



ISSN (E): 2277-7695  
ISSN (P): 2349-8242  
NAAS Rating: 5.23  
TPI 2023; 12(8): 2509-2511  
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[www.thepharmajournal.com](http://www.thepharmajournal.com)

Received: 12-06-2023

Accepted: 16-07-2023

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## Effect of customized fertilizers (CFG) on scaling up productivity and profitability of chickpea under agro climatic condition of Manipur

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### Abstract

A field experiment was conducted during the winter (rabi) seasons of 2019-20 and 2020-21 at Imphal, Manipur, to study the effect of customized fertilizer (NPKSZnMo) on performance of chickpea (*Cicer arietinum* L.). The experiment was laid out in a thrice replicated randomized block design. Different doses of customized fertilizer were used in the study. The customized fertilizer (CF)–combination of N, P, K, S, Zn and Mo mixture–significantly influenced yield attributes and seed yield. The highest seed yield (1141 kg/ha), biological yield (4276 kg/ha) and the highest net returns (Rs 37,682/ha) were obtained with the application of 125% CF dose. However, in terms of benefit: cost (B:C) ratio, application of 75% CF resulted in nearly equivalent value of 1.28 with that of 125% CF dose. Hence, application of 75% CF dose can be considered as optimum for chickpea under agro climatic conditions of Manipur

**Keywords:** Chickpea, customized fertilizer, economics, benefit cost ratio

### Introduction

Pulses are an essential part of the diet of humans as an excellent protein source and are crucial for agricultural sustainability because they improve the soil by biologically fixing roughly 40–50% of nitrogen per hectare. (Hariprasanna and Bhatt, 2002) [3]. Pulses are an excellent source of protein, carbs, dietary fiber, vitamins, minerals, and phytochemicals, which help feed the world's billions of people. About 33 percent of the world's land area was cultivated for pulses, and 27 percent or so of the world's food supply came from them. India accounts for 25 percent of global production and is both a major producers as well as consumers of pulses. In India, the most valuable pulse crop is *Cicer arietinum* L. The chickpea is a member of the Fabaceae family and the Faboideae subfamily. There are two different varieties of chickpea: the Desi chickpea and the Kabuli chickpea. Fertilizers in particular N, P, and K, are crucial for boosting pulse crop output. India is the 2<sup>nd</sup> largest consumer of fertilizer in the world (Tiwari, 2010) [8]. It is necessary to externally apply sufficient amounts of additional plant nutrients for every additional ton of food grain production. Nutrient mining is regarded as one of the major factors contributing to the loss in crop yield and productivity because of the unbalanced utilization of nutrients by plants. The disposal of crop waste and animal manure for other uses worsens negative nutrient budgets. Like other pulse crops, the chickpea (*Cicer arietinum* L.) is an important primary food source in many developing nations. Chemical fertilizers are an essential input in chickpea farming since they are the most crucial component. Due to shortage of awareness regarding the nutritional needs of legumes based on soil-test values for micronutrients as well as macro nutrients, farmers typically apply chemical fertilizers to pulse crops, particularly chickpea, in an imbalanced and inadequate dose, resulting in significant loss of vegetation, soil, and ecological systems. One of the best solutions to this issue is the application of customized fertilizer. The term "customized fertilizer" refers to multi-nutrient carrier that comprise macro, secondary, as well as micronutrients from both organic and inorganic sources. To get the desired percentage of N, P, K, S, and micronutrients in the customized fertilizers, urea, DAP, MOP, ZnS, bentonite sulphur, and boron granules must be combined and crushed (Rakshit *et al.* 2012) [6]. The potential for sustaining soil health through appropriate fertilization is great for crop, soil, and site specific customized fertilizers (Tiwari, 2010) [8]. Customized fertilizers are a new category of area/soil/crop specific fertilizers that have been added by the Central Fertilizer Committee to the FCO 1985.

The relevance of customized fertilizers is acknowledged by Fertilizer (Control) Order (FCO), and the method for developing customized fertilizers is complicated but extremely promising. Customized fertilizers have the same price as regular fertilizers. Customized fertilizers make it easier to apply the full spectrum of plant nutrients in the right amounts, meet the unique needs of a crop at various growth stages, and are more pertinent when used in conjunction with site-specific nutrient-management techniques. In light of the aforementioned circumstances, a study was conducted to determine the impact of customized fertilizers on scaling up production and profitability of chickpeas.

### Materials and Methods

The trial was initiated during the *rabi* season, 2020-21. This was the first year of trial. The crop was sown on November 27, 2020 with five treatments viz., RDF (recommended level of NPK), RDF1 (Recommended level of NPKSZnMo), CFG1 (NPKSZnMo) based on recommendation (100%), CFG2 (NPKSZnMo) based on recommendation (75%) and CFG3 (NPKSZnMo) based on recommendation (125%). The chickpea variety GL-13001 was used as test crop. The soil of the experimental site was clay loam having pH 5.8 with 0.48% organic carbon content. The available Nitrogen, Phosphorus and Potassium content in the soil was found to be 188.8 kg/ha, 45.95 kg/ha and 478.46 kg/ha respectively. The average temperature recorded were 19.45 °C with average relative humidity at morning and evening of 86.34% and 50.48% respectively. Average rainfall received during the trial was 17.48 mm with an average of 2.06 number of rainy days and average sunshine hours of 6.65 hrs. The analysis of variance methodologies described by Gomez and Gomez (1984) [9] were used to compute the data obtained on the experiment's many elements. Every time there were significant treatment differences, the treatment critical differences at the 5% probability level were calculated. While NS was used to indicate non-significant results.

