E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; SP-7(8): 29-31
Received: 11-06-2024
Accepted: 20-07-2024

Pushpalata
M.Sc. Scholar,
Department of Agronomy, School of Agriculture Science, Technology & Research, Sardar Patel Agriculture University, Balaghat, Madhya Pradesh, India

JS Bisen
Associate Professor,
Department of Agronomy, School of Agriculture Science, Technology & Research, Sardar Patel Agriculture University, Balaghat, Madhya Pradesh, India

Navneet Satankar
Director, School of Agriculture Science, Technology & Research, Sardar Patel Agriculture University, Balaghat, Madhya Pradesh, India

Devendra Turkar
Assistant Professor,
Department of Agronomy, School of Agriculture Science, Technology & Research, Sardar Patel Agriculture University, Balaghat, Madhya Pradesh, India

Corresponding Author:
Pushpalata
M.Sc. Scholar,
Department of Agronomy, School of Agriculture Science, Technology & Research, Sardar Patel Agriculture University, Balaghat, Madhya Pradesh, India

Response of different levels of phosphorus on growth and yield of chickpea (*Cicer arietinum* L.)

Pushpalata, JS Bisen, Navneet Satankar and Devendra Turkar

DOI: https://doi.org/10.33545/2618060X.2024.v7.i8Sa.1219

Abstract
The study titled "Response of different levels of Phosphorus on growth and yield of Chickpea (*Cicer arietinum* L.)" was designed with the objective to evaluate different levels of phosphorus on the growth and yield of chickpeas effectively. The experiment was conducted at the student research farm, department of Agronomy, School of Agriculture Science, Technology and Research, Sardar Patel University, Balaghat (M.P.) during the *rabi* season of the year 2021-22. A set of seven treatments *viz*., T_1-Phosphorus @ 0 kg/ha, T_2-Phosphorus @ 15 kg/ha, T_3-Phosphorus @ 25 kg/ha, T_4-Phosphorus @ 35 kg/ha, T_5-Phosphorus @ 45 kg/ha, T_6-Phosphorus @ 55 kg/ha and T_7- Phosphorus @ 65 kg/ha were tested in randomized block design with 3 replications. Chickpea (*var.* AKG1109) was sown at 30.0 cm x 10.0 cm row-to-row and plant-to-plant spacing on October, 25^{th} 2021. All the fertilizers and nutrients were applied as per the treatments. Based upon this experiment it is concluded that application of phosphorus @ 65 kg/ha recorded the maximum and significantly higher grain yield of chickpea (18.89 q/ha), gross monetary returns (₹ 96654.00 Rs/ha), net monetary returns (₹ 73406.00 Rs/ha) and highest B: C ratio of 3.16: 1. Hence, it can be concluded that application of phosphorus @ 65 kg/ha obtained B: C ratio >3.0, can be used as a remunerative strategy.

Keywords: Phosphorus levels, chickpea (*Cicer arietinum* L.), growth and yield

Introduction

Chickpea (*Cicer arietinum* L.) is a self-pollinated crop having Chromosome number 2n=14 belonging to the Family-Leguminosae. Pulses occupy a unique position in every known system of farming. They are an integral part of the Indian dietary system due to their richness in protein and other important nutrients such as Calcium, Iron and Vitamins viz., carotene, thiamine, riboflavin and niacin. Indian population is predominantly vegetarian and protein requirement for the growth and development of human beings is mostly met with pulses. These pulses are said to be poor man's meat and rich man's vegetables. The daily per capita availability of pulses has decreased from 60 g during the sixties to the present level of less than 40 g against the recommendation of 90 g per day as per WHO, Geneva.

Pulses are known to improve soil fertility because of their ability to fix up atmospheric nitrogen through symbiotic nitrogen fixation with the help of bacterium called Rhizobia. Thus, every pulse plant is a mini-fertilizer factory itself and enhances the soil fertility also (Dotaniya *et al.*, 2014) [3]. Pulses can maintain the soil fertility through nitrogen fixation, release of soil-bound phosphorus, thus contribute significantly to the sustainability of the farming systems.

