www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(11): 496-499

www.thepharmajournal.com
Received: 28-08-2022
Accepted: 30-09-2022

Roshan Yengkokpam
Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences, Utlou, Bishnupur, Manipur, India

Sakhen Sorokhaibam
Krishi Vigyan Kendra, Bishnupur, Manipur, India

Athokpam Kalpana
Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences, Utlou, Bishnupur, Manipur, India

Corresponding Author:
Sakhen Sorokhaibam
Krishi Vigyan Kendra, Bishnupur, Manipur, India

Influence of nutrient management on nutrient uptake and status of chickpea (*Cicer arietinum*)

Roshan Yengkokpam, Sakhen Sorokhaibam and Athokpam Kalpana

Abstract
A field experiment entitled "Influence of Nutrient management on Nutrient Uptake and Status of Chickpea" was conducted at the experimental field of Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences located at Utlou, Bishnupur district, Manipur during *Rabi* season 2019-2020 to study the performance of chickpea (JG-14) under different management of nutrient. The soil of the experimental site was clayey, strongly acidic (pH 5.2), high in organic carbon (1.04%), medium in available nitrogen (296.81 kg ha-1), medium in available P2O5 (46.47 kg ha-1) and medium in available K2O (254.00 kg ha-1). The experiment was laid out in Randomized block design consisting of seven treatments i.e., T_1: NPK @ 20:40:20, T_2: NPKS @ 20:40:20:20, T_3: NPK 20:40:20 + 0.5% Zn foliar application, T_4: NPKS @ 20:40:20:20 (50%) + 0.5% Zn foliar application, T_5: NPKS @ 20:40:20:20 (75%) + 0.5% Zn foliar application, T_6: NPKS @ 20:40:20:20 (100%) + 0.5% Zn foliar application, T_7: NPKS @ 20:40:20:20 (125%) + 0.5% Zn foliar application with three replications. The experimental results revealed that application of NPKS @ 20:40:20:20 (125%) + 0.5% Zn foliar application was found to be ideal for chickpea for better NPK and protein content and uptake and also observed the highest yield and assured income in rain fed condition.

Keywords: Nutrient management, growth, yield and chickpea

Introduction
Pulses are an important food crop after cereals and it is an important source of dietary protein in the vegetarian diet in the world. In our country, they occupy a unique position in agriculture by virtue of the fact that they constitute a major and the only high protein component to the average Indian diet. Chickpea is currently grown on about 10.7 m ha worldwide with an average production of 12 million tons per year. Nutrient management is an important factor for production of chickpea. Although, chickpea still grow on low fertility soil, the yield quality and quantity has been impacted which can be improved by giving the plant the proper nutrition especially through an optimum nutrient combination. The potential of chickpea has not explored much in Manipur. Hence, the present investigation was carried out to find out appropriate nutrient management to give better productivity and economic returns in chickpea. Chickpea being a leguminous crop, improve soil fertility by fixing atmospheric nitrogen in available form ($NH_3^+$and NH_4^+) in the root through the phenomena of symbiosis. It can meet up to 80% of its nitrogen (N) requirement. A large amount of residual nitrogen is also leave behind for subsequent crops and adds plenty of organic matter to maintain and improve soil health and fertility.

Materials and Method
A field experiment entitled " Influence of nutrient management on nutrient uptake and status of chickpea" was conducted at the experimental field of Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences located at Utlou, Bishnupur district, Manipur during rabi season 2019-2020 to study the performance of chickpea (JG-14) under different fertilizer levels The soil of the experimental site was clayey, strongly acidic (pH 5.2), high in organic carbon (1.04%), medium in available nitrogen (296.81 kg ha-1), medium in available P2O5 (46.47 kg ha- 1) and medium in available K2O (254.00 kg ha-1).The experiment was laid out in Randomized block design consisting of seven levels of nutrients i.e. T_1: NPK @ 20:40:20, T_2: NPKS @ 20:40:20:20, T_3: NPK @20:40:20 + 0.5% Zn foliar application, T_4: NPKS @ 20:40:20:20 (50%) + 0.5% Zn foliar application, T_5: NPKS @ 20:40:20:20 (75%) + 0.5% Zn foliar application, T_6: NPKS @ 20:40:20:20 (100%) + 0.5% Zn foliar application, T_7: NPKS @ 20:40:20:20 (125%) + 0.5% Zn foliar application with three replications.

