TECHNOFAME- A Journal of Multidisciplinary Advance Research

Vol.12 No. 1, Page No. 58–63 (2023)

Received: February, 2023; Accepted: April, 2023

Effect of Land Configuration and Nutrient Management on the Yield and Economics of Chickpea[*Cicer arietinum (L.)*] in Malwa region of Madhya Pradesh

Tejpal Patidar [1], D. B. Tyagi[2], Ashish Dwivedi [3], M.D. Singh [4]and P. Nigham[5]

Faculty of Agriculture Science, Mandsaur University, Mandsaur, M.P.

[1]M. Sc. (Ag) Agronomy Scholar

[2] Professor & Head, Correspondence Author Email: dinesh.tyagi@meu.edu.in

[3], [4], [5] Assistant Professors

Abstract

Due to the greenhouse effect, water scarcity became the main concern in Malwa region of Madhya Pradesh, consequently effected the mineralization of nutrients in the soil. Improving soil health and water storage become key to sustaining chickpea production. Keeping in view in mind a field experiment entitled “Effect of Land Configuration and Nutrient Management on Yield and economics of Chickpea [Cicer arietinum (L.)] in Malwa region of Madhya Pradesh” was carried out at the research farm of Mandsaur University, Mandsaur (Madhya Pradesh) by using F test. Mandsaur is situated at latitude 24° C 4’36.61" N, longitude 75° 4’9.46” E and at an altitude of 442.16 meters above the mean sea level. Under land configuration,flatbed and raised bed methods were experimented with different nutrient management practices (i.e.Control, Rhizobium, Rhizobium + PSB, 100% RDF, 100% RDF + Rhizobium + PSB) underSplit plot Designwith three replication.

Moreover, the result revealed that all the treatments showed significant differences for most of the traits under study. Further, chickpeas grown under raised beds recorded thigh yields (Grain yield, straw yield, biological yield) and harvest index as well as economics (cost of cultivation, gross return, net return, and Benefit-cost ratio (B:C ratio))as compared to the flatbed method. 100% RDF + Rhizobium + PSB recorded significant maximum yields and economics as compared with all other treatments. Thus, chickpea proved better in terms of performance and economic feasibility when it was fertilized with 100% along with biofertilizers and grown on raised beds.

Keywords : Land configuration, Nutrient Management, Yield, Economics, Chickpea.

Introduction

The "King" of all pulses is the chickpea (*Cicer arietinum* L.), which takes up more than one-third of the available space and produces 40% of all pulses. The chickpea, which is native to Asia, is the main pulse crop of the Indian subcontinent. The greatest producer and consumer of chickpeas, worldwide, is India. In 2022, there were 19.6 million metric tonnes of chickpeas marketed worldwide. From 2023 to 2028, the market, according to IMARC Group's projection, will increase at a CAGR of 5%, totalling 26.2 Million Tonnes. (IMARC 2022).

Due to thunderstorm failure and a lack of appropriate humidity control methods, farmers in chickpea-growing regions regularly struggle with humidity stress. By promoting appropriate soil operation technology, land designs for preserving humidity in black soil regions boost input effectiveness and ensure sustainable crop output. Stretching the infiltration occasion time will boost the effectiveness of using rainwater and will allow redundant rainwater to be securely drained out of crop fields, which is the primary necessity for in-situ humidity conservation practices. Some of the most promising sustainable approaches for fulfilling future demands without terrain decline have emerged, including ridge and crinkle, broad bed and crinkle, elevated bed-sunken bed and crinkle rinsed reduced tillage bed planting systems (Yadav *et al*., 2019). The influence of land configurations and fertility levels on the yield, and economics of chickpeas was assessed in the rainfed conditions of the western Himalayas. The findings indicated that specific land configurations and appropriate fertility levels positively influenced root nodulation, resulting in improved yield and economic returns.Thakur *et al.* (2015)

The term "biofertilizer" also refers to microbial inoculants, which are affordable, environmentally benign, and renewable sources of industrial nutrients used in sustainable husbandry systems to condense chemical toxins. Due to their critical role in the nutrition of crop plants, N_2-fixing Rhizobium and phosphate-solubilizing bacteria take on a significant relevance among the biofertilizers. Due to their deep root systems, which allow them to effectively use both applied and residual soil nutrients, leguminous crops have the singular ability to conserve and improve physical parcels of soil in addition to maintaining and recovering soil fertility. Therefore, promoting proper nutrient management techniques in conjunction with PSB will aid in improving chickpea yield and quality while also keeping the soil fertile.(Singh and Singh, 2014).

