



Effect of Integrated Nutrient Management on Quality and Nutrient Uptake by Chickpea (*Cicer arietinum* L.)

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/jeai/2024/v46i72567>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here:

<https://www.sdiarticle5.com/review-history/116149>

Received: 20/02/2024

Accepted: 23/04/2024

Published: 07/06/2024

Short Research Article

ABSTRACT

Chickpea (*Cicer arietinum*) is the most dominant pulse (Grain Legume crop) having a share of around 40 per cent in the general production. It is predominantly a crop of low rainfall areas but gives good yield under irrigated conditions also. Excessive rain soon after sowing or at flowering can harm the crop. It is a highly nutritious pulse and places third in the importance list of the food legumes. It contains 25% proteins, which is the maximum provided by any pulse. In chickpea, symbiotic nitrogen fixation, crop meets up to 80% of the soil's nitrogen needs, so farmers have to apply less nitrogen fertilizer than they do for other non-legume crops. The experiment was laid out in split plot design with three replications and by taking four treatments of RDF i.e. F1-100%NPK, F2-75%NPK, F3-50% NPK through inorganic and F4-Control as factor 1 in main plot and three

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Cite as: Namdeo, Suvarna, and GS Bhatnagar. 2024. "Effect of Integrated Nutrient Management on Quality and Nutrient Uptake by Chickpea (*Cicer Arietinum* L.)". *Journal of Experimental Agriculture International* 46 (7):<https://www.sdiarticle5.com/review-history/116149>. <https://doi.org/10.9734/jeai/2024/v46i72567>.

treatments of biofertilizer i.e. BF1-FYM (7.5t ha⁻¹) + Azospirillum (5 kg ha⁻¹) + PSB (5 kg ha⁻¹), BF2 Rhizobium (1.5 kg/ha + FYM (7.5 t/ha) +PSB (5 kg ha⁻¹) and BF3-PSB + 3.75t/ha Vermicompost+ PSB (5Kg/ha). Highest grain yield is of F1 (2046.22 kg/ha) and BF3 (1842.35 kg/ha) in RDF and biofertilizer treatment respectively. The maximum percentage of nitrogen, phosphorus and potassium content was found in F1 and BF3 respectively in the grain. The maximum protein content was recorded by F1 (23.80%) and BF3 (22.89%) in the grain.

Keywords: Integrated nutrient management; rhizobium; pulses; chemical fertilizers; organic manures.

1. INTRODUCTION

"Pulses are important source of vegetable protein, essential adjunct to predominantly cereal based diet and increase biology value of protein-consumed. Pulse supplies the building material for body and aids in the wear and tear tissues, which is a constant feature in the processes of life. they contain vitamin B, especially thiamine and folic acid and mineral too, which are so essential for maintaining health. No wonder, that pulses because of their specific quality, are called as 'Unique Jewels' of Indian crop husbandry" [1]. "Chemical fertilizers are playing a crucial role to meet the nutrient requirement of the crop, So there is need to change the trend of dependency on chemical fertilizer for high yield. Hence integrated nutrient management is applied to get better yield with minimum use of chemical fertilizers. Chickpea is grown in India either in admixture with cereals and other crop or as pure stand. It is cultivated as a winter crop in the tropics and spring or summer crop in temperate climates. The chickpea responds well to one to two irrigation only, applied at seedling and flowering stages of the crops growth, while yield reduction occurs with more than two irrigation" [2]. "Integrated nutrient supply or management systems involve efficient and really appropriate supply of all of the most important components of plant nutrients sources. A significant improvement in yield and organic nitrogen fixation because of Rhizobium inoculation has been reported in chickpea" [3]. "There is an urgent need to reduce the usage of chemical fertilizers and in turn increase in the usage of rhizobium which needed to check the yield and quality levels. Use of rhizobium alone does not result in spectacular increase in crop yields, due to their low nutrient status" [4].