The chickpea variety JG 14 was sown in line with 30 x 10 cm and seed rate of 60 kg ha-1. Growth parameters *viz*. plant height, number of branches and dry matter production are recorded periodically at 45 DAS, 65 DAS, 85 DAS and at harvest. Yield parameters like number of pods per plant, number of seeds per pod and test weight are recorded at harvest. Seed and straw yield are recorded plot-wise and expressed in kg ha-1. To compare the effect of different nutrient levels was statistically analyzed by Simple randomized block design (sRBD) given by Gomez and Gomez (1984) [17]. The statistical differences of the data generated for each treatment and their pooled values were tested using analysis of variance technique (ANOVA). The standard error of means (SEm ±) and critical difference (CD) at 5% level of significance were calculated to compare the treatment means.

Results And Discussion NPK content and uptake

Nutrient uptake of NPK significantly increased with an increase in levels of nutrient application and the highest uptake was recorded with the treatment of NPKS @ 20:40:20:20 (125%) + 0.5% Zn foliar application at flowering stage (Table 1). Nutrient uptake increased significantly with increasing doses of N which may be due to stimulating root growth and development of crops and also helps in uptake of other nutrients. A higher dose of nitrogen also increases the amount of available organic nitrogen for uptake by plant from soil. Phosphorus too may help to stimulate root development and is attributed to deeper root growth resulting in higher absorption of nutrient by the plant. The application of K increased nitrogen and phosphorus availability in plant (Sahai, 2004) [18]. Sulphur also increases the uptake of nitrogen and phosphorus. Zn is one of the most important micro nutrients to maintain proper and optimal plant growth. Zn helps plant to uptake NPK properly and in adequate amount to maintain crop plant growth and production (Ankur *et al*., 2020) [19]. Due to higher uptake of NPK by plant, seed and straw also have higher nutrient content with the application of NPKS @ 20:40:20:20 (125%) + 0.5% Zn foliar application at flowering stage. Similar results have been reported by Patel *et al.* (2014) [16] and Balai *et al.* (2017) [3].

Table 1: Effect of Nutrient Management on levels of NPK, protein content and uptake chickpea

Treatment	Nitrogen Content (%)		Nitrogen Uptake (kg / ha)		Phosphorus Content (%)		Phosphorus Uptake (kg / ha)		Potassium Content (%)		Potassium Uptake (kg / ha)		Protein Content (%)
	Seed	Straw	Seed	Straw	Seed	Straw	Seed	Straw	Seed	Straw	Seed	Straw	
Fertilizer													
T_1	2.67	0.9	9.33	9.38	0.35	0.14	1.25	1.29	0.47	1.68	1.64	14.83	16.72
T_2	2.88	1.36	12.98	16.01	0.44	0.19	1.99	2.06	0.60	2.01	2.70	21.49	18.02
T_3	2.77	1.20	11.51	13.91	0.42	0.17	1.77	1.79	0.56	1.85	2.32	19.50	17.34
T_4	2.71	1.09	10.07	11.31	0.37	0.15	1.38	1.43	0.48	1.75	1.79	16.39	16.98
T_5	2.93	1.35	13.38	16.09	0.46	0.21	2.10	2.27	0.63	2.04	2.87	22.17	18.34
T_6	3.15	1.55	15.88	19.90	0.51	0.25	2.59	2.82	0.68	2.18	3.45	24.58	19.73
T_7	3.31	1.66	17.84	21.14	0.57	0.27	3.19	3.11	0.70	2.23	9.47	25.67	20.69
SEm ±	0.01	0.03	0.22	0.40	0.01	0.01	0.04	0.11	0.01	0.02	0.05	0.42	0.10
CD(P=0.5)	0.05	0.09	0.70	1.25	0.03	0.03	0.13	0.36	0.03	0.08	0.15	1.30	0.32