Nutrient management especially phosphorus application in legumes assume a significant role in increasing the productivity. Low soil fertility, particularly phosphorus deficiency is one of the major constraints to increase chickpea productivity (Rao *et al.*, 2003) [4]. Among the macro nutrients, phosphorus application contributes immensely for increasing the yield of pulses. Phosphorus plays primary role in many of the physiological processes such as the utilization of sugar and starch, photosynthesis, energy storage and transfer. Legumes generally have higher phosphorus requirement because the process of symbiotic nitrogen fixation consumes a lot of energy. Phosphorus is fascinating plant nutrient as it involved a wide range of plant processes from permitting cell division to the development of a good root system ensuring timely and uniform ripening of crop. It is needed by most by young, fast-growing tissues and performs several functions related to development and growth. it is a constituent of ADP and ATP, two of the most important substances in life processes. Among the nutrients, phosphorus deficiency is considered to be major cause for low pulse yield in this state and responses to phosphorus application by the chickpea crop have been obtained.

Phosphate fertilization of chickpea promotes growth, nodulation and enhances yield. It imparts hardiness to shoots, improves grain quality, regulates the photosynthesis, governs other physio-biochemical processes and also helps in rooten largement, nodule production and there by increases nitrogen fixation. Recent research results revealed that there is a good response of chickpea to phosphorus fertilizer applications (Mehar Singh *et al.*, 2000) [5].

Materials and Methods

The study titled "Response of different levels of Phosphorus on growth and yield of Chickpea (*Cicer arietinum* L.)" was designed with the objective to evaluate different levels of phosphorus on the growth and yield of chickpeas effectively. The experiment was conducted at the student research farm, department of Agronomy, School of Agriculture Science, Technology and Research, Sardar Patel University, Balaghat (M.P.) during the *rabi* season of year 2021-22. A set of seven treatments *viz*., T_1-Phosphorus @ 0 kg/ha, T_2-Phosphorus @ 15 kg/ha, T_3-Phosphorus @ 25 kg/ha, T_4-Phosphorus @ 35 kg/ha, T_5-Phosphorus @ 45 kg/ha, T_6-Phosphorus @ 55 kg/ha and T_7-Phosphorus @ 65 kg/ha were tested in randomized block design with 3 replications. Chickpea (var. AKG1109) was sown at 30.0 cm x 10.0 cm row to-row and plant to plant spacing in October, 25^{th} 2021. All the fertilizers and nutrients were applied as per the treatments. The full recommended dose of nitrogen and potassium at the rate of 20 kg/ha and 40 kg/ha, respectively was uniformly applied to each plot. Phosphorus was applied as per treatment. Full dose of nitrogen, phosphorus and potassium was applied as basal dose at the time of sowing. Fertilizers were applied by placement i.e., 5 cm away from seed row and 5 cm below the seed zone. The various ancillary observations on growth of crop were periodically recorded along with post-harvest studies to evaluate treatment effects. Other agronomic practices were performed in all the treatments as per recommended package of practices.

Results and Discussion

The overall improvement in crop growth of chickpea under the influence of recommended dose of NPK application could be attributed to better environment for growth and development that might be due to increased availability of nitrogen to the growing plants. Further, addition of phosphatic fertilizers in the soil increases the concentration of readily available H_2PO^- ions in the rhizosphere. The increased availability of phosphorus to plants might have enhanced early root growth and cell multiplication leading to more absorption of other nutrients from deeper layers of soil ultimately resulting in increased plant growth in terms of plant height, number of branches per plant, number of root nodules per plant and dry matter production.

The significant variations in plant height among the various treatments may be due to the fact that phosphorus application improved the root system through accelerating various. Metabolic processes such, as cell division, cell development and cell enlargement in roots. The increase in plant height and number of branches per plant was also reported by Jaiveer *et al.* (2017) [6] and Prajapati *et al*. (2017) [7].

The significantly highest plant height of chickpea was recorded under the application of phosphorus @ 65 kg/ha with the respective values of 9.22, 14.27, 23.80 and 31.80 cm at the 15, 30, 45 and 60 DAS, respectively proved significantly superior to rest of the treatments.

