Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8837

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2021) *9*(6), 23-27

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Performance of Potassium Levels and Varieties on Growth, Yield and Quality of Chickpea (*Cicer arientinum* L.)

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Received: 17.10.2021 | Revised: 24.11.2021 | Accepted: 3.12.2021

ABSTRACT

To study the effect of potassium levels and varieties on growth and yield of chickpea, an experiment was conducted at instructional farm of department of Agronomy, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) during rabi season of 2020-21. The experiment consisted of randomize block design having factorial arrangement with three replications. In this experiment, 12 treatment combinations including four levels of potassium viz., K_1- 0 kg K_2O/ha, K_2- 30 kg K_2O/ha, K_3- 40 kg K_2O/ha K_4- 50 kg K_2O/ha with three chickpea varieties viz., V_1- JG 11, V_2- JG 36 and V_3- JG 63. The gross and net plot size was 5.0 m x 3.5 m and 4.0 m x 3.0 m, respectively. The fertilizers grades were applied as per treatments. Full recommended dose of nitrogen and phosphorus at the rate of 20 kg N/ha and 60 kg P_2O_5/ha, respectively was uniformly applied to each plot (except control plots) as basal dose before sowing. Nutrient, potassium was applied as per treatment, as basal dressing during land preparation in the experimental plot as per the treatments. Highest plant height (41.45 cm) and number of branches per plant (9.80) at 90 DAS while, number of pods per plant (35.60), number of grains per pods (2.20), seed index (20.97 g), grain yield (19.82 q/ha), stover yield (37.10 q/ha) and protein content (21.38 %) were recorded under the application of potassium @ 50 kg/ha with the chickpea variety of JG- 63.

Keywords: *Varieties, Potassium, Branches, Pods, Test weight, Stover yield.*

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the third most important legume in the world. India alone contributes more than 62-67% of the total global production. It is popularly known as Gram or Bengal gram mainly grown during rabi season. Chickpea is an important winter season pulse crop of India and 68 per cent of total chickpea is mainly cultivated as rainfed crop.

Cite this article: Pandey, K., & Chaturvedi, D. P. (2021). Performance of Potassium Levels and Varieties on Growth, Yield and Quality of Chickpea (*Cicer arientinum* L.), *Ind. J. Pure App. Biosci. 9*(6), 23-27. doi: http://dx.doi.org/10.18782/2582-2845.8837

During 2017-18, chickpea production has been reported to be about 11.16 mt which is about 45% of the total pulse production in India from an area of 10.76 m ha with the productivity of 1037 kg/ha (Anonymous, 2018). This makes our country a largest producer of chickpea in the world.

Fertilizers, even though comparatively a costly input of production are essential for securing higher yields. The potassium is also one of the major plant nutrients, which is important for the growth and development of plants. The major functions of potassium in the plants are, activation of a number of enzymes involved in photosynthesis, metabolism of carbohydrates and proteins, improved utilization of nitrogen, improved utilization of sunlight during cool and cloudy periods, enhanced resistance of plants in many cases to withstand pests, diseases and stresses such as those improved crop yield and quality in a number of crops. Among the nutrients, potassium deficiency is considered to be major cause for low pulse yield and responses to potassium application by the chickpea crop have been obtained. Potassium is rarely applied to pulse crops despite larger K_2O requirements of pulses and continued mining of soil potassium, resulting in imbalanced nutrient supply and lower crop yield.

Among the various agronomic practices, suitable variety is the most important non-monetary input which helps in the maximization of yield under favourable environmental conditions. Production of crop also depends on the stability of variety. Stability is defined as the fixed production efficiency of a species under different environmental condition. Thus, stability in production efficiency of certain variety under changing conditions of environment is very important. Selection of variety for an environment would be easier by determining the stability, of a variety for an environment. Presently several high yielding chickpea varieties are available for Madhya Pradesh, but there is a need to test such varieties suitable to the Vindhya region. The present study was planned to estimate the suitable chickpea variety and potassium levels and its impact on growth and yield of chickpea.