T_1: NPK@ 20:40:20, T_2: NPKS @ 20:40:20:20, T_3: NPK @ 20:40:20 + 0.5% Zn foliar application, T_4: NPKS @ 20:40:20:20 (50%) + 0.5% Zn foliar application, T_5: NPKS @ 20:40:20:20 (75%) + 0.5% Zn foliar application, T_6: NPKS @ 20:40:20:20 (100%) + 0.5% Zn foliar application, T_7: NPKS @ 20:40:20:20 (125%) + 0.5% Zn foliar application

Table 2: Effect of Nutrient Management on yield of chickpea

Treatments	Seed Yield (kg ha-1)	Stover Yield (kg ha-1)
T_1	350.30	883.05
T_2	450.50	1065.75
T_3	416.16	1054.20
T_4	370.88	936.60
T_5	456.27	1083.60
T_6	509.21	1127.70
T_7	561.21	1152.90
SEm ±	11.55	15.81
CD (P = 0.05)	35.61	2.62

T_1: NPK@ 20:40:20, T_2: NPKS @ 20:40:20:20, T_3: NPKZn @ 20:40:20 + 0.5% Zn foliar application, T_4: NPKSZn @ 20:40:20:20 (50%) + 0.5% Zn foliar application, T_5: NPKSZn @ 20:40:20:20 (75%) + 0.5% Zn foliar application, T_6: NPKSZn @ 20:40:20:20 (100%) + 0.5% Zn foliar application, T_7: NPKSZn @ 20:40:20:20 (125%) + 0.5% Zn foliar application

Table 3: Effect of Nutrient Management on economics of chickpea

Treatments	Economics			
	Cultivation cost (₹ / ha)	Gross Return (₹ / ha)	Net return (₹ / ha)	B: C ratio
Fertilizers				
T_1	26,553	28,024	1,471	1.01
T_2	32,629	36,040	3,411	1.06
T_3	28,293	33,292	5,000	1.17
T_4	27,679	29,664	1,985	1.07
T_5	31,024	36,501	5,478	1.17
T_6	34,369	40,739	6,368	1.18

T_7	37,713	44,896	7,184	1.19

T_1: NPK@ 20:40:20, T_2: NPKS @ 20:40:20:20, T_3: NPKZn @ 20:40:20 + 0.5% Zn foliar application, T_4: NPKSZn @ 20:40:20:20 (50%) + 0.5% Zn foliar application, T_5: NPKSZn @ 20:40:20:20 (75%) + 0.5% Zn foliar application, T_6: NPKSZn @ 20:40:20:20 (100%) + 0.5% Zn foliar application, T_7: NPKSZn @ 20:40:20:20 (125%) + 0.5% Zn foliar application

Protein content

Application of NPKS @ 20:40:20:20 (125%) + 0.5% Zn foliar application at flowering stage gives the highest protein content in seed (Table 1). This might be due to synergistic effect of both N and S which increased their availability in the soil (Ramkala and Gupta, 1999) [24] and an increasing in protein content obtained with higher dose of sulphur was mainly owing to greater absorption of N and S by chickpea grain. Since both nutrients are closely linked with protein metabolism and their relation is synergistic (Aulakh and Pasrich, 1983) [25]. The increasing in grain protein content is expected. Similar findings have been observed from Pandya *et al*. (2007) [21], Balai *et al*. (2017) [3] and Sindagi *et al*. (2014) [22].

NPK content in soil after harvest

The increasing levels of fertilizers significantly increase NPK content in soil. Application of NPKS @ 20:40:20:20 (125%) + 0.5% Zn foliar application at flowering stage significantly increased NPK content in soil over control (Tabel 1). This could be due to ample supply of fertilizers in soil which provides a congenial environment in rhizosphere for microbial population and mineralization. The acid secreted by the nodule bacterial increase the available soil phosphorus by dissolving the acid soluble phosphorus (Jain and Singh 2003). The application of potassium increased nitrogen and phosphorus availability (Sahai, 2004) [18]. Sulphur also increases the nitrogen and phosphorus content in soil. It was only due to in general the residual available status of applied nutrients in soil after crop harvest showed considerable improvement over initial status. It may be concluded that growing of chickpea enhanced the soil fertility status due to heavy leaf drop and leaf over root system coupled with nitrogen fixation. (Patel *et al*., 2014) [16]. These results are in close concurrence with those reported by Patel *et al*. (2014) [16] and Balai *et al*. (2017) [3].

