International Journal of Environment, Agriculture and Biotechnology
Vol-9, Issue-5; Sep-Oct, 2024
Peer-Reviewed International Journal
Journal Home Page Available: https://ijeab.com/
Journal DOI: 10.22161/ijeab

Effect of Different Sources of Phosphorus on Nutrient Content and Uptake by Chickpea (*Cicer arietinum* L.)

Suraj Kumar[1*], R.H. Meena[1], D.P. Singh[1], Vinod Saharan[2], Hemant Swami[3]

[1]Department of Soil Science and Agricultural Chemistry RCA, MPUAT, Udaipur, Rajasthan
[2]Department of Molecular Biology and Biotechnology, RCA, MPUAT, Udaipur, Rajasthan
[3]Department of Entomology, RCA, MPUAT, Udaipur, Rajasthan
*Corresponding Author Email: surajbishnoi199@gmail.com

Received: 29 Aug 2024; Received in revised form: 27 Sep 2024; Accepted: 03 Oct 2024; Available online: 11 Oct 2024

Abstract— *A field experiment entitled "Effect of Different Sources of Phosphorus on Productivity of Chickpea (Cicer arietinum L.) and Soil Properties" was conducted during Rabi season of 2023-24 at Instructional Farm, Rajasthan College of Agriculture, Udaipur (Rajasthan). The experiment included nine phosphorus sources treatments (SSP, RP with and without PSB). The experiment was set up in a randomized block design with three replications. Application of 75% RDP through SSP +25% RDP through RP + PSB (T_7) significantly increased nutrient content and uptake (N, P and K) by chickpea (Cicer arietinum L.) and recorded highest nutrient content and uptake over control.*

Keywords— ***Single Super Phosphate, Rock Phosphate, Phosphorus Solubilizing Bacteria, Nutrient Content, Nutrient Uptake, Chickpea***

I. INTRODUCTION

Pulses play an important role in developing countries to provide nutritional security as a major source of protein in vegetarian diets. In India, the pulses have been called as "poor man's meat and rich man's vegetable". In addition to protein, pulses contain a good amount of essential amino acids, vitamins, dietary fibers and minerals required by human beings. It also has unique property of maintaining and restoring the soil fertility through biological nitrogen fixation as well as conserving and improving the physical properties of soil by virtue of their nodulated root system and leaf fall. hickpea is a good source of carbohydrates and proteins, which together constitute about 80% of the total dry seed mass. The starch content of chickpea cultivars has been reported to vary from 41% to 50% and kabuli type contains more soluble sugars (Jambunathan and Singh, 1980). The unavailable carbohydrate content is higher in chickpea than other legumes (Kamath and Belavady, 1980) and chickpea carbohydrate has a lower digestibility than that of other pulses (Rao, 1969). The crude protein content of chickpea varies from 12.4 to 31.5%. PSB is capable to solubilize the fixed soil phosphorus (Singh et al, 2008). The use of organic and inorganic amendments with microbial inoculation is considered to be the best possible eco-friendly option (Shahzad, et al., 2017). In general increase in uptake of total potassium due to addition of rock phosphate along with PSB might be due to increased availability of nutrients from rock phosphate blend with manures especially phosphorus would have enhanced root proliferation which helped in more uptake of potassium. The higher K uptake in wheat by the application of Phosphate solubilizers and organic amendments with rock phosphate was also reported by Saurabh, (2012).

Chemical fertilizers are highly expensive these days, therefore effective nutrient management not only helps to increase current agricultural output levels, but also to sustain production and protect the environment from all types of risks caused by improper fertilizer management. Chemical fertilizers combined with organic sources resulted in higher N, P, and K concentrations as well as chickpea uptake (Deshpande et al., 2015). Organic Manures are an excellent source of nutrients for microorganism growth and development.

Table-1: Effect of different sources of phosphorus on nutrient (N, P, K) content (%) by chickpea

