EFFECT OF SOME BIOLOGICAL FACTORS ON
SOIL VARIABILITY IN THE TROPICS

II. EFFECT OF OIL PALM TREE
(ELAEIS GUINENSIS JACQ.)

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SUMMARY

Soil heterogeneity induced by oil palm trees was investigated in the forest zone of western Nigeria. Surface and subsoil samples taken from adjacent to the palm tree showed lower bulk density, higher soil moisture retention, higher organic matter content and nutrient status than the surrounding soil.

Maize plants grown on the palm site soil showed better growth, nutrient status and yield. The palm tree effect on soil productivity could not be blanketed with addition of N, P and K fertilizers because of the effect also of better soil physical conditions. The implication of the palm tree effect on field experimentation in the area was discussed.

INTRODUCTION

Soil variability, particularly on recently cleared land is a major problem in conducting field experimentation in the tropics. In the forested zone of western Nigeria, soil variability on an Alfisol is also shown to be affected by the pre-clearing vegetation. After secondary forest, the soil shows a higher degree of variability in their chemical properties than after thicket or cropping.

One of the major factors which significantly contribute to the chemical variability of the soil under secondary forest vegetation is the presence of oil palm trees (Elaeis guinensis Jacq.). The soil from the oil palm tree sites show higher organic matter and nutrient contents than the adjacent soil. The importance of certain trees in affecting soil variability is also reported in the case of Acacia trees in the dry tropics of Africa. Oil palm trees are however, of more
importance in the humid tropics where they are found in fertile valleys, in secondary forest and on old farms. In West Africa, the palm trees are most abundant in the zone between the dense evergreen and deciduous forest and the open grass savanna. However, when the forest has been cut and is regenerating, the palm trees do not develop well. A survey in western Ghana shows an average of 240 trees/ha in the forest and only 40 trees/ha when the forest had been cut and fallowed.

In order to obtain more information on the soil variability due to the palm tree sites and its effect on crop growth and yield, some investigations were carried out, the results of which are reported in this paper.

**MATERIALS AND METHODS**

*Investigation I*

This was carried out to determine the physical and chemical soil variability at various distances from the oil palm tree trunk. For this study, four palm trees grown in a secondary forest on a sandy loam Egbeda soil series (Oxic Paleustalf) in the forest zone of western Nigeria were selected. The trees were of unknown age and have an average height of approximately 9 m. From around each tree, composite surface soil (0–15 cm) and subsoil (15–30 cm) samples were collected at distances of 0.25, 0.50, 1.0, 2.0, 3.0 and 4.0 m from the tree trunk. Each of the composite samples consist of four subsamples, all collected in the same way except in four different directions from the tree. The corresponding composite samples from each of the four trees were composited again for soil analysis. For bulk density measurement, undisturbed samples were taken with a core sampler. Soil moisture retention measurements were done using a pressure plate method at 1/3 and 15 atmosphere pressures. Soil pH was measured using glass electrode from a 1:1 soil-water paste. Organic matter content of the soil was determined by wet digestion. Total N was measured using the Kjeldahl method. Extractable P was extracted with Bray No. 1 and measured colorimetrically by molybdenum blue method. Exchangeable K, Ca and Mg were extracted with 1N ammonium acetate at pH 7.00. K and Ca were measured with a flame photometer and Mg with atomic absorption spectrophotometer. Soil CEC was measured by summation of the amount of exchangeable cations including exchangeable H and Al.

*Investigation II*

Greenhouse experiments were carried out to determine the N, P and K responses of maize plants grown on surface soils (0–15 cm) collected from 15 cm wide strips at distances of about 0.5 m and 3 m from around the tree. Two soils were used, Egbeda soil series and Apomu soil series (Psammentic Ustorthent). For each soil series, the experiment was conducted in a complete