Yield of chickpea

Data regarding seed yield as affected by various levels of nutrients are shown in Table 2. The value increased as higher dose of NPK are applied in the soil and sulphur increased the rate of photosynthesis while Zinc helps to utilize physiological and morphological properties of plants such as nitrogen metabolism as well as helps in increasing chlorophyll synthesis (Potarzycki and Grzebisz, 2009) [23]. Application of NPKS @ 20:40:20:20 (125%) + 0.5% Zn foliar application (Table 2) gives the highest seed yield (561.21 kg ha-1) which is 60.20% from control (350.30 kg ha-1) and highest stover yield 1152.90 kg ha-1 which is 30.55% higher compare to control 883.05 kg ha-1 in chickpea. These results are in close concurrence with those reported by Arya *et al*. (2005) [2].

Economics

The economics return of crop cultivation is an important factor as it indicates its benefit while implementing a specific treatment. The highest cultivation cost was obtained from T_7 due to higher fertilizers needed in this treatment and the lowest was obtained from T_1 (Table 3). Although, application of NPKS @ 20:40:20:20 (125%) + 0.5% Zn foliar application had a higher cost of cultivation, the highest gross return (₹44,896 ha-1), net return (₹7,184 ha-1) and B: C ratio (1.19) was obtained with this treatment. This might be due to the higher seed yield obtained, resulting in a higher net return than other treatments. The lowest return was obtained from control with a gross return of ₹28,024 ha-1, a net return of ₹1,471 ha-1 and B: C ratio of 1.01. Similar results have been reported from the results of Arya (2005) [2] and Srinivasulu *et al*. (2015) [20].

Conclusion

Thus, from the present investigation, it can be concluded that increasing levels of nutrients with 125% of the recommended NPKS (20:40:20:20 kg ha -1) along with the foliar application of Zinc (0.5%) at the flowering stage proved to give better nutrient content and uptake as well as profitable in rain fed chickpea cultivation of Manipur during rabi season.

Acknowledgements

The authors are thankful to Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences, Utlou, Bishnupur District, Manipur, India and ICAR RC for NEH Region Manipur Centre for providing the facility and technical support to carry out this field experiment.

References

1. Alukh MS, Pasricha NS. Effect of P and S on the growth and nutrient uptake of mung. Plant and Soil. 1997;17(2):341-345.
2. Arya RL, Kumar L, Singh KK, Kushwaha BL. Effect of fertilizers and tillage management in rice (*Oryza sativa*)–chickpea (*Cicer arietinum*) cropping system under varying irrigation schedules. Indian Journal of Agronomy. 2005;50(4):256-259.
3. Balai K, Jajoria M, Verma R, Deewan P, Airwa SK. Nutrient content, uptake, quality of chickpea and fertility status of soil as influenced by fertilization of phosphorus and zinc. Journal of Pharmacognosy and Phytochemistry. 2017;6(1):392-398.
4. Chen G, Feng H, Hu Q, Qu H, Chen A, Xu G, *et al*. Improving rice tolerance to potassium deficiency by enhancing OsHAK16p: WOX11-controlled root development. Plant Biotechnology Journal. 2015;13:833-848.
5. Goud VV, Konde NM, Mohod PV, Kharche VK. Response of chickpea to potassium fertilization on yield, quality, soil fertility and economic in vertisols. Legume Research-An International Journal. 2014;37(3):311-315.
6. Goyal S, Verma HD, Nawange DD. Studies on growth and yield of Kabuli chickpea (*Cicer arietinum* L.) genotypes under different plant densities and fertility levels. Legume Research-An International Journal. 2010; 33(3):221-223.
7. Hepler PK, Vidali L, Cheung AY. Polarized cell growth in higher plants. Annual Review of Cell and Developmental Biology. 2001;17:159-187.
8. Jain L, Singh P. Growth and nutrient uptake of chickpea (*Cicer arietinum* L.) as influenced by bio-fertilizer and phosphorus nutrition. Crop Research. 2003;25(3):410-413.
9. Kadam CS, Thanki JD, Gudadhe NN. Response of

