Ann. Agric. Res. New Series Vol. 46 (3) : 275-279 (2025)

Effect of integrated nutrient management on growth, yield and quality of chickpea (*Cicer arietinum* L.)

Hari Narayan Jat[1]*, O. P. Sharma[1], Shantanu Kumar[1], Vaishali Chaturvedi[1], Gourav Singh[1] and Kunal Bhamboo[1]

Department of Agronomy, School of Agriculture, Suresh GyanVihar University, Jaipur-302017 Rajasthan, India
Corresponding Author's Email: harinarayan7993@gmail.com

Received: May 2025; Revised Accepted: August 2025

Abstract

Pulses are a major source of dietary protein, India is the largest producer, consumer and the importer of pulses in the world. Chickpea (*Cicer arietinum* L.) is the third important pulse crop in the world after french bean (*Phaseolus vulgaris* L.) and field pea (*Pisum sativum* L.). Integrated nutrient management (INM) is a judicious use of organic and inorganic sources of nutrient to crop fields for sustaining and maintaining soil productivity. Bio fertilizers are the inoculations of microbial cultures which are actually multiplied artificially of certain soil microorganisms that can improve soil fertility and crop productivity. Bio fertilizers are economical as their cost is very low and are also the renewable sources through which the plant gets nutrients which supplemented with chemical fertilizers. In the present work, experiment was laid out in a randomized block design with Integrated nutrient management (INM) on growth and yield of Chickpea (*Cicer arietinum* L.) with ten treatments and three replications, of recommended dose of fertilizers (50%, 75% and 100%), two type of organic manures (farm yard manure and vermi compost) and two type of bio fertilizers (*Rhizobium* and PSB) on chickpea variety GNG-1581. The experimental results showed that application of 50% RDF with 2 t vermi compost and PSB produced significantly higher plant height and dry matter accumulation at 40 DAS, 80 DAS and at harvest, effective nodules at 45 DAS, number of braches at 40 DAS, and no. of pods per plant, number of seeds per pod, test weight, seed yield, straw yield and biological yield and harvest index and net returns over control.

Key words: Chickpea, RDF, Bio fertilizer, Manure, Growth, Yield, Economics

Introduction

Pulses play a vital role in the human nutrition. Pulse have been functioning as the 'fertilizer factories' on the cultivated fields. In India most of the population are vegetarian and dependability on the pulses are much higher besides this the pulses enrich the soil through "symbiotic nitrogen fixation, from atmospheric nitrogen. Chickpea (*Cicer arietinum* L.) is the third important pulse crop in the world after french bean (*Phaseolus vulgaris* L.) and field pea (*Pisum sativum* L.), with an acreage of 14.56 m ha, production of 14.77 million tonnes and productivity of 885 kg ha^{-1}(FAO, 2021). It is an important pulse crop of the semi-arid tropics, particularly in the rainfed ecology of the Indian subcontinent, the Mediterranean region, the West Asian and North African region, Eastern Africa and Latin America. In India, it is the premier food legume crop covering about 9.85 m ha area with a production of 11.99 million tonnes and productivity of 1217 kg ha^{-1}(AICRPC, 2023).

The integrated plant nutrient supply system, by which we can apply the nutrients in balanced form, is emerging as the most logical concept for managing and sustaining long term soil fertility and productivity. INM, which entails the

maintenance of soil fertility to an optimum level for crop productivity to obtain the maximum benefit from all possible sources of plant nutrients both organics as well as inorganic in an integrated manner (Aulakh and Grant, 2008), is an essential step to address the twin concerns of nutrient excess and nutrient depletion.

Integrated nutrient management (INM) is a judicious use of organic and inorganic sources of nutrient to crop fields for sustaining and maintaining soil productivity. However, the use of appropriate and conjunctive use of application of suitable nutrients through organic and inorganic solely or in combination can provide the solutions to the problems such as increase in the price of inorganic fertilizers and deterioration effect of soil fertility and productivity. Hence, judicious application of these combinations can sustain the soil fertility and productivity.

