

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(7): 891-893
www.biochemjournal.com
Received: 04-04-2024
Accepted: 11-05-2024

Rishi Kumar Mund
M.Sc. Scholar, Department of
Agronomy, Naini Agricultural
Institute, Sam Higginbottom
University of Agriculture,
Technology and Sciences,
Prayagraj, Uttar Pradesh,
India

Jagdish Prasad Gurjar
M.Sc. Scholar, Department of
Agronomy, Naini Agricultural
Institute, Sam Higginbottom
University of Agriculture,
Technology and Sciences,
Prayagraj, Uttar Pradesh,
India

Jitendra Jitarwal
M.Sc. Scholar, Department of
Agronomy, Naini Agricultural
Institute, Sam Higginbottom
University of Agriculture,
Technology and Sciences,
Prayagraj, Uttar Pradesh,
India

Corresponding Author:
Rishi Kumar Mund
M.Sc. Scholar, Department of
Agronomy, Naini Agricultural
Institute, Sam Higginbottom
University of Agriculture,
Technology and Sciences,
Prayagraj, Uttar Pradesh,
India

Effect of nitrogen and foliar application of potassium on yield and economics of chickpea (*Cicer arietinum* L.)

Rishi Kumar Mund, Jagdish Prasad Gurjar and Jitendra Jitarwal

DOI: <https://doi.org/10.33545/26174693.2024.v8.i7Sl.1666>

Abstract

A field Experiment was conducted during *rabi* season 2023-24. at Crop Research Farm in department of agronomy (Shuats). The treatment consisted of treatments *i.e.*, Nitrogen (15, 20 and 25 kg/ha), foliar application Potassium nitrate (0.5, 1.0 and 2.0%) and control. The experiment was layout in Randomized Block Design (RBD) with ten treatment and three replicated. The treatment details are as follows T₁: Nitrogen – 15 kg/ha + 0.5% KNO₃, T₂: Nitrogen – 15 kg/ha + 1.0% KNO₃, T₃: Nitrogen – 15 kg/ha + 2.0% KNO₃, T₄: Nitrogen – 20 kg/ha + 0.5% KNO₃, T₅: Nitrogen – 20 kg/ha + 1.0% KNO₃, T₆: Nitrogen – 20 kg/ha + 2.0% KNO₃, T₇: Nitrogen – 25 kg/ha + 0.5% KNO₃, T₈: Nitrogen – 25 kg/ha + 1.0% KNO₃, T₉: Nitrogen – 25 kg/ha + 2.0% KNO₃, T₁₀: Control RDF- NPK 20:40:20. The results of the experiment revealed that the Application of Nitrogen (25 kg/ha) and Potassium nitrate (2.0%) recorded highest seed yield (2228.67 kg/ha), stover yield (3543.00 kg/ha). Maximum B:C ratio (2.50) was also recorded in same treatment, treatment No. 9 (Nitrogen – 25 kg/ha +2.0% KNO₃) in chickpea crop.

Keywords: Chickpea, nitrogen, potassium, yield and economics

1. Introduction

Chickpea is the most important source of protein as it plays an important role in human nutrition for large population in the developing world. Chickpea valued for its nutritive seeds with high protein content (18-22%), carbohydrate (52-70%), fat (4- 10%), minerals (Calcium, Phosphorus and Iron) and Vitamins. Chickpea plays a main role in increasing soil fertility due to its nitrogen fixing ability. It can fix up to 140 kg N ha⁻¹ in a growing period (Pooniya and Pithia, 2013) [9]. It leaves substantial amount of residual nitrogen for subsequent crops and adds plenty of organic matter to maintain and improve soil health and fertility.

The per capita per day protein requirement is 25 g. In order to supplement this need of protein about 120 g dal is essential in our daily diet. The protein content in chickpea is about 22%. It is good source of amino acids. The amino acid contains 0.44 mg lysine, 0.30 mg thiamine, 0.15 mg riboflavin, 2.9 mg niacin per kg chickpea seed. Chickpea seeds are good source of vitamin 'C' and minerals. Germinated seed is recommended against the scurvy disease. The protein content and amino acid composition vary with the variety, germination, environment and application of fertilizers. The protein content in pulses is almost double than that in cereals. The protein in chickpea is highly digestible (70-90%) (Sumera *et al.* 2009) [12].