2. MATERIALS AND METHODS

Field experiment was conducted during rabi season 2020-21 and 2021-22 at the field of Agronomy Department, School of Agricultural Sciences, Career Point University- Kota, situated in Southeast part of Rajasthan at an altitude of

579.5metre above mean sea level and at 24°35' N latitude and 73°42' E longitude. The region falls under agro- climatic zone V (humid Southeastern Plain) of Rajasthan.

The experiment was laid out in split plot design with three replications. Main plot treatments comprised of three field layouts viz.

Factor "A"

Main plot (RDF)

- F1- 100%NPK
- F2- 75%NPK
- F3- 50% NPK through inorganic
- F4- Control

Factor "B"

JNN

Sub Plot (bio fertilizer)

- BF1- FYM (7.5t ha⁻¹) + Azospirillum (5 kg ha⁻¹) + PSB (5 kg ha⁻¹)
- BF2- Rhizobium (1.5 kg/ha + FYM (7.5 t/ha) +PSB (5 kg ha⁻¹)
- BF3- Rhizobium (1.5 kg/ha) + 3.75t/ha Vermicompost+ PSB (5Kg/ha)

The recommended dose of fertilizer for chickpea (25:50:0 N: P₂O₅:K₂O kg ha⁻¹) was applied through inorganic fertilizers (urea, single super phosphate and muriate of potash), whereas farm yard manure and vermicompost were used as organic manures. The details of composition of organic manures are given in Table 1. The gross and net plot sizes were 6.00 m x 5.40 m and 5.5 m x 3.0 m, respectively. The treatments were allotted randomly to each plot in every replication by using random number.

3. RESULTS AND DISCUSSION

3.1 Total N.P.K. and Protein Content in Grain (%)

The data pertaining to average value of Nitrogen, Phosphorus, Potassium and Protein

Table 1. Nitrogen (%), Phosphorus (%), Potassium (%) and Protein (%) Content in Grain

S. No.	Factors	N content (%) in grain			P content (%) in grain			K content (%) in grain			Protein content (%) in grain		
		Rabi Season 2020-21	Rabi Season 2021-22	Pooled	Rabi Season 2020-21	Rabi Season 2021-22	Pooled	Rabi Season 2020-21	Rabi Season 2021-22	Pooled	Rabi Season 2020-21	Rabi Season 2021-22	Pooled
A	Fertilizers												
	F1	3.80	3.82	3.81	0.47	0.47	0.47	0.80	0.81	0.80	23.75	23.85	23.80
	F2	3.75	3.77	3.76	0.46	0.46	0.46	0.79	0.80	0.80	23.45	23.55	23.50
	F3	3.29	3.30	3.30	0.41	0.41	0.41	0.68	0.69	0.68	20.55	20.65	20.60
	F4	3.07	3.09	3.08	0.36	0.36	0.36	0.61	0.61	0.61	19.20	19.29	19.25
	SEm±	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.13	0.16	0.11
	C.D. at 0.05	0.07	0.08	0.05	0.01	0.01	0.01	0.01	0.02	0.01	0.43	0.50	0.33
	CV: F (%)	2.47	2.46	2.47	3.64	3.62	3.63	2.49	2.48	2.49	2.47	2.46	2.47
B	Biofertilizers												
	BF1	3.35	3.36	3.35	0.41	0.41	0.41	0.70	0.71	0.71	20.92	21.02	20.97
	BF2	3.43	3.45	3.44	0.41	0.41	0.41	0.71	0.72	0.71	21.45	21.55	21.50
	BF3	3.65	3.67	3.66	0.46	0.47	0.46	0.75	0.75	0.75	22.84	22.94	22.89
	SEm±	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.08	0.06
	C.D. at 0.05	0.04	0.04	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.27	0.23	0.16
	CV: BF (%)	1.47	1.46	1.46	2.57	2.56	2.56	1.56	1.54	1.55	1.47	1.46	1.46

Table 2. Nitrogen (Kg./ha), Phosphorus (Kg./ha), Potassium (Kg./ha) Content Uptake and Protein Yield (Kg./ha) by Grain