MATERIALS AND METHODS

The experiment was carried out at instructional farm, Faculty of Agriculture, AKS University, Satna (M.P.) during *rabi* season 2020-21. The experiment was conducted in randomize complete block design having Factorial concept with three replications. Different levels of potassium and chickpea varieties will be allocated to the plots as per treatments. Seed rate used as 80 kg/ha for sowing with 30.0 x 10.0 cm distance. In this experiment, 12 treatment combinations including four levels of potassium *viz*., K_1- 0 kg K_2O/ha, K_2- 30 kg K_2O/ha, K_3- 40 kg K_2O/ha K_4- 50 kg K_2O/ha with three chickpea varieties *viz*., V_1- JG 11, V_2- JG 36 and V_3- JG 63. The gross and net plot size was 5.0 m x 3.5 m and 4.0 m x 3.0 m, respectively. The fertilizers grades were applied as per treatments. Full recommended dose of nitrogen and phosphorus at the rate of 20 kg N/ha and 60 kg P_2O_5/ha, respectively was uniformly applied to each plot (except control plots) as basal dose before sowing. Nutrient, potassium was applied as per treatment, as basal dressing during land preparation in the experimental plot as per the treatments. All the other agronomic practices were applied uniformly to all the treatments.

RESULTS AND DISCUSSION

Data regarding plant height and number of branches per plant are reported in Table- 1. Statistical analysis of the data revealed that Highest plant height (41.45 cm) and number of branches per plant (9.80) at 90 DAS while, number of pods per plant (35.60), number of grains per pods (2.20), seed index (20.97 g), grain yield (19.82 q/ha), stover yield (37.10 q/ha) and protein content (21.38 %) were recorded under the application of potassium @ 50 kg/ha with the chickpea variety of JG- 63.

The positive effect of potassium on growth character due to its favourable effect on growth and augmenting cell division and cell expansion. Potassium plays a crucial role in meristematic growth through its effect on the synthesis of phyto-hormones. Among various plant hormones, cytokinin plays important role in growth of branches and pods (Kumar et al. (2014). The increase plant height owing to potassium application might be attributed to crucial role in meristematic

growth through its effect on the synthesis of hormones. Among various plant hormones, cytokinine play important role in growth of plant. Probably, potassium ensured the availability of other essential nutrients as a result maximum growth was occurred and the ultimate results is the maximum number of branches/leaves per plant. Beneficial effects of K on growth have been reported by Amal et al. (2015), Jadeja et al. (2016) and Amol et al. (2020).

At all the growth stage, variety JG- 63 produced significantly higher plant height and number of branches over the remaining varieties. The differences among the varieties with respect to branches formation may be owing to inheritance of genetic divergence of the varieties. Further, the differential behaviour among the varieties could be explained by the variation in their genetic makeup and their differential behavior under different climatic conditions. Govardhan et al. (2017) and Datta and Das (2018) also obtained similar variation in chickpea varieties.

Significant variation was observed on the number of grains per pod of chickpea when the field was fertilized with different doses of potassium. This might be due to the fact that plant treated with higher potassium doses, resulting increased the branches through better root development and more nutrient availability, resulting in vigorous plant growth and dry matter accumulation leading to flowering, fruiting and grain formation as well as number of grains per pod. Higher plant population due to potassium application increases inter plant competition so that the total dry matter is high with the same amount of grain yield. The increase in grain yield was owing to the application of higher rate of potassium, as it plays a vital role in many plant processes including photosynthesis, translocation of photosynthates, protein synthesis, activation of plant enzymes etc. Goud et al. (2014) also reported such favourable effect of K on seed index of chickpea.

The various yield attributing characters viz. number of pods per plant, number of seed per plant and weight of 100 seeds were recorded significantly maximum in application of 50 kg K_2O/ ha might be due to enhanced availability of plant nutrients, photosynthetic activity, followed by efficient transfer of metabolites and subsequent accumulation of these metabolites in the seed with the resulting in the all yield attributing character. Almost similar results were reported by Rajput (2018), Abdul et al. (2019), Jadeja et al. (2019) and Ali et al. (2020).

The increase in nitrogen uptake with the application of K may be due to favourable effect of potassium fertilization on the absorption of nitrogen by chickpea crop. The increase in N uptake by chickpea seeds may be described to higher content and grain production of chickpea due K application. As potassium has synergistic effect on nitrogen uptake, facilitates protein synthesis and activates different enzymes, therefore, protein content increased significantly with each increase in potassium level.

This increase in yield and yield attributes of JG- 63 might be due to higher production efficiency which was reflected through improvement in different yield contributing characters. Differential yield potential due to different chickpea varieties was reported by Patidar and Singh (2018), Mondal and Sengupta (2019) and Sangeetha et al. (2020). Increase in grain yield and its parameters may be due to increase in the number of leaves which worked as an efficient photosynthesis structure and produced high amount of carbohydrates in the plant system. More number of branches which borne more number of flowers, which resulted higher fruits/plant and fruit yield and their attributes. Similar findings also reported by Chala et al. (2020). The variation in yield attributes of JG-63 variety may be due to genetic characteristics among different genotypes under present investigation. These findings are in agreement with the findings of Mondal and Sengupta (2019) and Sangeetha et al. (2020).