Potassium application has been neglected in many countries, including India, which has resulted in soil K depletion in agricultural ecosystems and a decline in crop. yields (Regmi *et al.*, 2002) [11]. Potassium has been described as the “quality element” for crop production (Usherwood, 1985; Pettigrew, 2000) [13, 8]. Potassium increases the protein content of plants, the starch content in grains and tubers, Vitamin and the solid soluble contents in fruits. The crucial importance of K in quality formation confirms its role in promoting the production of photosynthates and their transport to storage organs such as fruits, grains and tubers and enhancing their conversion into starch, protein, vitamins and oil (Mengel and Kirkby, 2001) [6].

Nitrogen is one of the most important mineral nutrients for plants influencing growth, development, yield and protein content of grains (Heydari Sharifabad, 2012) [3]. It promotes shoot elongation, tillering and regeneration after defoliation and governs to considerable degree, the utilization of phosphorus, potassium and other elements in the plant. Nitrogen is the most limiting factor for high crop productivity but its use efficiency is low. Secondly, the application of increased doses of N increases cost of production. Nitrogen as known is very crucial to plants for its growth as it forms the basic structure of protein and nucleic acid which further plays important role in plant physiological phenomenon. Chlorophyll, the most important component, green color material of every plants and the one responsible for photosynthesis have the component nitrogen. Nitrogen is one or other way associated with proper functioning of plants.

2. Materials and Methods

This experiment was laid out during the *rabi* season of 2023-24 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The crop research farm is situated at 25° 39' 42" N latitude, 81° 06' 56" E longitude and at an altitude of 98 m above mean sea level. The experiment was layout in Randomized Block Design (RBD) with ten treatment and three replicated. The treatment details are as follows T₁: Nitrogen 15 kg/ha + 0.5% KNO₃, T₂: Nitrogen 15 kg/ha + 1.0% KNO₃, T₃: Nitrogen 15 kg/ha + 2.0% KNO₃, T₄: Nitrogen 20 kg/ha + 0.5% KNO₃, T₅: Nitrogen 20 kg/ha + 1.0% KNO₃, T₆: Nitrogen 20 kg/ha + 2.0% KNO₃, T₇: Nitrogen 25 kg/ha + 0.5% KNO₃, T₈: Nitrogen 25 kg/ha + 1.0% KNO₃, T₉: Nitrogen 25 kg/ha + 2.0% KNO₃, T₁₀: Control RDF- NPK 20:40:20 kg/ha. The observations were recorded for Seed yield (kg/ha), Stover yield (kg/ha) and Economics.

Treatment combination

Nitrogen – 15 kg/ha + 0.5% KNO ₃
Nitrogen – 15 kg/ha + 1.0% KNO ₃
Nitrogen – 15 kg/ha + 2.0% KNO ₃
Nitrogen – 20 kg/ha + 0.5% KNO ₃
Nitrogen – 20 kg/ha + 1.0% KNO ₃
Nitrogen – 20 kg/ha + 2.0% KNO ₃
Nitrogen – 25 kg/ha + 0.5% KNO ₃
Nitrogen – 25 kg/ha + 1.0% KNO ₃
Nitrogen – 25 kg/ha + 2.0% KNO ₃
Control RDF- NPK 20:40:20

3. Results and Discussion

3.1 Yield Parameter

3.1.1 Seed yield (kg/ha)

At harvest, significant and maximum seed yield (2228.67 kg/ha) was observed in treatment-9 with the application of Nitrogen – 25 kg/ha along with 2.0% KNO₃, which was significantly superior over rest of the treatments. However, treatment-8 Nitrogen – 25 kg/ha + 1.0% KNO₃ and treatment-6 Nitrogen – 20 kg/ha + 2.0% KNO₃ was found to be statistically at par with treatment- 9 Nitrogen – 25 kg/ha + 2.0% KNO₃.

