

Effect of Phosphorus Enriched Organic Manures on Yield and Uptake of Phosphorus in Maize in Vertisol

In Vertisol, the phosphorus availability to crops seldom exceeds 15-20 per cent due to high fixation capacity of the soil. Hence, to reduce the phosphorus fixation in soil and to enhance the efficiency of the applied phosphatic fertilizer and to keep phosphorus more timely available to crops, organic matter play a great role. It has been proved that addition of P-enriched farmyard manure to the soil reduced the fixation and enhanced the availability of P to crops from the native and applied source. But, availability of FYM to apply to soil as per the recommendation is very difficult. Therefore, there is a need to develop viable technology to increase the efficiency of inorganic P-fertilizer through P-enriched organic manures.

A field experiment was conducted at Main Research Station, University of Agricultural Sciences, Dharwad (Karnataka) on a Chromic Haplustert during kharif season of 1997-98, to investigate the effect of phosphorus enriched organic manures on yield of maize under irrigated conditions.

The experiment was laidout in a split-plot design with three main plot treatments viz., control (0 kg P_2O_5 per ha), 50 per cent of recommended dose of P (37.5 kg P_2O_5 per ha) and 100 per cent of recommended dose of P (75 kg P_2O_5 per ha) and nine sub-plot treatments viz., no organic manure, farmyard manure @ 5 t per ha, vermicompost @ 2 t per ha, biogas slurry @ 3 t per ha and poultry manure @ 2 t per ha, P-enriched farmyard manure @ 2.5 t per ha, P-enriched vermicompost @ 1 t per ha, P-enriched

biogas slurry @ 1.5 t per ha and P-enriched poultry manure @ 1 t per ha.

The total content in all the selected farmyard manure (FYM), vermicompost (VC), biogas slurry (BS), poultry manure (PM) were determined and the calculated quantity of each organic manure was taken separately and mixed well with single superphosphate to make exactly the double the quantity of phosphorus in each organic manure. Single superphosphate mixed organic manure were filled separately in polyethylene bag and required quantity of water was added to each bag to maintain moist condition (50% of maximum water retention capacity of the manure). These bags were kept for a period of one month by adding water as per the requirement to maintain uniform moisture level in the entire incubated time. After the incubation period of 30 days all these manures were dried and applied to soil.

The maize grain yield in no organic manure was 51.57 q/ha (Table 1.) Addition of P-enriched PM increased the grain yield significantly to 56.02, this increase in grain yield over no organic manure was to the tune of 8.63 per cent.

The maize grain yield was more in P-enriched organic manures than that of organic manure which can be attributed to the significant increase in the plant height of maize may be due to the increase in the availability of phosphorus and zinc in the P-enriched organic manures than that of organic manures (More and Ghonsikar, 1988, Madhumita Das *et al.*, 1991 and Dosani *et al.*, 1999).

Table 1. Effect of P- enriched organic manures at all levels of P-fertilizer on maize grain yield (q/ha)

| Treatments | Pooled data for 2 years (1997-98) | | | Mean |
|--|-----------------------------------|----------------|----------------|-------|
| | M ₀ | M ₁ | M ₂ | |
| T ₁ - Control (RDF-NK) | 46.9 | 53.2 | 54.5 | 51.57 |
| T ₂ - FYM @ 5 t/ha + RDF-NK | 49.0 | 55.0 | 56.4 | 53.48 |
| T ₃ - VC@ 2 t/ha + RDF-NK | 47.9 | 53.6 | 55.2 | 52.26 |
| T ₄ - BS @ 3 t/ha + RDF-NK | 48.4 | 54.3 | 55.8 | 52.85 |
| T ₅ - PM @ 2 t/ha+ RDF-NK | 49.7 | 55.8 | 57.2 | 54.25 |
| T ₆ - P-FYM @ 5 t/ha + RDF-NK | 51.2 | 55.2 | 58.6 | 55.03 |
| T ₇ - P-VC @ 1 t/ha + RDF-NK | 50.0 | 54.3 | 55.5 | 53.28 |
| T ₈ - P- BS @ 1.5 t/ha + RDF-NK | 50.5 | 55.2 | 58.0 | 54.60 |
| T ₉ - P- PM @ 1 t/ha + RDF-NK | 51.8 | 56.4 | 59.8 | 56.02 |
| Mean | 49.5 | 54.8 | 56.80 | |
| | S.Em± | | C.D at (5%) | |
| M | 0.179 | | 0.497 | |
| T | 0.230 | | 0.639 | |
| MxT (T at same level of M) | 0.399 | | 1.106 | |
| MxT (M at same or different level of T) | 0.399 | | 1.655 | |

