

Effect of Udaipur rock phosphate alone and in combination with organics on maize (*Zea mays*)–wheat (*Triticum aestivum*) production under acid soil

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Crops vary greatly in their ability to utilize phosphorus from rock phosphates under acid soil conditions. This differential behaviour may be related to their demand for calcium in addition to P. Among the important means evolved to increase P utilization from rock phosphate, the use of organics, viz. farmyard manure (FYM) and biogas slurry is of immense importance. The present investigation was therefore, undertaken to study the effect of Udaipur rock phosphate and organic manures on maize (*Zea mays* L.) wheat (*Triticum aestivum* L.) sequence under acid soil conditions. To meet out the objectives a field experiment was conducted at the HPKV,

Table 1. Grain yield, P uptake of maize and available P in soil as influenced by Udaipur rock phosphate alone and in combination with organics

Treatment	Direct effect (maize)		Residual effect (wheat)		Available P (kg/ha)
	Grain yield (q/ha)	Grain P uptake (kg/ha)	Grain yield (q/ha)	Grain P uptake (kg/ha)	
T ₁ , Absolute control	37.6	3.5	11.1	2.5	12.3
T ₂ , N and K only	48.0	5.7	15.7	3.6	13.0
T ₃ , 60 kg P ₂ O ₅ /ha (SSP)	63.8	10.4	23.4	6.8	17.0
T ₄ , 60 kg P ₂ O ₅ /ha (URP)	54.8	9.3	17.5	4.5	19.0
T ₅ , 60 kg P ₂ O ₅ /ha (URP) + 20 tonnes FYM/ha at sowing	58.3	12.5	22.3	6.1	21.3
T ₆ , 60 kg P ₂ O ₅ /ha (URP) + 20 tonnes FYM/ha 15 days before sowing	62.4	10.3	19.6	5.4	21.7
T ₇ , 60 kg P ₂ O ₅ /ha (URP) + 20 tonnes BGS/ha at sowing	54.6	9.1	21.2	5.5	22.0
T ₈ , 60 kg P ₂ O ₅ /ha (URP) + 20 tonnes/ha 15 days before sowing	63.7	9.2	21.2	6.0	21.7
CD (P = 0.05)	6.6	1.9	3.5	1.6	3.6

URP, Udaipur rock phosphate; BGS, biogas slurry

Palampur, in silty clay-loam soil having pH 5.7. Available N, P and K contents were 308, 11 and 332 kg/ha, respectively. 'Parvati' maize was taken during the rainy (*kharif*) 1989. Basal application of N and K_2O @ 120 and 40 kg/ha was done through urea and muriate of potash respectively. Phosphorus was applied @ 60 kg P_2O_5 /ha through Udaipur rock phosphate (16% P_2O_5) and single superphosphate was kept as standard. Farmyard manure and biogas slurry were applied @ 20 tonnes/ha before 15 days sowing and at the time of sowing constituting a separate treatment. After maize harvest, soil samples were collected for available P analysis. During the winter season (*rabi*) of 1989-90 'S 308' wheat was taken with only N and K_2O at the recommended level.

Significant effect of various treatments on maize yield was observed. Maximum grain yield of maize (63.8 q/ha) was obtained with 60 kg P_2O_5 /ha, applied through single super-phosphate (Table 1). Application of Udaipur rock phosphate along with FYM, both at sowing and 15 days before sowing (T_5 , T_6) resulted in substantial increase in grain yield of maize over the control. Similar trend was observed for increased maize grain yield when rock

phosphate was used in conjunction with biogas slurry. Application of P @ 60 kg P_2O_5 through rock phosphate along with FYM, registered higher P uptake values in maize than biogas slurry treatments. The results are in conformity with those of Sivasubramanio Rajan and Kothandaraman (1986).

As regards the residual effect, P application @ 60 kg P_2O_5 /ha through rock phosphate to maize resulted in significantly higher grain yield of wheat over T_1 and T_2 treatments. However, application of rock phosphate in conjunction with FYM and biogas slurry (T_5 , T_6 , T_7 and T_8), resulted in significantly higher wheat grain yield over the control and (T_2). The residual effect of rock phosphate caused higher P uptake by wheat, due to relatively low rate of fixation of gradually soluble P from rock phosphate and build up of available P in the soil as a result of slow release of P from rock phosphate.

REFERENCE

- A Sivasubramanio Rajan and Kothandaraman, G. V. 1986. Influence of organic matter on the rock phosphate and its effect on yield and uptake of nutrients by Rice (*Oryza sativa* L.). (In) *Rock Phosphate in Agriculture*. Pyrites, Phosphates and Chemicals Ltd, New Delhi.