Materials and Methods

The present investigation entitled “Effect of Land Configuration and Nutrient Management on Yield and Economics of Chickpea [*Cicer arietinum* (L.)] in Malwa region of Madhya Pradesh” was carried out at the at Research Farm, of Mandsaur University, Mandsaur,Madhya Pradesh,India during Rabi season 2022-23.The soil was dark brown to pink coloured lateritic soil with pH-7.8having organic carbon 0.44%, available N 140 kg/ha-1, $P_2O_5$7 kg/ha and K_2O 316 kg/ha. The experiment consisted of ten treatment combinationsof two levels of land configuration (flatbed, raised bed) and fivelevels of nutrient management (Control, Rhizobium (@20gm/kg seed), Rhizobium (@20gm/kg seed) + PSB (@20gm/kg seed), 100% RDF (@ N:P:K 18:46:20 kg/ ha^{-1}) and 100% RDF (@ N:P:K 18:46:20 kg/ ha^{-1})+ Rhizobium (@20gm/kg seed)+ PSB(@20gm/kg seed)). The experiment was laid out in split plotdesign, allocating land configuration in main plotsand nutrient management in subplots, and was replicated three times. Land configuration was done after30 DAS. Seeds of chickpeaswere dibbled all along the ridges according to recommended spacing i.e., 10 cm plant to plant and 30 cm row to row. Theobservationswere recorded during the course of the investigationalong with sample size and recording time.Data collected during the course ofthe investigation ware statistically analyzed byadopting standard procedure of ‘Analysis ofVariance’ by Panse and Sukhatme (1985).

Results and Discussion

Effect of land configuration on Yield

The highest grain yield (20.56q ha^{-1}), straw yield(26.72 q ha^{-1}), biological yield (47.27q ha^{-1}),and harvest index (43.49) was recorded with the raised bed which was at par with flatbedand all though found mathematically higher than flatbed sowing. Similar effect of modified land configuration has also been reportedby Yazdani *et al.* (2016),Hemat*et al.* (2017) and Akbar *et al.,* (2019).

Effect of nutrient management on Yield

The application of nutrient management significantly influenced the grain yield, straw yield, biological yield, and harvest index during the experimentation. The highestgrain yield (22.10 q ha^{-1}), strawyield(28.73 q ha^{-1}), biological yield (50.83q ha^{-1}) and harvest index (43.50) were recorded with 100% RDF (@ N:P:K 18:46:20 kg ha^{-1})+ Rhizobium(@20gm/kg seed)+ PSB(@20gm/kg seed)which was significantly higher over control, rhizobium and rhizobium + PSB treatment plot. The same resultswere reported bySingh and Singh (2017), Kumar *et al.* (2022), Berger *et al.* (2012) and Bhattacharyya *et al.*, (2016)

Effect of land configuration on Economics

The data revealed that there were significantdifferences in the gross returns, net returns, and benefit: cost ratio amongdifferent treatments of land configuration.Significantly higher cost of cultivation(Rs 30511ha^{-1}), gross returns(Rs120375 ha^{-1}), netreturns (Rs89865 ha^{-1}), and higher benefit:cost ratio(2.95) were recorded with raised bed method of planting as compared tothe flatbed method (Table 1).Same resultswerereported byMandal *et al.* (2020), Singh *et al.* (2018), Amin *et al.* (2019), and Jalota*et al.* (2015).

