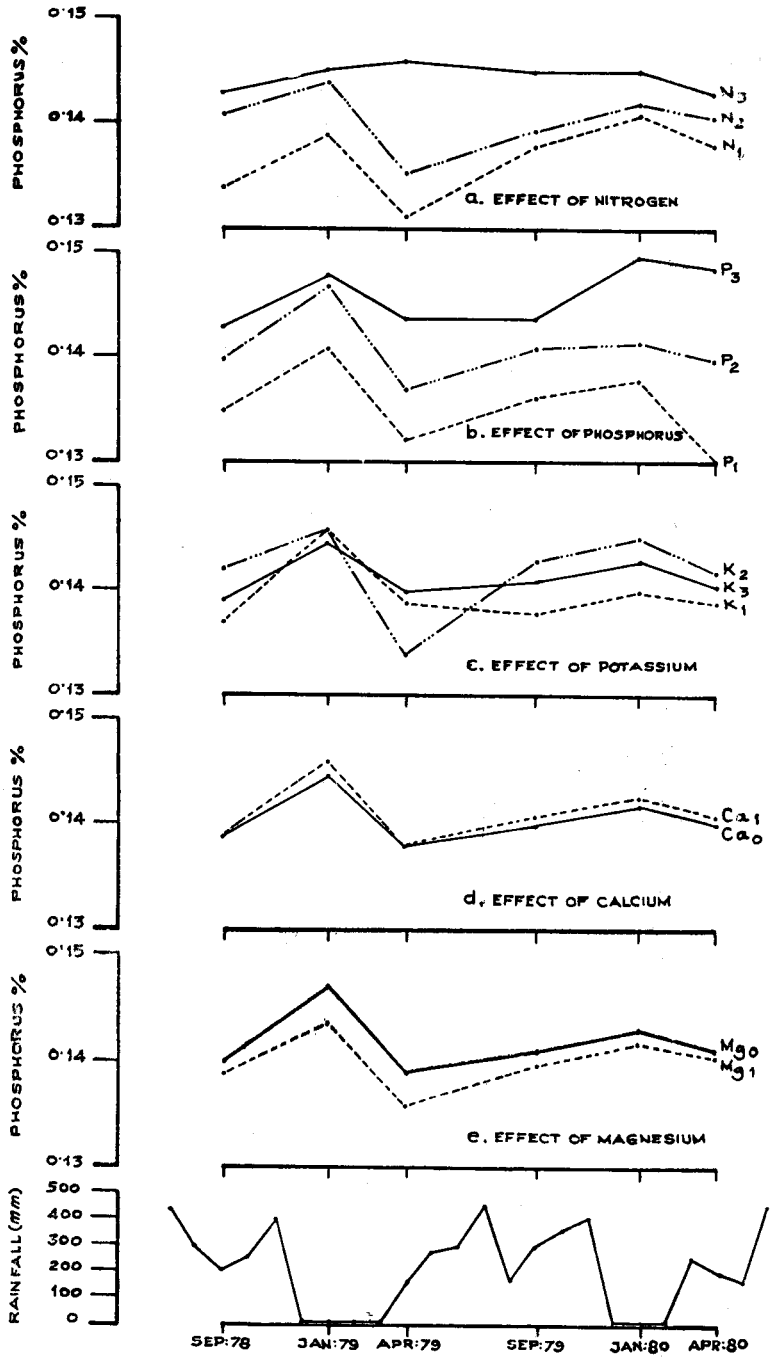
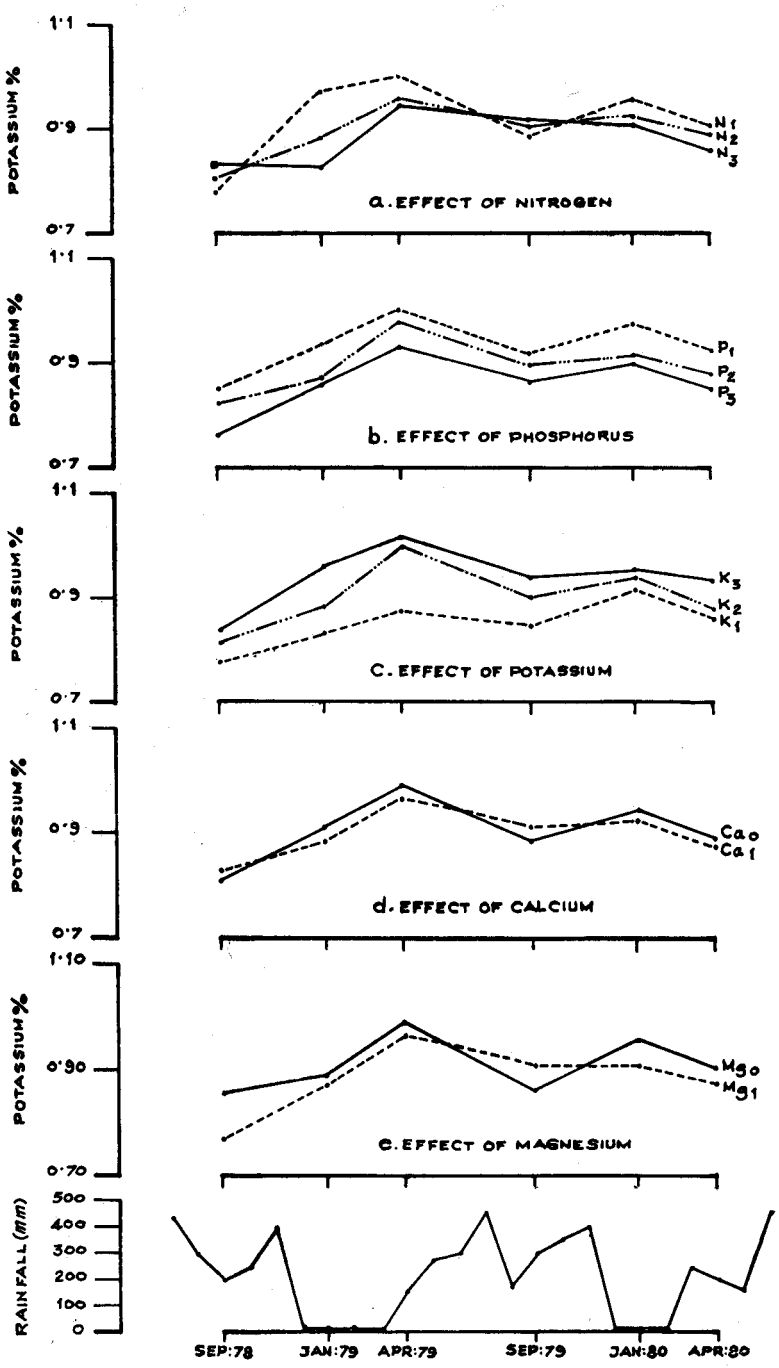


FIG. 3. EFFECT OF FERTILISERS ON THE TISSUE POTASSIUM CONTENT IN DIFFERENT SEASONS



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