Additionally, neither organic nor inorganic fertilizers alone by themselves can sustain production (Jat *et al*., 2015). According to reports, 100% application of organic manure enhances the pH, nitrogen, and carbon content of the soil but did not result in a high-quality crop production. In contrast, 100% use of inorganic fertilizer increased crop output but significantly decreased soil quality (Wu *et al*., 2022). Organic nutrients such as farm yard manure (FYM), vermi compost (VC), and enriched compost(EC) provides a direct source of carbon for soil bacteria which in turn can decompose the organic matters quickly and release more organic acids into the soil (Lakaria *et al*., 2012).

Beneficial effects of farm yard manure on crop production through improved fertility and physical properties of soil is an established fact (Shah and Ahmad, 2006) while organic sources such as vermi compost contains hormone-like substances that contributes to the amelioration of various stresses and boost the synthesis of CO_2 and humic compounds, which leads to an increase in microbial activity (Atik, 2013). Use of compost prepared through enrichment with various micronutrients or microorganisms have been proved to be the best remedies for maintaining soil health as well as productivity and for partial replacement of mineral fertilizer (Sutaria *et al*., 2010).

Materials and Methods

The experiment was conducted during *Rabi* 2024-25 at Research Farm, School of Agriculture, Suresh Gyan Vihar University, Jaipur (Rajasthan). Geographically, the study area is located at 75° 51′44" E longitude and 26°48′35′′N latitude and altitude of 427 m mean sea level.

The experiment was laid out in randomized block design with three replications. The treatments consisting three levels of recommended dose of fertilizers (50%, 75% and 100%), two type of organic manures (farm yard manure and vermi compost) and two type of bio fertilizers (rhizobium and PSB). Seeds of chick pea variety 'GNG-1581' were sown manually by 'Kera' method at rate of 100 kg ha^{-1} maintaining row distance of 30 cm and plant to plant distance 10 cm placed at depth of 5 cm and sowing was done on 14thNovember 2024. Fertilizers were placed beneath the seed, after placing the seed in furrows it was covered with soil for uniform germination and to protect from bird damage.

Chickpea crop was harvested from net plot of 3.0 m x 2.7 m= 8.1 m^2 separately, and taken from the particular plot when it reached physiological maturity. The plants from net plot were cut close to the ground, and spread out on the threshing floor to dry in the sun.

Results and Discussion

Effect of Integrated Nutrient Management

Data clearly showed that the growth attributes of chickpea were affected significantly by application of primary nutrients with vermi compost and PSB. Results revealed that application of 50% RDF with 2 t vermi compost and PSB significantly increased growth parameters viz., plant height at 80 DAS and at harvest, dry matter accumulation at 40 DAS, 80 DAS and at harvest, effective nodules, and number of branches 40 DAS over control (Table 1). One of the main factors limiting chickpea's growth and productivity is nutrient stress. The application of organic substances in terms of either vermicompost or FYM resulted in improvement of fertility status of soil, enhanced population of desired microbes in root zone during early stage of infection, release of bacterial cells

in the cortex plays a vital role in induction of nodule development. Improvement in plant height, nodulation and chlorophyll content with vermicompost may also be due to improved water holding capacity of the soil, which results in reduced water stress (Khurana *et al*., 1988), balanced supply of nutrients for longer period and improved nutritional environment under better soil condition. Similar finding were also reported by Ghanshyam *et al*., (2010), Choudhary *et al*., (2011), Singh *et al*., (2010), Amin *et al*., (2015) in chickpea and Sharma (2016) in mustard.

Table 2 indicated that primary nutrients with vermi compost and PSB significantly enhanced the number of pods/plant, seeds/pod, test weight, grain, stover, and biological yields, and the harvest index than control in enhancing yield characteristics and chickpea yield. The result revealed that treatment 50% RDF with 2 t vermi compost and PSB recorded significantly higher values of effective pods/plant, seeds/pod, test weight, than control.