The uptake of a nutrient is a product of yield and its concentration in plant, the significant increase in total uptake of nitrogen, phosphorus and iron of variety JG- 63 might be the result of cumulative effect of higher content of these nutrients in grain and straw along with its higher yield. The conformity with findings of other workers like Rahman et al. (2020).

Table 1: Effect of Potassium Levels and Varieties on Growth and Yield of Chickpea

Treatment	Plant height (cm)	Number of branches/ plant	Number of pods per plant	Number of grains/pod	Seed index (g)	Grain yield (q/ha)	Stover yield (q/ha)	Protein content (%)
	Effect of potassium levels							
K_0	29.13	4.76	25.76	1.36	14.36	12.16	31.84	18.94
K_1	35.52	6.02	29.13	1.62	16.68	15.75	33.64	19.66
K_2	36.41	6.62	29.67	1.76	17.43	16.47	34.07	19.80
K_3	38.47	7.60	31.44	1.96	18.60	17.92	36.13	20.26
S. Em±	1.51	0.50	1.05	0.21	0.77	0.78	0.76	0.34
C.D.	4.42	1.48	3.08	0.63	2.26	2.28	2.22	0.99
	Effect of varieties							
V_1	29.72	4.65	26.07	1.30	14.33	12.89	30.88	18.97
V_2	36.11	6.37	29.15	1.73	17.08	16.10	34.81	19.63
V_3	38.82	7.73	31.78	1.98	18.88	17.73	36.07	20.40
S. Em±	1.74	0.58	1.21	0.25	0.89	0.90	0.87	0.39
C.D.	5.10	1.71	3.56	0.73	2.61	2.63	2.56	1.14
	Interaction effect between potassium levels and varieties							
K_0V_1	20.31	3.53	22.33	1.13	10.99	10.49	29.01	18.57
K_0V_2	32.48	5.07	27.13	1.40	15.61	12.77	32.08	19.05
K_0V_3	34.61	5.67	27.80	1.53	16.48	13.21	34.43	19.20
K_1V_1	31.09	4.40	26.60	1.13	14.20	12.12	29.31	18.84
K_1V_2	36.20	6.40	29.13	1.67	17.01	16.72	35.62	19.76
K_1V_3	39.28	7.27	31.67	2.07	18.82	18.40	35.98	20.38
K_2V_1	32.12	4.87	27.00	1.33	15.41	12.57	29.77	19.00
K_2V_2	37.16	6.80	29.93	1.80	17.62	17.34	35.68	19.79
K_2V_3	39.94	8.20	32.07	2.13	19.24	19.50	36.76	20.63
K_3V_1	35.35	5.80	28.33	1.60	16.74	16.38	35.43	19.48
K_3V_2	38.60	7.20	30.40	2.07	18.08	17.56	35.87	19.91
K_3V_3	41.45	9.80	35.60	2.20	20.97	19.82	37.10	21.38
S. Em±	0.87	0.29	0.61	0.12	0.44	0.45	0.44	0.19
C.D.	1.80	0.60	1.26	NS	0.92	0.93	0.90	0.40

CONCLUSION

Based upon this experiment it is concluded that the chickpea variety JG- 63 sown with application of potassium @ 50 kg K2O/ha, recorded the maximum and significantly higher grain yield (19.82 q/ha), net returns (₹ 80939.00/ ha) and highest B: C ratio of 3.16: 1. Hence, it can be concluded that application of 50 kg K2O/ha with the chickpea variety of JG- 63 with B:C ratio >3, can be used as a remunerative strategy.

However, these results are only indicative and require further experimentation to arrive at more consistent and final conclusion to be passed on to farmers.

Acknowledgement

Author is sincerely thankful to Department of Agronomy, Faculty of Agriculture, AKS University, Satna for providing all facilities to successfully completing research work.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest

The author(s) declares no conflict of interest.

Author Contributions

Kreetika Pandey was involved in data collection, analysis, interpretation and writing first draft of the manuscript. D.P. Chaturvedi was involved in revision and final compilation of the manuscript.