Increasing the number of branches might be due to the fact that phosphorus application improved the root system through accelerating various metabolic processes such as cell division, cell development and cell enlargement in roots. The increase in plant height and number of branches and root nodules per plant was also reported by Pingoliya *et al*. (2014) [8], Vikram *et al*. (2018) [9], Laharia *et al*. (2019) [10] and Kumawat *et al*. (2020) [11].

The significantly maximum number of branches per plant of chickpea was recorded under the application of phosphorus @ 65 kg/ha with the respective values of 2.33, 4.47, 6.07 and 7.93 at the 15, 30, 45 and 60 DAS, respectively proved significantly superior to rest of the treatments.

Application of phosphorus improved the nutrient availability status, resulting into grater removal which might have increased the photosynthesis and then translocated the synthase to different parts for promoting meristematic development in potential apical buds and intercalary meristems and hence increased growth parameters of the crop. These results corroborated the findings.

The overall trends evidently indicate that the progressive increase in root length among the treatment was inconsistent. Secondly, there were significant variations in root length at every stage of observations. Significant variation was observed in the root length of the chickpea when the field was fertilized with different doses of phosphorus. Among the different doses of phosphorus @ 65 kg P_2O_5/ha showed the highest root length at every growth stages. On the other hand, the lowest root length was observed in the P0 treatment without phosphorus was applied @ 0 kg/ha.

The maximum grain yield per plant as well as per hectare with optimum phosphorus rates was attributable to better nodulation and efficient functioning of nodule bacteria for fixation of nitrogen to be utilized by plants during seed development stage in the synthesis of protein which in turn led to increase in seed yield. These results confirm the earlier findings of Satybhan Singh (2017) [2], Rajneesh *et al*. (2018) [1] and Kumawat *et al*. (2020) [11].

The significantly highest grain yield per plot of chickpea was recorded under the application of phosphorus @ 65 kg/ha with the respective value of 2.27 kg proved significantly superior to rest of the treatments.

The significantly highest Stover yield per hectare of chickpea was recorded under the application of phosphorus @ 65 kg/ha with the respective value of 22.10 q/ha proved significantly superior to rest of the treatments.

Application of phosphorus @ 65 kg/ha recorded the maximum gross monetary, net monetary retur ns as well as B:C ratio proved significantly superior to rest of the treatments. The significantly higher net return was found under this treatment was possibly due to proportionately larger increase in grain and straw yield which contributed to higher gross returns/ha.

The significantly higher net monetary return was found under this treatment was possibly due to proportionately larger increase in grain and straw as compared to the cost involved which contributed to higher net monetary returns/ha. The significantly higher B:C ratio was found under this treatment was possibly due to proportionately highest net return as compared to the cost involved which contributed to B:C ratio. Similar result was also observed by Ramesh *et al*. (2010) [12], Raghvendra *et al*. (2018) [13], Vikram *et al*. (2018) [9] and Kumawat *et al*. (2020) [11].

Table 1: Response of different levels of phosphorus growth and yield of chickpea (*Cicer arietinum* L.)

Treatments	Plant height (cm)	Numbers of branches/plants	Number of pods/plant	Number of Grains/pod	Grain yield/hectare (q/ha)	Stover yield/hectare (q/ha)	Protein content (%)	Harvest index (%)	B: C ratio
T1	21.34	4.40	25.60	1.13	9.47	15.20	18.00	38.43	1.35
T2	22.85	5.00	26.07	1.27	11.78	16.06	18.37	42.22	1.83
T3	25.65	5.60	27.13	1.33	13.14	18.14	19.84	41.64	2.11
T4	26.32	6.13	27.87	1.40	13.78	21.29	20.05	39.25	2.21
T5	27.06	6.40	28.60	1.80	17.64	21.32	20.48	45.28	3.02
T6	28.42	6.87	30.27	2.07	18.14	21.74	22.04	45.44	3.06
T7	31.80	7.93	33.73	2.20	18.89	22.10	22.51	46.02	3.16
S.Em. ±	0.72	0.29	0.84	0.22	1.00	0.55	0.23	1.77	0.23
C.D. 5%	2.08	0.85	2.45	0.65	2.92	1.59	0.67	5.14	0.66

Conclusion

Based upon this experiment it is concluded that application of phosphorus @ 65 kg/ha recorded the maximum and significantly higher grain yield of chickpea (18.89 q/ha), gross monetary returns (₹ 96654.00 Rs/ha), net monetary returns (₹ 73406.00 Rs/ha) and highest B:C ratio of 3.16: 1. Hence, it can be concluded that application of phosphorus @ 65 kg/ha obtained B:C ratio >3.0, can be used as a remunerative strategy.