Treatments			Nitrogen Content		Phosphorus Content		Potassium content	
			Grain	Haulm	Grain	Haulm	Grain	**Haulm**
T_1	:	Control	2.110	0.500	0.310	0.120	0.480	**1.400**
T_2	:	100% RDP through SSP	2.840	0.590	0.440	0.197	0.560	**1.800**
T_3	:	75% RDP through SSP+PSB	2.757	0.588	0.430	0.187	0.560	**1.767**
T_4	:	50% RDP through SSP+PSB	2.440	0.533	0.360	0.160	0.500	**1.570**
T_5	:	100% RDP through SSP+PSB	3.600	0.770	0.460	0.240	0.730	**2.493**
T_6	:	75% RDP through SSP+25% RDP through RP	3.410	0.660	0.450	0.223	0.630	**2.330**
T_7	:	75% RDP through SSP +25%RDP through RP + PSB	3.670	0.800	0.490	0.253	0.763	**2.580**
T_8	:	50% RDP through SSP+50% RDP through RP	3.377	0.650	0.450	0.206	0.620	**2.210**
T_9	:	50% RDP through SSP + 50% RDP through RP + PSB	3.610	0.783	0.477	0.240	0.733	**2.503**
SEm±			0.046	0.013	0.015	0.005	0.015	**0.046**
CD (at 5 %)								

II. MATERIALS AND METHODS

The field experiment conducted during rabi season of 2023-24 at the Instructional Farm, Rajasthan College of Agriculture, Udaipur. which is located at an elevation of 579.5 m above mean sea level at 24o 35' latitude and 74o 42' longitude. The region is a part of Rajasthan's agro-climatic zone IV-a (Sub-Humid Southern Plain and Arawali Hills).

Table 2: Effect of different sources of phosphorus on nutrient uptake (kg ha^{-1}) by chickpea

Treatments			Nitrogen uptake		Phosphorus uptake		Potassium uptake	
			Grain	Haulm	Grain	Haulm	Grain	**Haulm**
T_1	:	Control	2.110	0.500	0.310	0.120	0.480	**1.400**
T_2	:	100% RDP through SSP	2.840	0.590	0.440	0.197	0.560	**1.800**
T_3	:	75% RDP through SSP+PSB	2.757	0.588	0.430	0.187	0.560	**1.767**
T_4	:	50% RDP through SSP+PSB	2.440	0.533	0.360	0.160	0.500	**1.570**
T_5	:	100% RDP through SSP+PSB	3.600	0.770	0.460	0.240	0.730	**2.493**
T_6	:	75% RDP through SSP+25% RDP through RP	3.410	0.660	0.450	0.223	0.630	**2.330**
T_7	:	75% RDP through SSP +25%RDP through RP + PSB	3.670	0.800	0.490	0.253	0.763	**2.580**
T_8	:	50% RDP through SSP+50% RDP through RP	3.377	0.650	0.450	0.206	0.620	**2.210**
T_9	:	50% RDP through SSP + 50% RDP through RP + PSB	3.610	0.783	0.477	0.240	0.733	**2.503**
SEm±			0.046	0.013	0.015	0.005	0.015	**0.046**
CD (at 5 %)			**0.138**	**0.040**	**0.044**	**0.014**	**0.044**	**0.137**

The soil of site was slightly alkaline, loamy structure, medium in available nitrogen, phosphorus and potassium. The experiment comprised 9 treatments to find out the effect of various sources of phosphorus on productivity of chickpea and the experiment was laid out in a RBD with three replications. GNG-2144 var. was used for the experiment as a test crop. Single super phosphate, Rock phosphate and PSB was used as various sources of phosphorus. The concentration of nutrient was determined by the following methods, N colorimetric method for nitrogen (Snell and Snell, 1949), P by vanodomolybdo phosphoric acid yellow colour method for phosphorus (Jackson, 1973) and potassium determined by Flame photometer method (Jackson, 1973). The nutrient uptake calculated by multiplying the concentration of nutrients to the yield of field crop.

III. RESULTS AND DISCUSSION

The results of this experiment showed that application of 75% RDP through SSP +25%RDP through RP + PSB (T_7) significantly enhanced the nutrient content and uptake by chickpea over control. Nutrient content and uptake are the most important parameters to increase the capacity of soil to provide nutrients to plant and increase the yield parameters. The maximum total nitrogen, phosphorus and potassium uptake were noted in the with application of 75% RDP through SSP + 25% RDP through RP + PSB (T_7). This might be due to increased microbial activity in rock that has led to increase in the total N uptake by chick pea. Beneficial microbes like P solubilizers and N fixers in the organic matter as well as added PSB induced solubilization of rock phosphate in presence of organic matter and helped in N fixation. The higher N uptake in wheat by the application of PSB and organic amendments with rock phosphate was also reported by Saurabh, (2012).

The results showed that application of rock phosphate amendment along with seed inoculations with PSB had promising positive effects on the seed and haulm yield of chickpea crop as compared with to control treatment. Rhizosphere colonization by microbial inoculants has been described as a crucial factor for plant growth promotion was observed by Lugtenberg, (2001).

