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RESEARCH ARTICLE :

Effect of phosphorus management through rock phosphate application to preceding crops on growth and yield of groundnut under organic condition

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SUMMARY : Field experiment was carried out during 2014-15 and 2015-16 at Main Agricultural Research Station, UAS, Raichur to study the impact of varied levels of rock phosphate application to preceding sunhemp and bajra crops on growth and yield of groundnut [*Arachis hypogaea* (L.)]. The two years pooled data indicated that significantly higher pod yield of groundnut recorded with soil application of higher levels of rock phosphate at 150 and 200 kg ha^{-1} to preceding sunhemp (1826 and 1859 kg ha^{-1}, respectively) and preceding bajra (1774 and 1810 kg ha^{-1}, respectively) and these treatments were at par with treatment receiving RDF + FYM (1871 kg ha^{-1}) to both bajra and groundnut crops in the system.Number of pods per plant was significantly higher with the treatment of RDF + FYM application to both the crops in bajra-groundnut system and it was at par with treatments receiving rock phosphate @ 150 and 200 kg ha^{-1} to preceding sunhemp.The yield parameters such as number of pods per plant and pod weight per plant were higher with higher levels of rock phosphate application. Significantly higher plant height, number of primary branches per plant, leaf area index and dry matter production were recorded with application of RDF + FYM and it was at par with the application of rock phosphate at 150 and 200 kg ha^{-1} to preceding bajra and sunhemp crops.

KEY WORDS :
Rock phosphate, Sunhemp, Preceding crops

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BACKGROUND AND OBJECTIVES

Groundnut [*Arachis hypogaea* (L.)] is one of the major oil seed crops of India produced in an area of 4.72 million hectare with the production of 4.70 million tonnes. In Karnataka, it ranks 5th in area with 5.90 lakh hactares with a production of 4.0 lakh tonnes and the productivity of 678 kg per hectare (Anonymous, 2014). Of the total area under groundnut in the state as much as 49.2 per cent of the area is cropped under irrigation during *Rabi* / summer seasons mainly in Northern Karnataka. Groundnut seeds contain 40-50 per cent fat, 20-50 per cent protein, and 10-20 per cent carbohydrate apart from some essential minerals and vitamins (Okello *et al*., 2010). Rock phosphate is one of the important sources of phosphorus and soil amendment

that is permitted to use in organic production systems. It is a naturally occurring mineral source of insoluble phosphate and is much less expensive than soluble phosphatic fertilizers. Among the organic nutrient sources that are used in organic production system rock phosphate contains higher quantity of phosphorus. The residual effect of rock phosphate application on succeeding crops is also distinct. Nazeer and Mohammed (2014) reported that application Hazara rock phosphate (HRP) in wheat-maize system produced a significant residual effect on grain and biomass yield of maize. The variations induced by levels of HRP were mostly similar while the residual levels showed better results in terms of yield and yield components for higher doses compared to lower doses in succeeding maize.

RESOURCES AND METHODS

Field experiment was conducted to study theeffect of phosphorus management through rock phosphate application to preceding crops in organic cultivation of groundnut at Main Agricultural Research Station, University of Agricultural Sciences, Raichur, during *Kharif* and *Rabi* seasons of 2014-15 and 2015-16. The soil of the experimental site was sandy clay loam in texture with bulk density of 1.34 g per cc, pH of 7.75 with organic carbon content of 0.43%. The soils were low in available N (272.2 kg/ha) and available P_2O_5 (32.5 kg ha^{-1}) and medium in available K_2O (292.4 kg ha^{-1}). The treatments consisted of four levels of rock phosphate 50, 100, 150 and 200 kg ha^{-1} applied to two preceding crops bajra and sunhemp. The treatment with RDF + FYM applied for bajra and groundnut in the system. Bajra and sunhemp taken during *Kharif* and succeeding groundnut was sown during *Rabi* season. All the organic treatments received recommended dose of nitrogen through compost and vermicompost (50:50). At the time of sowing, recommended dose of fertilizer for bajra 50:25:0 kg N: P_2O_5:K_2O ha^{-1} and for groundnut 25:75:25 kg N: P_2O_5: K_2O ha^{-1} was applied in RDF + FYM treatment and remaining organic treatments received N through Compost and vermicompost (50:50). Mussoorie Rock phosphate along with Phosphate Solubilising Bacteria (PSB) was applied to preceding crops in *Kharif* as per the treatments. The experiment was laid out in RCBD with three replications.

