

Long-term effect of phosphate rocks for rice-groundnut cropping system

P.K. SAMANT, S.K. SWAIN, H.K. SENAPATI AND S.K. SAHU

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ABSTRACT

A field experiment was conducted for five years in the Central Research Station of Orissa University of Agriculture and Technology, Bhubaneswar, Orissa during 1994-1995 in order to study the long-term effects of phosphate rocks for rice-groundnut cropping system. Rice variety Lalat and groundnut variety ICGS 11 were taken as the test crop. Altogether there were ten treatments including control. The soil of the experimental site was sandy to sandy clay loam (Fluventic Ustochrept) having pH 5.6, low organic carbon, medium available 'P', (Olsen and Bray) and low CEC. Three rock phosphates (water insoluble) namely Yousouffia, Gafssa and Tebessa (YRP, GRP, and TRP) imported from Morocco along with one indigenous *i.e.* Mussoorie rock phosphate (MRP) were applied @ 250kg and 500kg P₂O₅ ha⁻¹ once before planting of rice was compared with water soluble form of fertilizer *i.e.* DAP was applied @ 50 kg ha⁻¹ to each crop on each seasons for five years. Application of rock phosphate increased the yield of rice and groundnut over control and DAP. Application of 500kg P₂O₅ ha⁻¹ from rock phosphate source produced significantly higher yield over 250kg P₂O₅ ha⁻¹ but reverse trend was marked in case of apparent 'P' recovery (APR), agronomic efficiency (AE) and production efficiency (PE). Available 'P' status showed an increasing trend from the initiation of the experiment till the end of the experiment. The sustainable yield index (SYI) indicated almost all the treatments to be recommendable excepting control in case of groundnut.

See end of the article for authors' affiliations

Correspondence to :

P.K. SAMANT

Department of Soil Science,
Krishi Vigyan Kendra,
Jajang, Kapaleswar,
KENDRAPARA (ORISSA)
INDIA

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In recent years the increase in price of phosphatic fertilizers and environmental pollution, practice of application of rock phosphate is definitely cheap and ecofriendly. The total reserves of rock phosphates in India is around 200M.T (Fertilizer Focus, 1991) comprising station of Andhra Pradesh, Madhya Pradesh, Tamil Nadu, West Bengal, Rajasthan etc. Mostly the indigenous rockphosphates are of low grade (<20% P₂O₅) but imported rockphosphates are of high grade (>30% P₂O₅). The efficiency of chemically processed fertilizers is very slow due to chemical fixation and perpetuation making 10 – 20% of applied 'P' available to the crops. This experiment is an approach to know the direct effect of phosphate rocks in an acidic environment to rice and residual effect to both rice and groundnut. Mitra *et al.* (1993) reported maximum yield of groundnut and rice in a groundnut-rice cropping system in lateritic soils of Orissa.

MATERIALS AND METHODS

Direct effect of application of rock phosphates in rice and residual effects in both rice and groundnut was studied and its efficiency was compared with water soluble form *i.e.* DAP which was applied @ 50 kg P₂O₅ ha⁻¹ to each crop in each season. The various treatments imposed are T₁-control T₂-DAP, T₃-YRP-250, T₄-YRP-500, T₅-GRP-250, T₆-GRP-500, T₇-MRP-250, T₈-MRP-

500, T₉-TRP-250, T₁₀-TRP-500. The rock Phosphates (YRP, GRP, MRP and TRP) @ 250kg and 500kg P₂O₅ ha⁻¹ were applied before planting of rice during 1994.

The soil and plant samples after harvest of each crop were collected for further analysis of various components of soil and plants. The available phosphorus status was determined following the procedure of Olsen's *et al.* (1954). The phosphorous, potassium, sulphur and calcium contents of plant samples were analysed following the procedure of Jackson (1973). The efficiencies of phosphatic fertilizers were calculated as per the following formula given by Moll *et al.* (1982).

$$\text{APR (Apparent Phosphorus Recovery \%)} = \frac{\text{Total P uptake in treatment plot (kg ha}^{-1}) - \text{Total 'P' uptake in the control plot (kg ha}^{-1})}{\text{Total 'P' applied (kg ha}^{-1})} \times 100$$

Agronomic Efficiency (AE) = Kg grain produced/ kg 'P' applied

$$\text{Agronomic Efficiency (AE)} = \frac{\text{Yield in treatment plot (kg ha}^{-1}) - \text{yield in control plot (kg ha}^{-1})}{\text{Total 'P' applied (kg ha}^{-1})}$$

Production Efficiency (PE) = Kg grain produced/ kg 'P' uptake

$$\text{Production Efficiency (PE)} = \frac{\text{Yield in treatment plot (kg ha}^{-1}) - \text{yield in control plot (kg ha}^{-1})}{\text{Total P uptake in treatment plot (kg ha}^{-1}) - \text{Total 'P' uptake in the control plot (kg ha}^{-1})}$$