S. No.	Factors	N content (Kg./ha)			P content (Kg./ha)			K content (Kg./ha)			Protein yield (Kg/ha) by grain		
		Rabi Season 2020-21	Rabi Season 2021-22	Pooled	Rabi Season 2020-21	Rabi Season 2021-22	Pooled	Rabi Season 2020-21	Rabi Season 2021-22	Pooled	Rabi Season 2020-21	Rabi Season 2021-22	Pooled
A	Fertilizers												
	F1	77.64	78.94	78.29	9.61	9.77	9.69	16.26	16.65	16.46	485.27	493.37	489.32
	F2	74.07	75.35	74.71	9.13	9.28	9.21	15.65	16.00	15.82	462.95	470.91	466.93
	F3	53.53	54.63	54.08	6.68	6.81	6.74	11.08	11.38	11.23	334.59	341.44	338.02
	F4	40.18	41.17	40.67	4.73	4.84	4.78	7.92	8.17	8.05	251.13	257.30	254.22
	SEm±	1.19	1.38	0.98	0.18	0.21	0.14	0.23	0.27	0.19	7.44	8.65	6.09
	C.D. at 0.05	3.81	4.43	2.90	0.57	0.66	0.43	0.74	0.87	0.57	23.79	27.68	18.11
	CV: F (%)	7.76	7.67	7.71	9.38	9.28	9.33	7.27	7.20	7.23	7.76	7.67	7.71
B	Biofertilizers												
	BF1	56.48	57.60	57.04	6.89	7.02	6.95	11.87	12.18	12.03	353.01	360.00	356.51
	BF2	59.36	60.50	59.93	7.04	7.17	7.10	12.34	12.67	12.50	370.99	378.15	374.57
	BF3	68.23	69.46	68.85	8.69	8.84	8.76	13.97	14.31	14.14	426.46	434.11	430.29
	SEm±	1.17	1.02	0.72	0.14	0.13	0.09	0.25	0.22	0.15	7.30	6.35	4.48
	C.D. at 0.05	3.41	2.96	2.04	0.42	0.37	0.25	0.73	0.64	0.44	21.29	18.53	12.73
	CV: BF (%)	6.59	6.50	6.54	6.66	6.57	6.61	6.82	6.72	6.77	6.59	6.50	6.54

Content in Grain have been given in Table 1. A cursory glance over the Table 1 obviously revealed that the of Nitrogen, Phosphorus, Potassium and Protein Content in Grain were significantly influenced by RDF and bio-fertilizer treatment during 2019-20 and 2020-21. The maximum nitrogen , Potassium and Protein Content in Grain were recorded by F1 and it was significantly superior over F4 Under biofertilizer treatment maximum nitrogen Potassium and Protein Content in Grain recorded with BF3 which was statistically at par with BF2 but significantly superior over BF1.

3.2 Total NPK Uptake and Protein Yield by Grain (kg/ha)

The data pertaining to average value of nitrogen uptake have been given in Table 2. A cursory glance over the Table 2 obviously revealed that the nitrogen, Phosphorus, Potassium uptake and Protein yield in grain uptake were significantly influenced by RDF and bio-fertilizer treatment during 2019-20 and 2020-21. "The maximum nitrogen ,Phosphorus, Potassium uptake and Protein yield in grain were recorded by F1 and it were significantly superior over F4 while statistically on par with F2 and F3 ,Hence both treatments were not significantly different. Under biofertilizer treatment maximum nitrogen, Phosphorus, Potassium uptake (kg/ha) and Protein yield in grain recorded with BF3 which was statistically at par with BF2 but significantly superior over BF1" [5-8].

4. CONCLUSION

On the basis of present investigation, it may be concluded that: the application of 100%NPK (F1) and FYM (7.5t ha⁻¹) + Azospirillum (5 kg ha⁻¹) + PSB (5 kg ha⁻¹) given maximum percentage of nitrogen, phosphorus , potassium and Protein content in grain , as well as maximum Nitrogen, Phosphorus , Potassium Uptake and Protein Yield by grain.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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