Significant and higher grain yield was with application of Nitrogen (25 kg/ha) might be due to vigorous and enhanced plant growth and development of reproductive parts due to

continuous and synchronize supply of nitrogen throughout the growth stages of crop. Similar result was also reported by Kumar *et al.*, (2023) [5]. The application of potassium nitrate supplied N and K which are absorbed as anion and cation by plants, and might have delayed the synthesis of abscisic acid and promoted cytokinin activity causing higher chlorophyll retention which turn promoted more number of leaves and leaf area. This may secure higher photosynthetic activity in effective leaves and supplied developing pods with current photosynthates for proper filling, resulting in higher yield. Bhosale *et al.*, (2003) [1] Reddy *et al.*, (2004) [10] and Msaakpa *et al.*, (2011) [7] also reported similar results.

3.1.2 Stover yield (kg/ha)

At harvest, treatment 9 with the application of Nitrogen – 25 kg/ha along with 2.0% KNO₃ recorded significantly higher stover yield (3543.00 kg/ha) which was significantly superior over rest of the treatments. However, treatment-8 Nitrogen – 25 kg/ha + 1.0% KNO₃ and treatment-6 Nitrogen – 20 kg/ha + 2.0% KNO₃ was found to be statistically at par with treatment- 9 Nitrogen – 25 kg/ha + 2.0% KNO₃.

Significant and higher straw yield was with application of Nitrogen (25 kg/ha) might be due to adequate supply of nitrogen leads to higher photosynthesis and assimilation rate, metabolic activity and protein synthesis, which were responsible for increase in growth, grain and straw yield of crop. Similar results were also reported by Islam *et al.*, (2010) [4] in wheat. Further, significant and higher straw yield was with application of KNO₃ (2%) might be due to increased availability of KNO₃ in soil helps in absorption of other nutrients which led to improved functioning of physiological process and improves the straw content. Similar result was also reported by Banti and Debbarma (2023) [2].

3.1.3 Harvest index (%)

At harvest, maximum harvest index (38.60%) was observed in treatment-9 with the application of Nitrogen – 25 kg/ha along with 2.0% KNO₃, though there was non-significant difference among the treatments.

3.2 Economics

In Table 2 data pertaining to economics of growing as influenced by nitrogen and foliar application of potassium on chickpea has been exhibited. The common and variable cost of production has been given in table 2.

3.2.1 Cost of Production (INR/ha)

Cost of production (36050.00 INR/ha) was found to be highest in treatment 9 (with the application of Nitrogen – 25 kg/ha along with 2.0% KNO₃ as compared to other treatment.

3.2.2 Gross return (INR/ha)

Gross return (126269.16 INR/ha) was found to be highest in treatment 9 with the application of Nitrogen – 25 kg/ha along with 2.0% KNO₃ as compared to other treatment.

3.2.3 Net return (INR/ha)

Net return (90219.16 INR/ha) was found to be highest in treatment 9 with the application of Nitrogen – 25 kg/ha along with 2.0% KNO₃ as compared to other treatment.

3.2.4 B:C Ratio

Benefit Cost Ratio (2.50) was found to be highest in

treatment 9 with the application of Nitrogen – 25 kg/ha along with 2.0% KNO₃ as compared to other treatment.

Table 1: Influence of Nitrogen and foliar application of Potassium on yield of Chickpea.

S. No.	Treatment combinations	Yield		
		Seed yield (kg/ha)	Stover yield (kg /ha)	Harvest index (%)
1.	Nitrogen – 15 kg/ha + 0.5% KNO ₃	1137.08	3075.33	26.70
2.	Nitrogen – 15 kg/ha +1.0% KNO ₃	1057.30	3102.00	24.86
3.	Nitrogen – 15 kg/ha+ 2.0% KNO ₃	1074.54	3142.30	25.66
4.	Nitrogen – 20 kg/ha + 0.5% KNO ₃	1441.08	3163.67	30.79
5.	Nitrogen – 20 kg/ha +1.0% KNO ₃	1534.02	3172.00	32.53
6.	Nitrogen – 20 kg/ha +2.0% KNO ₃	1877.00	3458.00	34.77
7.	Nitrogen – 25 kg/ha + 0.5% KNO ₃	1606.20	3170.67	33.36
8.	Nitrogen – 25 kg/ha +1.0% KNO ₃	1720.17	3271.00	34.21
9.	Nitrogen – 25 kg/ha +2.0% KNO ₃	2228.67	3543.00	38.60
10.	Control RDF- NPK 20:40:20	1026.07	3049.85	23.89
	F-test	S	S	NS
	S.Em(±)	188.27	95.60	0.93
	CD (p=0.05)	559.29	284.01	-

Table 2: Economics of different treatments in Chickpea.