### Results and Discussion

#### Effect of customized fertilizer on growth and yield of chickpea

Data on growth and yield of chickpea are presented in the Table 1. In all the treatments, effect of customized fertilizers on plant height was significantly different, highest value was recorded under CFG1 (NPKSZnMo) based on recommendation (100%) (47.85 cm) followed by CFG3 (NPKSZnMo) based on recommendation (125%) (47.30 cm). And lowest was observed under RDF1 (Recommended level of NPKSZnMo) (42.50 cm) followed by RDF (recommended level of NPK) and CFG2 (NPKSZnMo) based on

recommendation (75%) with same value 45.00 cm. The above results may be obtained due to increased nutrient uptake of the plant due to the recommended dose of fertilizers and micronutrients. Similar result was observed by Dwivedi *et al.* (2019) [1] in chickpea. The greatest number of branches per plant was recorded in CFG3 (NPKSZnMo) based on recommendation (125%) followed by RDF1 (Recommended level of NPKSZnMo) and the least number branches per plant was observed in RDF (recommended level of NPK) which may be due to the lower availability of micro and macro nutrients in RDF (Recommended dose of fertilizer). Similar results were observed by Maliwal *et al.* (1985) [4] in finger millet. The highest numbers of pods per plant (19.90) were observed in CFG1 (NPKSZnMo) based on recommendation (100%) and lower number of pods plant per pod (14.80) observed in RDF (recommended level of NPK). The higher rate of photosynthesis, translocation and assimilation of metabolites in the sink ultimately increased the number of pods plant per pod. Similar results were reported by Dwivedi *et al.* (2019) [1]. The seeds per pod was found to significantly superior in RDF1 (Recommended level of NPKSZnMo) followed by CFG1 (NPKSZnMo) based on recommendation (100%) and lowest in RDF (Recommended dose of fertilizer). The 100 seed weight is found to be non-significant under all the treatments. The maximum seed yield (1141.36 kg/ha) was observed in CFG3 (NPKSZnMo) based on recommendation (125%) followed by CFG1 (NPKSZnMo) based on recommendation (100%) (1125.71 kg/ha) and minimum seed yield was observed in RDF (Recommended dose of fertilizer) (940.39 kg/ha). This was due to the fact that the crop has not experienced nutrient stress at any growth stage because of balanced nutrition and improved vegetative growth and growth parameters. Similar results have been reported by Sekhon *et al.* (2012) [7]. The utmost harvest index (30.46%) was recorded in CFG3 (NPKSZnMo) based on recommendation (125%) followed by (27.78%) CFG1 (NPKSZnMo) based on recommendation (100%) and lowest in RDF (recommended level of NPK) (20.37%). This might be due to higher accumulation of photosynthates and translocation of nutrient to economic part of the crop. Similar results were observed by Nandan *et al.* (2018) [5].

#### Effect of customized fertilizer on economics of chickpea

Regarding the gross returns, net returns and B: C ratio highest was recorded in CFG3 (NPKSZnMo) based on recommendation (125%) with the values Rs. 68481.45/ha, Rs. 37682.17 and 1.32 respectively and lowest in RDF (recommended level of NPK) with the values of Rs. 56423.52/ha, Rs. 2335.17/ha and 1.15 respectively. However, B: C ratio is found to be non-significant.

**Table 1:** Effect of customized fertilizer on growth and yield of chickpea

Treatment	Plant height (cm)	Branches per plant	Pods/plant	Seeds/pod	100 seed weight (g)	Seed yield (kg/ha)	Biological yield (kg/ha)	Harvest Index
RDF (recommended level of NPK)	45.00	6.70	14.80	1.38	23.10	940.39	4648.90	20.37
RDF1 (Recommended level of NPKSZnMo)	42.50	7.90	16.10	1.43	22.65	1023.14	4276.29	24.14
CFG1 (NPKSZnMo) based on recommendation (100%)	47.85	7.75	19.90	1.42	20.46	1125.71	4086.28	27.78
CFG2 (NPKSZnMo) based on recommendation (75%)	45.00	7.30	15.75	1.38	22.64	1024.81	4276.29	24.36
CFG3 (NPKSZnMo) based on recommendation (125%)	47.30	8.55	16.90	1.32	21.57	1141.36	3780.97	30.46
S.Em±	1.14	0.34	1.06	0.04	0.84	44.84	309.17	1.18
CD at 5%	3.50	1.05	3.27	NS	NS	137.84	NS	3.62

**Table 2:** Effect of customized fertilizer on economics of chickpea

Treatment	Gross returns (Rs/ha)	Net Returns (Rs/ha)	BC ratio
RDF (recommended level of NPK)	56423.52	23335.17	1.18
RDF1 (Recommended level of NPKSZnMo)	61388.55	24076.80	1.15
CFG1 (NPKSZnMo) based on recommendation (100%)	67542.39	37282.17	1.28
CFG2 (NPKSZnMo) based on recommendation (75%)	61488.45	31767.29	1.28
CFG3 (NPKSZnMo) based on recommendation (125%)	68481.45	37682.17	1.32
S.Em±	2690.17	2690.17	0.10
CD at 5%	8270.39	8270.39	NS

### Conclusion

Based on the data, we can conclude that the application of customized fertilizer CFG3 (NPKSZnMo) based on recommendation (125%) resulted in 21 per cent yield enhancement over the recommended dose of fertilizer and is found to be most effective customized fertilizer as compared to other treatments. However, application of 75% CF dose can be considered as economic optimum for chickpea under agro climatic conditions of Manipur.

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