chickpea to irrigation methods, fertilisers and biofertiliser under south Gujarat condition. Indian Journal of Fertilisers. 2014;10(4):20-24.
10. Kaiser WM. Correlation between changes in photosynthetic activity and changes in total protoplast volume in leaf tissue from hygro-, meso-and xerophytes under osmotic stress. Planta. 1982;154:538-545.
11. Lemma W, Wassie H, Sheleme B. Response of chickpea (*Cicer arietinum* L.) to nitrogen and phosphorus fertilizer S in halaba and taba, Southern Ethiopia. Ethiopian Journal of Natural Resources. 2013;13(2):115-128.
12. Li G, Zhang ZS, Gao HY, Liu P, Dong ST, Zhang JW, *et al*. Effects of nitrogen on photosynthetic characteristics of leaves from two different stay-green corn (*Zea mays* L.) Varieties at the grain-filling stage. Canadian Journal of Plant Science. 2012;92:671-680.
13. Liew CS. 1988) Foliar Fertilizers from Uniroyal and their Potential in Pakistan. Proceedings of Seminar on Micronutrient in Soils and Crops in Pak; c1998. p. 277.
14. Liu Z, Gao J, Gao F, Liu P, Zhao B, Zhang JW. Photosynthetic characteristics and chloroplast ultrastructure of summer Maize response to different nitrogen supplies. Frontiers in Plant Science. 2018;9:576.
15. Mansourifar C, Shaban M, Ghobadi M, Ajirlu AR. Effect of drought stress and N fertilizer on yield, yield components and grain storage proteins in chickpea (*Cicer arietinum* L.) cultivars. African Journal of Plant Science. 2011;5(11):634-642.
16. Patel HK, Patel PM, Suthar JV, Patel MR. Yield, Quality and Post-harvest Nutrient Status of Chickpea as Influence by Application of Sulhur and Phosphorus Fertilizer Management. International Journal of Scientific and Research Publications. 2014;4(7):1-4.
17. Gomez KA, Gomez AA. Statistical procedures for agricultural research. John wiley & sons; c1984 Feb 17.
18. Sahai A, Hoven N, Tandra R. Some fundamental limits on cognitive radio. In Allerton Conference on Communication, Control, and Computing; c2004 Oct (Vol. 16621671).
19. Ankur K, Busireddy NK, Osuri KK, Niyogi D. On the relationship between intensity changes and rainfall distribution in tropical cyclones over the North Indian Ocean. International journal of climatology. 2020 Mar 30;40(4):2015-25.
20. Srinivasulu R, Victor AS, Daniel KK, Richard M, Dannie R, Magesa AM, *et al*. Technical efficiency of traditional African vegetable production: A case study of smallholders in Tanzania. Journal of Development and Agricultural Economics. 2015 Mar 31;7(3):92-9.
21. Pandya AJ, Ghodke KM. Goat and sheep milk products other than cheeses and yoghurt. Small Ruminant Research. 2007 Mar 1;68(1-2):193-206.
22. Sindagi PS, Nair M. PFM. 53 Audit of management and prognosis of Isolated mild Ventriculomegaly in Aneurin Bevan University Health Board (ABUHB) from 2003 to 2012. Archives of Disease in Childhood-Fetal and Neonatal Edition. 2014 Jun 1;99(Suppl 1):A99-100.
23. Potarzycki J, Grzebisz W. Effect of zinc foliar application on grain yield of maize and its yielding compone. Plant, soil and environment. 2009 Dec 28;55(12):519-27.
24. Kala R, Gupta SP. Comparative response of some rabi crops to sulphur application in Ustipsamment soil of Haryana. Journal of the Indian Society of Soil Science (India). 1999;47(1):94-96.
25. Aulakh MS, Kabba BS, Baddesha HS, Bahl GS, Gill MP. Crop yields and phosphorus fertilizer transformations after 25 years of applications to a subtropical soil under groundnut-based cropping systems. Field Crops Research. 2003 Sep 15;83(3):283-96.