It is probable to correlate the overall increase in crop growth caused by integrated nutrient application to improved root development of plant in the soil. The plant height varied from 40.55 to 47.69 cm among all the treatments. The highest plant height (47.69 cm) was recorded with application of 50% RDF with 2 t vermicompost and PSB(T_8) which was superior over other treatments. The highest dry matter accumulation in chickpea plant (28.95 g plant^{-1}) was registered with application of the treatment T_8 (50% RDF with 2 t vermi compost and PSB) which was significantly superior over all treatments. The effective nodules was found highest (19.77) in 50% RDF with 2 t vermi compost and PSB treatment T_8 which was significantly superior over all treatments. The number of branches was found highest (9.33) in treatment T_8 (50% RDF with 2 t vermi compost and PSB)

Table 1. Effect of Integrated nutrient management on growth attributes of chickpea.

Treatments	Plant height (cm)		Dry matter accumulation per metre row length (g)		Effective nodules	No. of branches
	60 DAS	At harvest	60 DAS	At harvest		
50% RDF	31.29	40.55	9.21	23.96	15.39	6.48
75% RDF	32.34	42.02	9.75	24.77	16.15	6.27
100% RDF	32.66	42.09	10.29	25.26	16.60	6.59
50% RDF+5 t FYM	33.05	43.90	10.81	25.86	17.25	6.72
50% RDF+ 2 t VC	34.11	44.47	11.35	26.79	18.10	7.84
75% RDF+5 t FYM	34.65	45.39	11.57	26.95	18.45	8.15
75% RDF+ 2 t VC	36.62	46.17	12.37	27.19	19.00	8.56
50% RDF+5 t FYM +Rhizobium	37.31	47.36	12.72	28.23	19.48	8.85
50% RDF+ 2 t VC+ PSB	37.43	47.69	13.34	28.95	19.77	9.33
SEm ±	1.40	1.54	0.77	0.99	0.82	0.70
CD (p=0.05)	4.22	4.64	2.32	2.99	2.47	2.11

Table 2. Effect of Integrated nutrient management on Yield attributes of chickpea.

Treatments	No. of pods/plant	No. of seeds per pod	Test weight (g)
50% RDF	41.07	1.13	129.84
75% RDF	42.05	1.21	136.84
100% RDF	42.77	1.28	142.81
50% RDF+5 t FYM	43.40	1.45	144.40
50% RDF+ 2 t VC	44.11	1.49	147.21
75% RDF+5 t FYM	45.59	1.58	150.11
75% RDF+ 2 t VC	45.91	1.61	152.39
50% RDF+5 t FYM +Rhizobium	46.93	1.59	154.40
50% RDF+ 2 t VC+ PSB	47.38	1.65	156.37
SEm ±	1.39	0.13	5.09
CD (p=0.05)	4.17	0.39	15.26

Table 3. Effect of Integrated nutrient management on Yield of chickpea.

Treatments	Grain Yield (kg/ha)	Strover Yield (kg/ha)	Biological Yield (kg/ha)	Harvest index (%)
50% RDF	1641	1935	3337	45.80
75% RDF	1763	1958	3406	47.26
100% RDF	1884	2022	3652	48.18
50% RDF+5 t FYM	1959	2066	3601	48.63
50% RDF+ 2 t VC	2032	2106	3690	49.06
75% RDF+5 t FYM	2017	2133	3780	48.51
75% RDF+ 2 t VC	2088	2207	3859	48.57
50% RDF+5 t FYM +Rhizobium	2161	2285	3954	48.58
50% RDF+ 2 t VC+ PSB	2293	2359	4068	49.28
SEm ±	122	82	149	2.03
CD (p=0.05)	366	246	446	6.11