The seeds of groundnut were treated with *Rhizobium* in all the treatments. The preceding bajra (var. ICTP-8203) and sunhemp crops sown during first fortnight of July and second crop groundnut (var. K-9) was sown in the second fort night of December in 30 cm x 10 cm spacing. The plant protection measures were taken with spraying of nimbicidine in organic treatments and in case of RDF treated plots carbendazim and profenophos were used.

The data collected from the experiment were analyzed statistically following the procedure described by Gomez and Gomez (1984). The level of significance used in 'F' and 't' tests was P = 0.05. Critical difference values were calculated wherever the 'F' test was significant.

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

Growth parameters :

The treatments of preceding sunhemp with rock phosphate @ 50, 100,150 and 200 kg ha^{-1} (34.31, 34.40, 35.68 and 36.17 cm, respectively), preceding bajra with rock phosphate @ 150 and 200 kg ha^{-1} (34.63 and 34.96 cm) and RDF + FYM to bajra and groundnut crops in the system (37.38 cm) were found at par with each other and recorded significantly higher plant height over rock phosphate application @ 50 and 100 kg ha^{-1} to preceding bajra crop (28.07 and 32.01 cm).

Significantly higher number of primary branches per plant was recorded with treatment supplied with RDF + FYM to both crops in bajra-groundnut system (7.57) and which inturn was at par with all other treatments except the treatments of rock phosphate @ 50 and 100 kg ha^{-1} to preceding sunhemp (6.48 and 6.71) and rock phosphate @ 100 kg ha^{-1} to preceding bajra (6.29). Application of rock phosphate @ 50 kg ha^{-1} to preceding bajra recorded significantly lower number of primary branches per plant (5.23).

Application of RDF + FYM to both bajra and groundnut crops in the system recorded significantly higher leaf area index (2.63) as compared to other treatments except treatments supplied with rock phosphate @ 150 and 200 kg ha^{-1} to preceding sunhemp (2.48 and 2.58) and rock phosphate @ 200 kg ha^{-1} to preceding bajra crop (2.41). While significantly lower leaf area index per plant was recorded with application

of rock phosphate @ 50 kg ha^{-1} to preceding bajra (1.89).

Higher values of dry matter production per plant were observed with the application of RDF + FYM to both bajra and groundnut crops in the system (36.57 g plant^{-1}) compared to all other treatments. The next best treatments were application of rock phosphate @ 150 kg ha^{-1} (33.62 g plant^{-1}) and 200 kg ha^{-1} (34.29 g plant^{-1}) to preceding sunhemp and rock phosphate @ 200 kg ha^{-1} to the preceding bajra (33.23 g plant^{-1}). Significantly lower dry matter production per plant was recorded with treatment of rock phosphate @ 50 kg ha^{-1} to the preceding bajra (29.98 g plant^{-1}) (Table 2). Higher dose of rock phosphate with PSB applied along with compost might have resulted in higher availability of P due to better mineralization of nutrients. This better availability and uptake of P by groundnut increased growth parameters. It also enhanced plant vigour in terms of increased leaf area and greater accumulation of photosynthates in the plants.

Yield parameters :

Application of varied levels of rock phosphate with PSB to preceding bajra andsunhemp crops had significant influenceon yield and yield attributes of succeeding groundnut such as number of pods per plant, pod weight per plant, pod yield and haulm yield (Table 2).