The increased nitrogen, phosphorus and potassium content in seed and haulm might be due to improving available nutrients particularly within the rhizosphere. The use of organic and inorganic amendments with microbial inoculation is considered to be the best possible eco-friendly option (Shahzad, et al., 2017). PSB biofertilizer also increase water uptake capacity. PSB inoculation convert the insoluble phosphorus in to soluble form by secreting organic acids (lactic, lectiolic, acetic and formic acid) (Gangwar and Dubey, 2012).

IV. CONCLUSION

On the basis of experimental results, it was concluded that application of 75% RDP through SSP +25% RDP through RP + PSB had significant effect with respect to N, P, K content and uptake. It means the combination of SSP, RP and PSB improves the nutrient concentration and uptake by plants (N, P, K). Seed treatment by PSB increase the solubility of rock phosphate and help the plant to absorb phosphorus and other macronutrients. This experiment also reveals that the combine application of SSP, RP and PSB enhanced the overall availability of macronutrients to the plant.

REFERENCES

[1] Deshpande, A.N., Dalavi, S.S., Pandey, S.H., Bhalerao, V.P. and Gosavi, A.B. 2015. Effect of rock phosphate along with organic manures on soil properties, yield and nutrient uptake by wheat and chickpea. *Journal of the Indian Society of Soil Science*, **63**: 93-99.

[2] Gangwar, S. and Dubey, M. (2012) Chickpea (Cicer arietinum L.) root nodulation and yield as affected by micronutrients application and Rhizobium inoculation. *Crop Research*. **44**: 37-41.

[3] Vidhauliya, Y., Singh, B., Kumar, A., 2024. Enhancement of Nutritional Value of Fermented Buttermilk using Vitamin A and D. IJHAF. https://doi.org/10.22161/ijhaf.8.2.4

[4] Jackson, M.L. 1973. Soil Chemical Analysis. Prentice Hall of India Pvt. Ltd., New Delhi, 263-393.

[5] Piccoli, A.P., 2024. Reproductive phenology and environmental temperatures in the Smooth Newt Lissotriton vulgaris meridionalis (Boulenger, 1882), (Amphibia, Urodela) in a Mediterranean habitat. IJEAB. https://doi.org/10.22161/ijeab.91.1

[6] Jambunathan, R. and Singh, U. 1980. Studies on desi and kabuli chickpea (*Cicer arietinum* L.) cultivars Chemical composition. In Proceedings of the International Workshop on Chickpea Improvement, 285 3 Feb - 2 Mar 1979, ICRISAT, Hyderabad, India. International *Crops Research Institute for the Semi-Arid Tropics*, **9**:61-66

[7] Nyanyoh, B.B., Wanie, C.M., 2024. Categorisation of Rural Development Stakeholders in Bui Division, North West Region of Cameroon. IJREH. https://doi.org/10.22161/ijreh.8.2.5

[8] Kamath, M.V. and Belavady, B. 1980. Unavailable carbohydrates of commonly consumed Indian foods. *Journal of the Science of Food and Agriculture*, **31**:194-202.

[9] Lugtenberg B. J. J., Dekkers, L., Bloemberg, G. V. 2001. Molecular determinants of rhizosphere colonization by Pseudomonas. *Annual Review Phytopathology*, **3**: 461–490.

[10] Rao, P.S. 1969. Studies on the digestibility of carbohydrate

in pulses. *Indian Journal of Medical Research*, **57**:2151-2157.

[11] Saurabh P. 2012. Effect of rock phosphate with organic manures on nutrient uptake and yield of wheat. M.Sc. (Ag.), Thesis, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra.

[12] Shahzad, S.M., Arifm, M.S., Riaz, M., Ashraf, M., Yasmeen, T., Zaheer, A., Bragazza, L., Buttler, A. and Robroek, B.J.M. 2017. Interaction of compost additives with phosphate solubilizing rhizobacteria improved maize production and soil biochemical properties under dryland agriculture. *Soil and Tillage Research*, **174**:70–80.

[13] Singh, R.P., Gupta, S.C. and Yadav, A.S. 2008. Effect of levels and sources of phosphorus and PSB on growth and yield of blackgram (*Vigna mungo* L.). *Legume Research*, **31**: 139-141.

[14] Snell, F.D. and Snell, C.P. 1949. Colorimetric Methods of Analysis. 3rd Ed. Vol. 2nd. D. Van Nostrand Inc. New York.