References

1. Rajneesh Singh, Tej Pratap, Durgesh Singh, Ghanshyam Singh, Abhinav Kumar Singh. Effect of phosphorus, sulphur and biofertilizers on growth attributes and yield of Chickpea (*Cicer arietinum* L.). J Pharmacognosy Phytochem. 2018;7(2):3871-3875.
2. Satybhan Singh. Effect of irrigation schedules and different levels of nutrients on growth, yield and quality of Chickpea (*Cicer arietinum* L.). Prog Res. 2017;12(1):91-95.
3. Dotaniya ML, Pingoliya KK, Lata M, Verma R, Deewan P, Regar KL, Dotaniya CK. Role of phosphorus in Chickpea (*Cicer arietinum* L.) production. Afr J Agric Res. 2014;9(51):3736-3743.
4. Rao Srinivasa R, Pratap Kumar Reddy A, Sailaja V. Growth, yield, nutrient availability and uptake of Chickpea (*Cicer arietinum* L.) as influenced by varieties and phosphorus levels. Andhra Agric J. 2003;58(3):283-285.
5. Mehar Singh, Rakeshkumar, Singh RC. Agro technology for kabuli Chickpea (*Cicer arietinum* L.). In: Proceedings of National Symposium on Agronomy: Challenges and Strategies for Millennium, Gujarat Agriculture University Campus, Junagadh; c2000. p. 128-35.
6. Jaiveer Singh Dhewa, Sameer Daniel, Sulochana. Effect of different levels of phosphorus and sulphur on growth and nutrient uptake of green gram (*Vigna radiata* L.) under teak (*Tectona grandis* L.) based agroforestry system. Int J Curr Microbiol Appl Sci. 2017;6(2):520-534.
7. Prajapati BJ, Nitin Gudadhe, VR Gamit, Chhaganiya HJ. Effect of integrated phosphorus management on growth, yield attributes and yield of chickpea. FMG & Mngmt. 2017;2(1):36-40.
8. Pingoliya KK, Mathur AK, Dotaniya ML, Jajoria DK, Narolia GP. Effect of phosphorus and iron levels on growth and yield attributes of Chickpea (*Cicer arietinum* L.) under agroclimatic zone of Rajasthan, India. Legume Res. 2014;37(5):537-541.
9. Vikram Singh, Ajeev Kumar, Manohar Lal, Mahesh Kumar. Chickpea cultivation governing by phosphorus application in calcareous soil. Int J Curr Microbiol Appl Sci. 2018;7(2):3419-3425.
10. Laharia GS, Varsha Apotikar, Age AB, Gite PA, Deshmukh DP. Effect of phosphorus levels with PSB on yield, nutrient use efficiency and uptake of nutrients by Chickpea. J Pharmacognosy Phytochem. 2019;8(3):3182-3185.
11. Kumawat Narendra, Yadav RK, Mahender Singh, Dudwe TS, Tomar IS. Effect of phosphorus and bioinoculants and their residual effect on succeeding Chickpea (*Cicer arietinum*). Indian J Agric Sci. 2020;90(2):320-325.
12. Ramesh P, Panwar NR, Singh AB. Crop productivity, soil fertility and economics of Chickpea (*Cicer arietinum* L.), Soybean (*Glycine max* L.) and Blond psyllium (Plantago ovata) under organic nutrient management practices. Indian J Agric Sci. 2010;80(11):73-76.
13. Raghvendra Singh, Vipul Singh, Prabhat Singh, Yadav RA. Effect of phosphorus and PSB on yield attributes, quality and economics of summer greengram (*Vigna radiata* L.). J Pharmacognosy Phytochem. 2018;7(2):404-408.