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Effect of Integrated Phosphorus Management on Soil Properties after French Bean (*Phaseolus vulgaris* l.) in Alfisols of Tirupati

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ABSTRACT

A field experiment was conducted in *rabi* , 2006-07 to study the effect of integrated phosphorous management on soil physico-chemical and chemical properties after the final harvest of French bean in Alfisols (*Typic haplustalf*) of Tirupati. The results revealed that the substitution of 20 per cent recommended level of 50 kg P_2O_5 ha^{-1} with poultry manure and vermi compost to French bean along with phosphobacteria significantly improved the organic carbon content, available P, S and cationic micro- nutrients status of soil over other treatments. The pH, EC, N,K ,Ca and Mg status of soil have not significantly differed but a slight improvement was observed.

Key words : French Bean, Soil Properties.

French bean is an important legume vegetable crop in the world, grown both as green vegetable and for seed purpose. Dry beans furnish a large portion of protein needs of low and middle class families. In India it is being cultivated in more than 1.48 lakh hectares with an annual production of 4.2 lakhs metric tonnes ((CMIE, 2004)

In recent years, chemical fertilizers have played significant role in providing nutrients for intensive crop production. Continuous and indiscriminate use of high analysis fertilizers has resulted in several problems such as acidity, alkalinity, micronutrient deficiencies and soil and ground water pollution (Chhonker, 1995). The supplementary and complementary use of organic manures and inorganic chemical fertilizers coupled with biofertilizers (Phosphobacteria) augment the efficiency of both the substances to maintain a high level of soil productivity. Keeping this in view, the present investigation was conducted to evaluate the effect of integrated phosphorus management on soil physico-chemical and chemical properties after French bean(*Phaseolus vulgaris* L.) in Alfisols of Tirupati

MATERIAL AND METHODS

A field experiment was conducted in *rabi* season during 2006-07 on Alfisols (*Typic haplustalf*) at Dryland Farm of Sri Venkateswara Agricultural College, Tirupati. The experimental soil was sandy loam, neutral in soil reaction (pH 7.72), medium in organic C (0.52%), low in alkaline $KMNO_4$ extractable N (225.79 kg ha^{-1}) , medium in available P (23.27 kg ha^{-1}) and NH_4 OAC extractable K 224 kg ha^{-1} and DTPA extractable Fe 29.7 mg kg^{-1}, Mn 14.3 mg kg^{-1}, Zn 2.03 mg kg^{-1} and Cu 5.9 mg kg^{-1}. The experiment was laid out with three replications in a randomized block design with 8 treatments control (RDF) 20-50-50 kg ha^{-1} of N, P_2O_5 and K_2O respectively, RDF + phosphobacteria @ 2.5 kg ha^{-1}, 75% P through RDF + phosphobacteria @ 2.5 kg ha^{-1}, 50% P through RDF + phosphobacteria @ 2.5 kg ha^{-1}, 80% P through RDF + 20% P through poultry manure, 80% P through RDF + 20% P through vermicompost, 80% P through RDF + 20% P though poultry manure + phosphobacteria @ 2.5 kg ha^{-1}, 80% P through RDF + 20% P through vermicompost + phosphobacteria @ 2.5 kg ha^{-1}. The N, P and K were applied as basal in the form of urea, single superphosphate and muriate of potash, respectively. The nitrogen and potash doses were common to all the treatments where as 20% P was substituted with PM, VC. N, P and K contents (%) of the poultry manure and vermicompost were as follows.

Organic manures	N	P	K
Poultry manure	3.0	2.5	1.5
Vermicompost	1.2	1.0	0.5

The organic sources and biofertilizers were applied at the time of field preparation .The locally popular variety of French bean (Selection-9) was sown with inter- and intra-row spacing of 50 x 30 cm and all the recommended cultural practices were followed. The soil samples were collected after final harvest of the crop and analyzed for physico-chemical and chemical properties by following standard methods (Jackson, 1973).

Table 1. Influence of Integrated phosphorus management on physico-chemical and chemical properties of soil after final harvest.