RDF-NK= Recommended dose of nitrogen and potash fertilizer

FYM= Farmyard manure, VC= Vermicompost, BS= Biogas slurry, PM= Poultry manure

M₀= No P- fertilizer, M₁= 50 % recommended dose of P-fertilizer (37.5 Kg P₂O₅/ha),M₂= 100% recommended dose of P-fertilizer (75.0 Kg P₂O₅/ha)

The mean grain yield of maize in no P-fertilizer was 49.51 q/ha and the highest grain yield 56.80 q/ha was obtained due to application of 100 per cent RDF-P. The increase in yield over fertilizer 0, 50 and 100 per cent RDF-P was to the extent of 10.68 and 14.72 per cent, respectively. It is obvious that maize being an exhaustive crop has heavy demand for nutrients and responded significantly to increasing levels of P-fertilizer application (Sharma and Saxena, 1985 and Sureshlal and Mathur, 1989).

significant effect on grain yield of maize, which accounted 27.50 per cent increase in yield over control. Such an increase in grain yield due to combined application of P-enriched organic manures and P-fertilizer is attributed to the fact that the added fertilizers besides meeting the immediate nutrient requirement of the crop in the early growth stages helped in reducing P fixation and increasing microbial activity in soil (Sharma and Saxena, 1985, Madhumita Das *et al.*, 1991, Dudhat *et al.*, 1996 and Sharma *et al.*, 1996).

The combined application of P-enriched organic manure at 100 percent RDF-P had

The uptake of P (Table 2) in P-enriched poultry manure (57.48 kg/ha) was more compared

Effect of Phosphorus.....

Table 2. Effect of P- enriched organic manures at all levels of P-fertilizer on the phosphorus uptake (kg/ha) by maize at harvest

| Treatments | Pooled data for 2 years (1997-98) | | | Mean |
|--|-----------------------------------|----------------|----------------|-------|
| | M ₀ | M ₁ | M ₂ | |
| T ₁ - Control (RDF-NK) | 33.2 | 48.0 | 50.3 | 43.85 |
| T ₂ - FYM @ 5 t/ha + RDF-NK | 36.5 | 53.9 | 55.7 | 48.70 |
| T ₃ - VC@ 2 t/ha + RDF-NK | 34.6 | 50.4 | 52.3 | 45.78 |
| T ₄ - BS @ 3 t/ha + RDF-NK | 35.7 | 51.9 | 53.7 | 47.13 |
| T ₅ - PM @ 2 t/ha+ RDF-NK | 41.7 | 58.1 | 59.2 | 53.03 |
| T ₆ - P-FYM @ 5 t/ha + RDF-NK | 41.4 | 57.9 | 58.2 | 52.52 |
| T ₇ - P-VC @ 1 t/ha + RDF-NK | 37.4 | 53.5 | 53.6 | 48.20 |
| T ₈ - P- BS @ 1.5 t/ha + RDF-NK | 39.1 | 55.1 | 55.3 | 49.85 |
| T ₉ - P- PM @ 1 t/ha + RDF-NK | 46.6 | 61.4 | 64.4 | 57.48 |
| Mean | 38.49 | 54.48 | 55.88 | |
| | S.Em± | | C.D at (5%) | |
| M | 0.120 | | 0.333 | |
| T | 0.149 | | 0.413 | |
| MxT (T at same level of M) | 0.258 | | 0.716 | |
| MxT (M at same or different level of T) | 0.258 | | 1.070 | |

RDF-NK= Recommended dose of nitrogen and potash fertilizer.