The number of pods per plant was significantly higher with the application of RDF + FYM to both bajra and groundnut in the system as compared to rest of the treatments except preceding sunhemp with rock phosphate @ 150 kg ha^{-1} (26.95) and 200 kg ha^{-1} (27.31) which were at par with each other. Significantly lower number of pods per plant was obtained with rock phosphate application @ 50 kg ha^{-1} (22.53) to preceding

Table 1 : Growth parameters of groundnut at harvest as influenced by phosphorus management through levels of rock phosphate to preceding crops (Pooled data 2014-15 and 2015-16)

Treatments	Plant height (cm)	No. of primary branches plant^{-1}	Leaf area index (at 90 DAS)	Dry matter (g plant^{-1})
T_1: RP @ 50 kg ha^{-1} to preceding sunhemp	34.31	6.48	2.08	29.98
T_2: RP @ 100 kg ha^{-1} to preceding sunhemp	34.40	6.71	2.15	30.64
T_3: RP @ 150 kg ha^{-1} to preceding sunhemp	35.68	7.25	2.48	33.62
T_4: RP @ 200 kg ha^{-1} to preceding sunhemp	36.17	7.30	2.58	34.29
T_5: RP @ 50 kg ha^{-1} to preceding bajra	28.07	5.23	1.89	27.61
T_6: RP @ 100 kg ha^{-1} to preceding bajra	32.01	6.29	2.09	28.87
T_7: RP @ 150 kg ha^{-1} to preceding bajra	34.63	7.08	2.31	31.93
T_8: RP @ 200 kg ha^{-1} to preceding bajra	34.96	7.12	2.41	33.23
T_9: RDF + FYM	37.38	7.57	2.63	36.57
S. E.±	1.57	0.25	0.08	0.76
C.D. (P=0.05)	4.71	0.75	0.24	2.27

Table 2 : Yield attributes and yield of groundnut as influenced by phosphorus management through levels of rock phosphate to preceding crops (Pooled data 2014-15 and 2015-16)

Treatments	Number pods plant^{-1}	Pod weight (g plant^{-1})	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})
T_1: RP @ 50 kg ha^{-1} to preceding sunhemp	23.70	18.15	1495	2036
T_2: RP @ 100 kg ha^{-1} to preceding sunhemp	23.95	18.30	1545	2080
T_3: RP @ 150 kg ha^{-1} to preceding sunhemp	26.95	20.32	1826	2409
T_4: RP @ 200 kg ha^{-1} to preceding sunhemp	27.31	21.27	1859	2457
T_5: RP @ 50 kg ha^{-1} to preceding bajra	22.53	17.60	1459	1940
T_6: RP @ 100 kg ha^{-1} to preceding bajra	22.86	17.85	1464	1992
T_7: RP @ 150 kg ha^{-1} to preceding bajra	24.57	18.67	1774	2313
T_8: RP @ 200 kg ha^{-1} to preceding bajra	25.02	19.52	1810	2408
T_9: RDF + FYM	27.75	22.79	1871	2514
S.E.±	0.76	0.73	52.5	86.8
C.D. (P=0.05)	2.26	2.20	157.3	260.4

bajra compared to rock phosphate application @ 50 kg ha^{-1} (23.7) and 100 kg ha^{-1} (23.95) to preceding sunhemp and RDF + FYM to both bajra and groundnut crops in the system (27.75).

Significantly higher pod weight was recorded with the application of RDF + FYM to both bajra and groundnut crops in the system (22.79 g $plant^{-1}$) and also with rock phosphate @ 200 kg ha^{-1} to preceding sunhemp (21.27 g $plant^{-1}$) over rest of the treatments. Significantly lower pod weight was recorded with rock phosphate application @ 50 kg ha^{-1} (17.60 g $plant^{-1}$) to preceding bajra. These increased yield attributes with higher level of rock phosphate applied to preceding sunhemp and bajra crops be attributed to the increased availability of Phosphorus which might also favoured the symbiotic N_2 fixation and in turn stimulated the growth of plants thereby having positive effects on yield attributes. These results are also in accordance with the findings of Alagawadi and Gaur (1988); Patil *et al*. (2012) and Nazeer and Muhammed (2014).

The data also indicated that application of RDF + FYM to both bajra and groundnut crops in the system recorded significantly higher pod yield (1871 kg ha^{-1}) over all other treatments except the treatments which received rock phosphate @ 150 and 200 kg ha^{-1} to preceding sunhemp (1859 and 1826 kg ha^{-1}) and bajra (1774 and 1810 kg ha^{-1}) crops, which inturn were at par with each other. Significantly lower pod yield was recorded in treatment receiving preceding bajra crop with rock phosphate @ 50 kg ha^{-1} (1459 and kg ha^{-1}) and it was at par with treatment of preceding crop of bajra with 100 kg rock phosphate ha^{-1} (1446 kg ha^{-1}) and sunhemp with rock phosphate @ 50 kg ha^{-1} (T_1) (1495 kg ha^{-1}) and 100 kg ha^{-1} (1545 kg ha^{-1}) application. Diatta *et al*. (2002) and Samant *et al*. (2008) also observed higher and at par yields with residual effect of rock phosphate application at higher levels in succeeding rice and groundnut crops when compared to highly water soluble fertilizer (DAP).