S.No.	Treatments	pH	EC (dsm^{-1})	O.C (%)	Available nutrients					
					Kg ha^{-1}			cmol (p+)kg^{-1}		mg kg^{-1}
					N	P	K	Ca	Mg	S
T_1	RDF (20-50-50 kg ha^{-1} N, P_2O_5, K_2O)	7.68	0.13	0.56	257.15	35.67	227.4	14.07	4.73	12.70
T_2	RDF+Phosphobacteria@2.5kg ha^{-1}	7.69	0.13	0.56	269.70	37.37	227.4	14.10	4.77	12.73
T_3	75% P through RDF+ Phosphobacteria @2.5kg ha^{-1}	7.67	0.13	0.56	250.88	35.98	226.99	14.00	4.73	12.50
T_4	50% P through RDF + Phosphobacteria @2.5kg ha^{-1}	7.68	0.14	0.56	244.61	35.31	226.61	13.97	4.70	12.47
T_5	80%P through RDF +20% P (Poultry manure)	7.66	0.13	0.57	270.30	36.77	227.73	14.17	4.97	12.97
T_6	80%P through RDF +20% P (Vermicompost)	7.69	0.14	0.59	263.55	36.53	227.9	14.13	4.80	12.90
T_7	80% P through RDF +20%P (Poultry manure)+ Phosphobacteria @2.5kg ha^{-1}	7.66	0.13	0.59	270.63	37.77	228.7	14.17	5.03	13.30
T_8	80%P through RDF +20%P (Vermicompost)+ Phosphobacteria @2.5kg ha^{-1}	7.66	0.13	0.59	270.30	37.37	226.61	14.10	4.97	13.00
	SE±	0.04	0.00	0.0	8.8	0.7	0.7	0.08	0.7	0.2
	C.D. 5%	NS	NS	NS	NS	1.53	NS	NS	NS	0.35

Table 2. Influence of integrated phosphorus management on available Fe, Mn, Zn and Cu content of soil after final harvest of French bean

S.No.	Treatments	Iron mg kg^{-1}	Manganese (mg kg^{-1})	Zinc (mg kg^{-1})	Copper (mg kg^{-1})
T_1	RDF (20-50-50 kg ha^{-1} N, P_2O_5, K_2O)	35.60	18.33	3.00	8.73
T_2	RDF+Phosphobacteria @2.5kg ha^{-1}	35.80	18.43	3.10	8.80
T_3	75% P through RDF+ Phosphobacteria @2.5kg ha^{-1}	33.63	18.00	2.80	8.57
T_4	50% P through RDF+ Phosphobacteria @2.5kg ha^{-1}	32.43	17.43	2.50	8.30
T_5	80%P through RDF+20% P (Poultry manure)	36.70	18.63	3.44	9.33
T_6	80%P through RDF +20% P (Vermicompost)	36.63	18.50	3.43	9.13
T_7	80% P through RDF +20%P (Poultry manure)+ Phosphobacteria @2.5kg ha^{-1}	39.03	19.33	3.60	9.83
T_8	80%P through RDF+20%P (Vermicompost) + Phosphobacteria @2.5kg ha^{-1}	36.63	19.00	3.47	9.16
	S.E ±	0.20	0.03	0.00	0.10
	C.D. 5%	0.39	0.08	0.01	0.11

RESULTS AND DISCUSSION

The available N, K, Ca and Mg status of soil did not differ significantly with integrated phosphorus management but there was a slight improvement. The pH, EC and organic carbon content of the soil did not differ significantly due to different nutrient management treatments.

Among the three major nutrients, soil available P increased significantly by the application of 2.5 kg ha^{-1} Phosphobacteria along with the recommended dose of fertilizer. Similar improvement was recorded by the integrated nutrient management by substituting 20% P through vermicompost or poultry manure and adding Phosphobacteria at 2.5 kg ha^{-1}.

Among the secondary nutrients the availability of S in the soil showed significant increase by substituting 20% P with poultry manure or vermicompost and addition of phosphate solubilising bacteria @ 2.5 kg ha^{-1}. The soil fertilized with recommended dose of 20: 40: 50 kg ha^{-1} N, P, K had 12.70 mg kg^{-1} soil S after the harvest of French bean. The availability of this nutrient increased to 13.30 and 13.0 mg kg^{-1} due to the respective integrated nutrient management treatments. Addition of organic fertilizers would supply sulphur to the crops through not only mineralization but also to release the native sulphur by priming effect, enhance the sulphur availability, (Anandswaroop and Ghosh, 1980) (Table1.)

Maximum quantity of 39.03 mg kg^{-1} soil available Fe, 19.33 mg Mn, 3.6 mg Zn and 9.83 mg kg^{-1} Cu was recorded by substituting 20% P through poultry manure and addition of 2.5 kg ha^{-1} phosphate solubilising bacteria. This was a significant improvement over the effect of inorganic fertilizers applied at recommended dose. The highest micronutrient content with the application of poultry manure coupled with biofertilizer might be due to the formation of complexes with micronutrients by the organic compounds present in poultry manure. Further, the complexing properties of poultry manures might have prevented the precipitation and fixation of Fe, Mn, Zn, Cu and kept them slowly in available form. Similar results were also obtained by Prasad *et al.,* 1984. Garg *et al.* (1971) reported that concentration of micronutrients in poultry manure *i.e.,* 60 to 100 ppm Zn, 7 to15 ppm Cu, 380 to 1450 ppm Fe and 120 to 200 ppm Mn. (Table2.)

It is inferred that integrated phosphorus management in French bean crop by substituting 20 per cent of recommended level of 50 P kg ha^{-1} through poultry manure , vermi compost along with phosphobacteria has increased the available nutrient status of field as it was analyzed after the harvest of the of the crop.

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