FYM= Farmyard manure, VC= Vermicompost, BS= Biogas slurry, PM= Poultry manure

M₀= No P- fertilizer, M₁= 50 % recommended dose of P-fertilizer (37.5 Kg P₂O₅/ha),

M₂= 100% recommended dose of P-fertilizer (75.0 Kg P₂O₅/ha)

to poultry manure (53.03 kg/ha) which may be ascribed to the increase in the availability of phosphorus in the soil (More and Ghonsikar, 1988 and Madhumita Das *et al.*, 1991).

The uptake of P in no P-fertilizer was 38.49 kg/ha and the highest uptake of P (55.88 kg/ha) was noticed due to application of 100 per cent RDF-P. This may be due to the increase in the availability of phosphorus with the levels of P-fertilizer in the soil which leads to more uptake of P by maize (Singh *et al.*, 1981, Sharma and

Saxena, 1985, Singh and Brar, 1985 and Subbareddy *et al.*, 1991).

Application of P-enriched PM alongwith the addition of 100 per cent RDF-P was found to be superior in the uptake of P (64.40 kg/ha) by maize. This may be due to the more availability of this nutrient and the increase in yield due to combined application of various organic manures and levels of P-fertilizer which led to more uptake of P (More and Ghonsikar, 1988, Madhumith Das, 1991 and Dosani *et al.*, 1999).

Dept. of Soil Science and Agril. Chemistry
University of Agricultural Sciences,
Dharwad - 580 005

BASAVARAJ
H.M. MANJUNTHAIAH

(Received: June, 2001)

References

- DOSANI, A.A.K., TALASHILKAR, S.C. AND MEHTA, V.B., 1999, Effect of poultry manure applied in combination with fertilizers on the yield, quality and nutrient uptake of groundnut. *Journal of the Indian Society of Soil Science*, **47**(1): 166-169.
- DUDHAT, M.S., MALAVIA, D.D., MATHUKIA, R.K. AND KHANPARA, V.D., 1996, Effect of organic manures and chemical fertilizers on wheat (*Triticum aestivum* L.) and their residual effect on green gram (*Phaseolus radiatus* L.). *Gujarat Research Journal*, **22**(1): 4-8.
- MADHUMITA DAS, SINGH, B.P., RAM, M., DWIVEDI, B.S. AND PRASAD, R.N., 1991, Effect of phosphorus fertilizer amended organic manures on P-nutrition of crops under mid altitude of Meghalaya. *Annals of Agricultural Research*, **12**: 134-141.
- MORE, S.D. AND GHONSIKAR, C.P., 1988, Effect of some organic manures on the availability of phosphorus to wheat. *Journal of the Indian Society of Soil Science*, **36** :372-374.
- SHARMA, C.M., KAUL, S. AND BHARDWAJ, S.K., 1996, Effect of Udaipur rock phosphate alone and in combination with organics on maize (*Zea mays*) wheat (*Triticum aestivum*) production under acid soil. *Indian Journal of Agronomy*, **41**(3): 505-506.
- SHARMA, J.P. AND SAXENA, S.N., 1985, Utilization of phosphorus by maize as influenced by various sources of organic matter and applied phosphorus. *Journal of the Indian Society of Soil Science*, **33** : 561-567.
- SINGH, N.P., PRASAD, B. AND GOSH, A.B., 1981, Effect of continuous use of fertilizers on yield and nutrient uptake in wheat soybean potato cropping system. *Journal of the Indian Society of Soil Science*, **29**: 537-542.
- SINGH, R.P. AND BRAR, S.P.S., 1985, Effect of organic manures and nitrogen on grain yield and soil properties in a maize-wheat-rotation. *Journal of Research Punjab Agricultural University*, **22**: 243-252.
- SUBBAREDDY, G. VENKATESHWARULU, B., VITTAL, K.P.R. AND SANKAK, G.R., 1991, Effect of different organic material as source of nitrogen and growth and yield of sorghum. *Indian Journal of Agricultural Sciences*, **61**:551-557
- SURESHLAL, S. AND MATHUR, B.S., 1989, Effect of long term fertilization, manuring and liming of an alfisol on maize, wheat and soil properties-1, maize and wheat. *Journal of the Indian society of Soil Science*, **37**: 717-724.