which was significantly superior over all treatments. The number of pods/plant were significantly increased under treatment 50% RDF with 2 t vermicompost and PSB(T_8) which was superior over all treatments. The pods/plant ranged from 41.07 to 47.38. The seeds/pod of chickpea was significantly increased under T_8 (50% RDF with 2 t vermicompost and PSB) as compared to other treatments. It can be inferred from the data that grain weight pod^{-1} of chickpea was significantly influenced by different treatments. Fertilizing chickpea with 50% RDF +2 t vermicompost + PSB recorded significantly higher test weight pod^{-1} (156.37 g). The different nutrient practices had significant effect on grain yield. Significantly higher grain yield of 2293 kg/ha was recorded under 50% RDF with 2 t vermicompost and PSB. The stover yield recorded after harvest of the chickpea crop as influenced by integrated nutrient management. The highest stover yield 2359 kg/ha was recorded under 50% RDF with 2 t vermicompost and PSB(T_8). The biological yield of chickpea was increased due to 50% RDF with 2 t vermi compost and PSB over control. Significantly superior biological yield was obtained (T_8) over control. The harvest index of chickpea was not influenced significantly due to integrated nutrient management practices. However, higher and lowest harvest index was recorded under 50% RDF with 2 t vermi compost and PSB and 50% RDF, respectively.

Conclusion

Based on results of one year experiment, it may be concluded that application of 50% RDF with 2 t vermicompost and PSB produced significantly higher seed, straw and biological yield and net returns as compared to other treatments.

Therefore, application of 50% RDF with 2 t vermi compost and PSB may be recommended for higher production and profitability of chickpea under semi- arid condition of Rajasthan.

References

Anonymous.2021. Annual Reports All India Coordinated Research Project on Chick pea.

Amin, A.M. and Mohgadasi, M.S. 2015. The interaction effect of nitrogen and vermicompost on chickpea yield and yield component in hamedan reason. *Biological Forue*, **7**(2): 812-816.

Aulakh, M. and Grant, C. 2008. Environment and Agriculture, CRC Press, Boca Raton, : 612-622.

Choudhary, H.R., Sharma, O.P., Yadav, L.R. and Choudhary, G.L. 2011. Effect of organic manure and chemical fertilizers on productivity of mungbean. *Journal of Food Legume*, **24**(4): 324-326.

Lakaria, B. L., Patne, M. K., Jha, P. and Biswas, A. K. (2012). Soil organic carbon poolsand indices under different land use systems in Vertisols of Central India. *Journal of the Indian Society of Soil Science*, 60(2):125-131.

Jat, L. K., Singh, Y. V., Meena, S. K., Meena, S. K., Parihar, M., Jatav, H. S. and Meena, V. S. (2015). Does integrated nutrient management enhance agricultural productivity. *J Pure Appl Microbiol*, 9(2):1211-1221.

Khurana, A.S., Bhandari, S.C., Gupta, R.A. and Arora,

B.S. 1988. Effect of water stress on growth and nitrogen fixation in mong bean. *Journal Research* PAU, **25**: 250-256.

Singh, G., Sekhon, H.S., Hari Ram and Sharma, P. 2010. Effect of farm yard manure, phosphorus and phosphate solubilizing bacteria on nodulation, growth and yield of *kabuli* chickpea. *Journal of Food Legumes,* **23**(3-4): 226-229.

Sharma, J. 2016. Influence of vermicompost and different nutrient on performance of Indian mustard [*Brassica juncia* (L.) czern and cross] in *Typic Haplusters*. M.Sc. (Ag.) Thesis, Maharana Pratap University of Agricultural and Technology, Udaipur.

Sutaria, G. S., Akbari, K. N., Vora, V. D., Hirpara, D.S. and Padmani, D. R. (2010). Response of legume crops to enriched compost and vermi compost on verticustochrept under rain fed agriculture. *Legume Research-An International Journal*, 33(2):128-130.

Wu, W.; Lin, Z.; Zhu, X.; Li, G.; Zhang, W.; Chen, Y. and Zhang, D. (2022). Improved tomato yield and quality by altering soil physicochemical properties and nitrification processes in the combined use of organic-inorganic fertilizers. *European Journal of Soil Biology*, 109: 103-384.