REFERENCES

Abdul Quddus Md., Md. Ashraf Hossain, Naser, H. M., Anwar, B., Md. Abdus Sattar & Khairul Mazed, H. E. M. (2019). Assessment of Potassium Element on Lentil (*Lens culinaris* Medic) Agronomy and Nutrient Use Efficiency in Calcareous Soils. *Journal of Energy and Natural Resources*, *8*(3), 116- 126.

Mohamed, A. A., Hassan, A. A., Adde, M. S. N., Noor, A. A., & Kabir Md. Ahsanul. (2020). Effect of Nitrogen and Potassium on the Growth, Yield and Yield Contributing Traits of French Bean. IOSR *Journal of Agriculture and Veterinary Science* (IOSR-JAVS), *13*(4), 01-12.

Ahmed, A. G., Magda, H. M., Hassanein, M. S., Nabila, M. Z., El Habbasha, S. F., Tawifk, M. M., & Manal, F. M. (2015). Effect of water regime and potassium fertilization on productivity of two chickpea (*Cicer arietinum* L.) cultivars. *International Journal of Chem Tech Research*, *8*(4), 1509-1519.

Bagadkar, A., Hiwale, S., & Nilima, D. (2020). Effect of graded levels of potassium on growth, yield and economics of green gram. *Journal of Pharmacognosy and Phytochemistry*, *9*(4), 1799-1801.

Anonymous, (2018). Directorate of Economics and Statistics, (2018). Agricultural statistics at a glance. Ministry of Agriculture, Govt. of India.

Chalchissa, C., Ashagire, H., & Ibrahim, H. (2020). Effect of Phosphorus Fertilizer Levels on Yield and Yield Component of Chickpea (*Cicer arietinum* L.) Varieties: *Adv. Crop. Sci. Tech*. an open access journal, *8*(4), 1-4.

Datta, S., & Das, K. (2018). Varietal performance of garden pea (*Pisum sativum* var. hortense) under Terai zone of West Bengal. *Journal of Applied and Natural Science*, *10*(3), 1032- 1036.

Goud, V. V., Konde, N. M., Mohod, P. V., & Kharche, V. K. (2014). Response of chickpea to potassium fertilization on yield, quality, soil fertility and economic in vertisols. *Legume Research*, *37*(3), 311- 315.

Govardhan, G., Reddy, K. H. P., & Reddy, D. M. (2017). Physiological response of mung bean genotype to irrigated and moisture stress condition. *Journal of Ecology, Environment and Conservation*, *23*(1), 259-264.

Jadeja, A. S., Rajani, A. V., Chapdiya, F., Kaneriy, S. C., & Kavar, N. R. (2016). Soil application of potassium and sulphur and effect on growth and yield components of chickpea (*Cicer arietinum* L.) under South Saurashtra region of Gujarat. *International Journal of Science, Environment and Technology*, *5*(5), 3172 – 3176.

Jadeja, A. S., Rajani, A. V., Kaneriya, S. C., & Hirpara, D. V. (2019). Nutrient Content, Uptake, Quality of Chickpea (*Cicer arietinum* L.) and Fertility Status of Soil as Influenced by Fertilization of Potassium and Sulphur. *Int. J. Curr. Microbiol. App. Sci*. *8*(6), 2351- 2355.

Kumar, P., Kumar, R., Kumar, S., Singh, S. K., Kumar, A., & Singh, B. B. (2014). Effect of fertility on growth, yield and yield attributes of pearl millet (*Penisetum glaucum* L.) under rainfed condition. *International Journal of Tropical Agriculture*. *32*, 3-4.

Mondal, R., & Sengupta, K. (2019). Study on the performance of mung bean varieties in the New Alluvial Zone of West Bengal. *Journal of Crop and Weed*, *15*(1), 186-191.

Ketan, P., & Singh, T. (2018). Effect of varieties and dates of sowing on growth, yield and quality of black gram (*Vigna mungo* L.). *Annals of Plant and Soil Research*, *20*(4), 428-431.

Khalil, R. B., Dhar, S., Khalili, A., Rasooli, M., & Jamal, T. (2020) Effect of sources of nutrient and biofertilizers on growth and yield of mung bean (*Vigna radiata* L.). *International Journal of Chemical Studies*, *8*(1), 555- 559.

Ambrin, R. (2018). Potassium Application on Chickpea Crop under Irrigated Area. *Journal of Agriculture*, *34*(4), 941-947.

Sangeetha, M., Indhumathi, K., & Shanmugam, P. S. (2020). Performance Evaluation of Chickpea Varieties under Rainfed Condition of Dharmapuri District, Tamil Nadu, India. *Current Journal of Applied Science and Technology*, *39*(14), 65-70.