eties with different growing habits. The relationship between adjusted P concentrations in the soil at planting time and cowpea yields is shown in Figure 26. The 4 varieties showed distinct differences in their external P requirement. Without P, a local variety, Shaki, gave the highest yield and has an external P requirement of about 0.06 ppm P while with P application, TVx 1193-7D, an improved erect variety, gave the highest yield and has the lowest external P requirement of about 0.016 ppm p. Ife Brown and VITA-4 gave the lowest yields, and Ife Brown has the highest external P requirement of about 0.10 ppm P while VITA-4 has an external P requirement of about 0.06 ppm P. From these results, it thus appears that though variety TVx 1193-7D is quite efficient in utilizing applied P in low P status soil, the local variety Shaki does better.

The differential phosphate requirements of 2 soybean varieties, TGM 51 × TGM 344 and TGM 479, were compared in a field experiment conducted on an Alfisol at Mokwa in the subhumid region of Nigeria. Results of the trial as shown in Fig. 27 clearly indicate that variety TGM 479 has a significantly lower yield than variety TGM 51 × TGM 344. Despite their differences in yield, both varieties have similarly low external P requirements of about .018 ppm P in soil solution. These low external P requirements may be attributed to other growth-limiting factors as indicated by grain yields. In spite of the low yield, data in Fig. 27 indicate the relatively higher efficiency of P utilization by variety TGM 51 × TGM 344 over variety TGM 479.

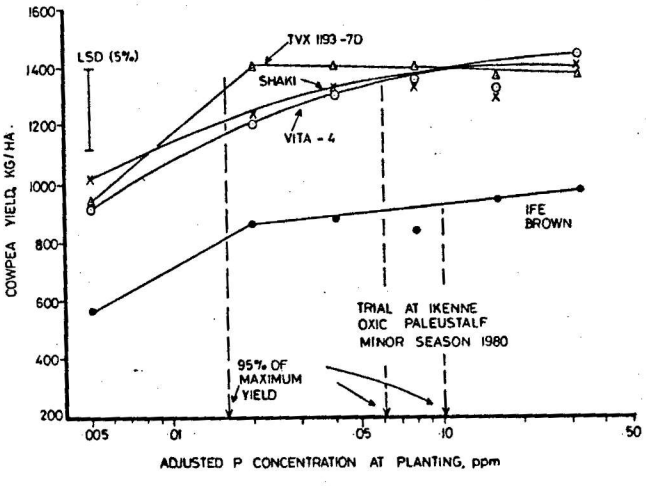

Fig. 26. Relationships between adjusted P concentrations and cowpea yield.

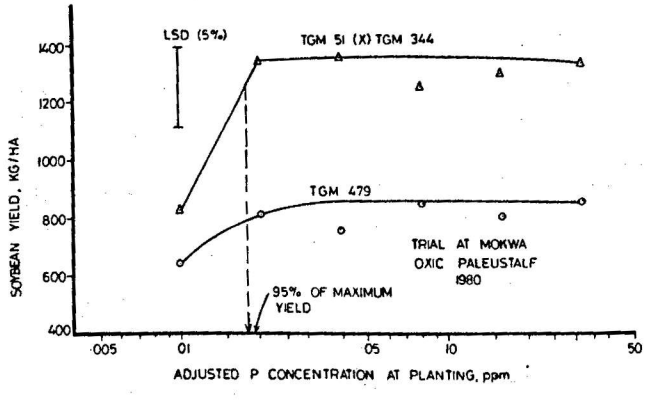

Fig. 27. Relationships between adjusted P concentrations and soybean yield.

Management of siliceous Ultisols

Maize-cowpea rotation

A 5-year management trial at Onne shows that a productive maize-cowpea rotation system is possible on coarse-textured deep and permeable Ultisols (Typic Paleudult) on a predominantly flat to gently undulating coastal land form. Maize was sown in early March and cowpea in late September or early October. Maximum grain yield throughout the 5 years ranges from 3.5 to 4.5 t/ha for maize and from 1.3 to 1.5 t/ha for cowpea.

A well-balanced fertilization scheme is required for the maize crop, N, P, K, S, Mg and Zn, and fertilization is generally not needed for cowpea in the second season as the residual fertility from the maize crop with residue return as surface mulch is adequate to support the cowpea crop. Reduced tillage with residue mulch is recommended because the coarse-textured, kaolin-dominated soil may be easily compacted.

It is important to point out that the maize, TZPB, and cowpea cultivars, VITA-1 and VITA-4, tested are fairly tolerant to soil acidity. The critical level of exchangeable Al saturation, i.e., a level required to attain 90 percent of maximum yield, for the maize cultivar ranges between 30-45 percent depending upon the rate of chemical fertilizer used (Fig. 28). The critical level of Al saturation for

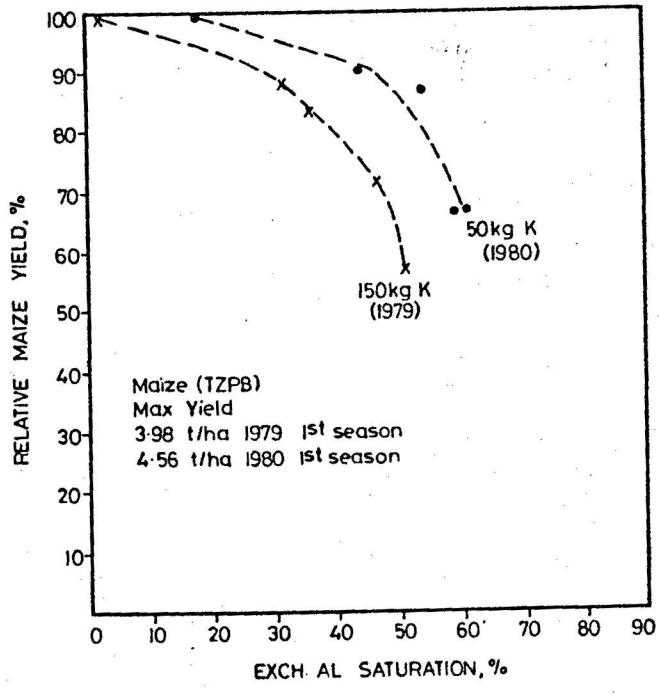

Fig. 28. Relative yield of maize as affected by percent exchangeable Al saturation in the soil.