ABSTRACT

Chemical and mineralogical properties, inherent fertility and fertilizer requirements of 13 dominant soils of four regions of the Interior of Guyana were determined.

The Riverine soils are low lying, recent in age, of marine origin, and contain illite and vermiculite. They are inherently more fertile than the other soils especially with respect to exchangeable bases. The other soils are from upland areas and have been subject to intense weathering and leaching and are relatively cation deficient and infertile. Their clays are dominated by kaolinite and/or goethite. Available-P was low in both groups of soils.

Of the major nutrients tested P was the most limiting, followed by K and N. Crop response to applied P is explained by low levels of native P, presence of substantial quantities (50 - 82 per cent) of the inorganic-P in the reductant solution form and large fixation capacity. In the laboratory, P was fixed initially in the saloid, Al, and Fe forms with the first two being converted to Fe-P with time. Under greenhouse and field conditions applied P was also found in the reductant soluble and occluded forms. Liming increased the amounts of applied P fixed in the saloid, Ca, Fe, and reductant fractions but decreased Al-P. Plant uptake was significantly positively correlated with the Fe, occluded, and reductant fractions. In field experiments applied P was leached down the profile, accumulating at the 15 - 30 cm horizon only if this was argillic. In a loamy sand, available-P increased with time when P was applied. Optimum grass performance was obtained by applying 66 kg P/ha/annum but an initial single large application (132 kg/ha) was as effective over a three-year period as 66 kg P/ha/annum applied

regularly. Triple superphosphate was a superior source of P compared to rock phosphate and basic slag.

The effect of liming on crop performance was dependent on the grass species, but when the initial soil pH was above 5.0 there was no response.

Soils with iron oxide clays had the largest concentrations of total - and exchangeable - K followed by those with 2:1 lattice clays and 1:1 lattice clays. The largest amounts of "difficulty available" - K and the greatest ability of the soil to provide K with repeated cropping were found in soils with 2:1 lattice clays. Optimum production Pangola grass was obtained on a fine sand with the application of 132 kg K/ha/annum. Potassium chloride was a superior source compared to two KM_gSO_4 variants.

Total-N in soils ranged from 0.02 to 0.25 per cent with the inorganic form, both exchangeable and non-exchangeable, representing 0.9 to 6.7 per cent. Soils of 2:1 clay lattice mineralogy had the largest concentrations of non-exchangeable-N. Mineralisable N which varied from 1 - 663 ppm bore no relationship with any measured soil characteristic.

Zero and 220 kg N/ha/annum were recommended for the optimum production of Pangola grass during the first and second years of establishment, respectively, on a fine sand. Recovery of applied N was low because of substantial losses particularly by leaching and by ammonia volatilisation. Inorganic-N in the soil was found exclusively as NH_4^+-N.

Based on field and greenhouse studies appropriate analytical methods for fertility diagnosis and fertilizer rates for maize were recommended.