

**REHABILITATION OF SOILS FORMERLY UNDER  
TEA USING PHOSPHORUS SOURCES AS SOIL  
AMENDMENTS**

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**BY**

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# REHABILITATION OF SOILS FORMERLY UNDER TEA USING PHOSPHORUS SOURCES AS SOIL AMENDMENTS C. OWINO GERROH

## ABSTARCT

Soil chemical factors responsible for stagnation and/or decline in yields of tea (*C. sinensis* L.) failure of alternative crops such as field bean (*P. Vulgaris* L.) to establish in former tea soils and their amendments with phosphorus sources were investigated in laboratory, greenhouse and field studies. Ando humic nitisols from four sites, viz., fields with moribund tea, teas planted in 1959 and 1979 and newly cleared forest in Kagaa, Lari Division, Kiambu District, Kenya were used. High aluminium ( $Al^{3+}$ ) concentration and saturation ( $> 480 \text{ g kg}^{-1}$ ), deterioration of soil nutrients balance, low phosphorus (P) content and high P - fixation capacity were found to be the most probable detriments.

The addition of triple superphosphate (TSP) and Minjingu phosphate rock (MPR) fertilizers at rates 0 (Control), 30, 45 and 60  $\text{kg P ha}^{-1}$  and 30  $\text{kg P ha}^{-1}$  as TSP plus lime ( $CaCO_3$ ) to the soils as sources of P and soil ameliorants and incubating for 1,7,14 and 28 days showed that TSP and 30  $\text{kg P ha}^{-1}$  (TSP) plus lime significantly increased  $Ca^{2+}$  and P and decreased  $Al^{3+}$  contents more than MPR did within one day of application. MPR significantly increased the soil reaction,  $Ca^{2+}$  and P and decreased  $Al^{3+}$  contents gradually within 14 days. The differences between the P sources was attributed to the higher solubility of TSP and also its ability to supply more P to the soils which reacted with  $Al^{3+}$  to form sparingly soluble compounds.

The yields of field beans grown on the soils studied were also significantly increased by TSP and 30  $\text{kg P ha}^{-1}$  (TSP) plus lime more than MPR fertilizer did when the above stated rates of TSP and MPR fertilizers and 30  $\text{kg P ha}^{-1}$  (TSP) plus lime were added to the soils. The differences were attributed to the abilities of the sources to supply sufficient quantities of P to satisfy both the soils high P-fixation capacities and also for the plant growth.

Incorporating field bean tops (shoots) into the soils significantly increased the yield of subsequent field bean crop. The yields were also significantly increased when the above

stated P sources were also added to the soils incorporated with field bean tops. Significantly higher increases were found when TSP and 30 kg ha<sup>-1</sup> (TSP) plus lime were applied than with MPR fertilizer. This was attributed to low C:N (6.3) and lignin:N (1.3) ratios, low polyphenolic (2.7g kg<sup>-1</sup>) and high N (50.4 g N kg<sup>-1</sup>) contents of the bean plant. These enabled it to decompose rapidly thereby releasing both N and other essential plant nutrients to the soil for plant growth. The ability of TSP and 30 kg P ha<sup>-1</sup> (TSP) plus lime to dissolve quickly and supply P to the soils which is good for higher microbial events led to the observed higher yields.

Agronomically, TSP fertilizer was found to be superior to MPR as a source of P and also as a soil ameliorant for growing field bean in soils formerly under tea. This is because the former releases P more quickly thereby reducing the soil's high P-fixation capacity and also supplying highly deficient P for plant growth in the soil.

The yield responses of tea (*Camellia sinensis* L. O'Kuntze) to 30, 45 and 60 kg P ha<sup>-1</sup> of TSP and MPR fertilizers, 30 kg P ha<sup>-1</sup> (TSP) plus lime (Ca CO<sub>3</sub>) and 25:5: 5:5 NPKS fertilizer (Control) in moribund tea and 1979 planted tea fields were statistically not significantly different because of " the complexation of Al " tolerance mechanism of the tea plant to high Al and low P content soils. Through this mechanism, the uptake of both P and Ca<sup>2+</sup> by the tea plant is insignificantly reduced.

In conclusion the study showed that for the tea plant, all the P - sources used are effective as sources of P but for the purpose of rehabilitation of moribund tea fields and also for sustainable productivity, 30 kg P ha<sup>-1</sup> (TSP) plus lime and MPR should be preferred because they reduce the high soil acidity, Al content and saturation and also increases the available P content in the soil. This will reduce Al build up in the plant tissues which exerts stress on the plant and eventually leads to the decrease in the plant's resistance to opportunistic diseases and such as *Armillaria melea* and *Hypoxyton serpens* hence vacancies and reduced yields.