Application of RDF + FYM to both bajra and groundnut crops in the system recorded significantly higher haulm yield (2514 kg ha^{-1}) as compared totreatments receiving preceding bajra crop with 50 kg (2036 kg ha^{-1}) and 100 kg (2080 kg ha^{-1}) rock phosphate ha^{-1} but was found at par with rest of the treatments. Significantly lower haulm yield was recorded with the treatment of preceding bajra with 50 kg rock phosphate application ha^{-1} (1940 kg ha^{-1}) which was at par with treatments which received 50 kg (1495 kg ha^{-1}) and 100 kg (1545 kg ha^{-1}) rock phosphate ha^{-1} to preceding sunhemp and 100 kg rock phosphate to preceding bajra (1464 kg ha^{-1}). These results were in conformity with the findings of Patil *et al*. (2012) where they found higher seed yield of chickpea with higher levels of rock phosphate application along with organic manures. Several workers also reported the increase in crop yield on residual effects with the application of higher levels of rock phosphate in succeeding crops (Reza *et al.*, 2012; Ali *et al*., 2014 and Nazeer and Muhammed, 2014).

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REFERENCES

Alagawadi, A.R. and Gaur, A.C. (1988). Associative effect of rhizobium and phosphate solubilizing bacteria on the yield and nutrient uptake of chickpea. *Plant Soil,* **105** : 241-246.

Ali, A., Sharif, M., Fazli, W., Zengqiang, Z., Shah, S. H. M., Rafiullah, Zahee, S., Khan, F. and Rehman, F. (2014). Effect of composted rock phosphate with organic materials on yield and phosphorus uptake of berseem and maize. *American J. Plant Sci*., **5** : 975-984.

Anonymous (2014). Agricultural statistics at a glance, Government of India, Ministry of Agriculture, Department of Agriculture and Cooperation, Directorate of Economics and Statistics. p. 63.

Diatta, S., Kotchi, V. and Sahrawat K. L. (2002). Direct and residual effect of rock phosphate from Mali on upland rice grown on acid soil of the Humid Forest Zone in Côte D'Ivoire. 12th ISCO Conference, Beijing. pp. 471-476.

Gomez, K.A. and Gomez, A.A. (1984). *Statistical Procedure for Agricultural Research*, An International Rice Research Institute Book, A Wiley – Inter Science, John Wily and Sons Inc., New York, United States of America.

Nazeer, M. and Muhammad, D. (2014). Direct and residual effect of hazara rock phosphate (HRP) on wheat and succeeding maize in alkaline calcareous soils. *Pak. J. Bot*., **46**(5): 1755-1761.

Okello, D.K., Biruma, M. and. Deom, C.M. (2010). Overview of groundnuts research in Uganda: Past, present and future. *African J. Biotechnol.*, **9**(39) : 6448-6459.

Patil, S.V., Halikatti, S.I., Gurumurthy, S.B. and Lokesh, M.S. (2012). Influence of integrated organic nutrient management practices on quality parameters of chickpea grown in *vertisol*

of northern dry zone of Karnataka. *Internat. J. Forestry & Crop Improvement.*, **3**(1): 8-12

Reza, S.K., Pal, S. and Singh, S. (2012). Rock Phosphate-enriched pressmud compost: direct effect in pearl millet (*Pennisetum glaucum* L.) and residual effect in mustard (*Brassica juncea*) in a Typic Haplustept. *J. Indian Soc. Soil Sci.*, **60**(2): 138-144.

Samant, P. K., Swain, S.K., Senapati, H.K. and Sahu, S.K. (2008). Long-term effect of phosphate rocks for rice-groundnut cropping system. *Asian J. Soil Sci.*, **3**(2): 289-292.