EFFECTS OF THE RATES OF APPLICATION OF COPPER AND LEAD ON SOIL MICROBIAL ACTIVITIES

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ABSTRACT

The study assessed the effect of copper and lead application on microbial activities in the soil. It also determined their effect on microbial population and the concentration that is toxic to soil microorganisms. This was with a view to assessing the quantitative and qualitative effects of these metals on soil microorganisms.

Composite samples from the 0-15 cm depth were obtained from Apomu and Egbeda soil series, and an old cocoa plantation at the Obafemi Awolowo University Teaching and Research Farm, Ile-Ife. The samples were also obtained from a mechanic's dump site and uncultivated plot on the Ife-Ibadan Express way. Physical and chemical properties were determined in air-dry samples. The soil organic matter contents, particle size distribution and bulk density were determined. Exchangeable cations were extracted using neutral 1 M NH_4OAc solution. The K, Ca and Na were determined using the flame photometry while Mg was determined using the Atomic Absorption Spectrophotometer. Carbon dioxide evolved from Apomu and Egbeda series amended with 0, 25, 50 and 100 mg/kg of copper and lead in factorial combination was determined weekly for six weeks in the laboratory. The populations of bacteria and fungi were determined using nutrient agar, malt extract agar and potato dextrose agar. The types of bacteria and fungi were also identified using a combination of microscopic and biochemical tests. The data were subjected to analysis of variance and the means separated using Duncan's Multiple Range Test ($p < 0.05$).

The results showed that the microbial populations were significantly reduced at the highest rates of copper and lead applications ($F = 5.03$; $p < 0.05$). The fungi population decreased from 6,712,500 cfu/g on the control to 1,880,000 cfu/g with the application of 50 ppm of Cu. The population of bacteria similarly decreased significantly from a mean of 2,755,000 cfu/g on the control to 2,221,250 cfu/g on 50 ppm Cu treated soil. About 50 ppm of both Cu and Pb were the concentration levels at which the heavy metals became toxic to the studied microorganisms in the soil. The microbial diversity was reduced in Egbeda series more than in Apomu series. The bacterium *Klebsiella pneumoniae* and the fungi *Fusarium sp.* and *Gliocladium sp.* were tolerant to high concentrations *of* copper and lead. The CO_2 evolution, an index of microbial respiration, decreased with increase in the concentrations of applied copper and lead.

It was concluded that the applications of copper and lead adversely affected microbial respiration and diversity with the fungi being more tolerant than the bacteria to the contaminants.