S. No.	Treatment combinations	Economics			
		Cost of cultivation (INR/ha)	Gross Return (INR/ha)	Net Return (INR/ha)	Benefit cost ratio
1.	Nitrogen – 15 kg/ha + 0.5% KNO ₃	35375.00	76289.81	40914.81	1.16
2.	Nitrogen – 15 kg/ha +1.0% KNO ₃	35500.00	72149.53	36649.53	1.02
3.	Nitrogen – 15 kg/ha+ 2.0% KNO ₃	35750.00	73274.49	37524.49	1.03
4.	Nitrogen – 20 kg/ha + 0.5% KNO ₃	35525.00	93017.14	57492.14	1.63
5.	Nitrogen – 20 kg/ha +1.0% KNO ₃	35650.00	98037.54	62387.54	1.75
6.	Nitrogen – 20 kg/ha +2.0% KNO ₃	35900.00	117841.00	81941.00	2.27
7.	Nitrogen – 25 kg/ha + 0.5% KNO ₃	35675.00	101897.31	66222.31	1.88
8.	Nitrogen – 25 kg/ha +1.0% KNO ₃	35800.00	108504.52	72704.52	2.04
9.	Nitrogen – 25 kg/ha +2.0% KNO ₃	36050.00	126269.16	90219.16	2.50
10.	Control RDF- NPK 20:40:20	34800.00	70215.64	35415.64	1.02

4. Conclusion

From the results, it is concluded that application of Nitrogen – 25 kg/ha along with foliar application of 2.0% KNO₃ (Treatment 9) in Chickpea has recorded maximum yield and benefit cost ratio.

5. References

- Bhosale VD, Deotale RD, Hmulwar SR, Raut SS, Kadwe SB. Effect of hormone and nutrients on morpho-physiological characters and yield of soybean. J Soils Crops. 2003;13(1):135-139.
- Banti, Debbarma V. Influence of potassium and zinc on growth, yield and economics of cluster bean (*Cyamopsis tetragonoloba* L.). Int J Plant Soil Sci. 2023;35(9):77-84.
- Heydari Sharifabad H. Crop physiology. Mashhad: Astan Quds Razavi (Behnashr); c2012.
- Islam MS, Kawochar MA, Karim MF, Ali MH, Islam MK. Response of chickpea to integrated nitrogen and irrigation management. J Exp Biosci. 2010;1:41-45.
- Kumar L, Singh R, Indu T. Influence of biofertilizer and phosphorus on yield and economics of chickpea (*Cicer arietinum* L.). Int J Environ Climate Change. 2023;13(8):793-797.
- Mengel K, Kirkby EA. Principles of plant nutrition. Dordrecht, Netherlands: Kluwer Academic Publishers; c2001.
- Msaakpa TS, Maiwa AZI, Obasi MO. Responses of cowpea to growth regulators on nodulation and yield. Int J Sci Res Publ. 2011;3(7):1-4. DOI: 10.29322/IJSRP.3.7.2011.p1250.
- Pettigrew WT. Potassium deficiency increased specific leaf weights and leaf glucose levels in field grown cotton. Agron J. 2000;91:962-968.
- Pooniya TC, Pithia MS. Pre- and post-emergence herbicides for weed management in chickpea. Indian J Weed Sci. 2013;45(3):223-225.
- Reddy JP, Narasimha Rao L, Narasimha Rao CL, Mahalakshmi BK. Effect of different chemicals on growth, yield and yield attributes of pigeon pea in vertisol. Ann Plant Physiol. 2004;17(2):120-124.
- Regmi AP, Ladha JK, Pasuquin E, Pathak H, Hobbs PR, Shrestha LL, *et al.* The role of potassium in sustaining yields in a long-term rice-wheat experiment in the Indo-Gangetic plains of Nepal. Biol Fertil Soils. 2002;36:240-247.
- Iqbal S, Asghari Bano. Water stress induced changes in antioxidant enzymes, membrane stability and seed protein profile of different wheat accessions. Afr J Biotechnol. 2009;8(23):6576-6587.
- Usherwood NR, Munson RD. The role of potassium in crop quality. In: Potassium in agriculture. Madison: American Society of Agronomy; c1985. p. 489-514.