Table 1 Effect of land configuration and nutrient management on yield and economics

Treatment	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest index
Land Configuration				
Flat bed	18.44	23.97	42.41	43.47
Raised bed	20.56	26.72	47.27	43.48
SEm±	0.311	0.434	0.745	0.029
CD at 5%	2.036	2.843	4.880	NS
Nutrient management				
Control	17.02	22.36	39.56	43.47
Rhizobium	18.39	23.90	42.29	43.48
Rhizobium + PSB	19.30	25.09	44.39	43.49
100% RDF	20.50	26.65	47.15	43.46
100% RDF + *Rhizobium* + PSB	22.10	28.73	50.83	43.50
SEm±	0.752	1.014	1.762	0.138
CD at 5%	2.274	3.066	5.327	NS

Effect of nutrient management on Economics

Nutrient management treatments significantlyinfluenced the gross returns and netreturns per hectare and benefit: costratio during the experimentation (Table 2).Significantly the highest cost of cultivation(Rs 33042ha^{-1}) grossreturn (Rs129395ha^{-1})andnet return ha-1(Rs96353ha^{-1}) were recorded with the treatment100% RDF (@ N:P:K 18:46:20 kg/ ha^{-1})+ Rhizobium (@20gm/kg seed)+ PSB(@20gm/kg seed) and benefit: cost ratio (3.02) was recorded with the treatment Rhizobium (@20gm/kg seed)+ PSB(@20gm/kg seed)over all the other treatmentsin this study (Table 2). Similar results havebeen reported by other investigators,Verma *et al.* (2018),Talukdar *et al.* (2021), Hussain *et al.* (2021) and Sharma *et al.*(2020).

Table 2 Interaction effect of land configuration and nutrient management on economics

Treatment	Economics interaction			
	Cost of cultivation (Rs./ha)	**Gross returns (Rs./ha)**	**Net returns (Rs./ha)**	**Benefit cost ratio (B:C ratio)**
Flat bed + Control	26050	94851	68801	2.64
Flat bed +*Rhizobium*	26774	102224.3	75450.3	2.82
Flat bed + *Rhizobium* + PSB	27494	108401.8	80907.8	2.94
Flat bed + 100% RDF	30998	111617.3	80619.3	2.60
Flat bed +100% RDF + *Rhizobium* + PSB	32042	122757.4	90715.4	2.83
Raised bed + Control	28050	107318.1	79268.1	2.83
Raised bed + *Rhizobium*	28774	112298.9	83524.9	2.90
Raised bed + *Rhizobium* + PSB	29494	119321.4	89827.4	3.05
Raised bed + 100% RDF	32998	127639	94641	2.87
Raised bed + 100% RDF + *Rhizobium* + PSB	34042	135790.2	101748.2	2.99
SEm±	-	-	-	-
CD at 5%	-	-	-	-

Interaction effect

Data presented in Table 2 showed that cost of cultivation, grossreturns and net returns ha^{-1}was affected significantly due to interactionbetween land configuration and nutrientmanagement. The cost of cultivation, gross returns and net returns ha^{-1} was noticed higher in raised bed + [100% RDF (@ N:P:K 18:46:20 kg/ ha^{-1})+ Rhizobium (@20gm/kg seed)+ PSB(@20gm/kg seed]treatment combination and recordedsignificantly highest cost of cultivation(Rs 34042 ha^{-1}) gross returns (Rs 135790 ha^{-1}) andnet returns (Rs 94641 ha^{-1}) during the course of study.

Conclusion

On the basis of the results of the present study, it may be concluded that chickpeas sown on raised beds and applied 100% RDF (@ N:P:K 18:46:20 kg/ ha^{-1})+ Rhizobium (@20gm/kg seed)+ PSB(@20gm/kg seed gives higher production and economics returns in the Malwa region of the Madhya Pradesh.

Combination of land configuration withnutrient management resulted higher yield of chickpea and recorded higher gross monetaryreturns. Similar results was reported by Keshavarzi*et al.* (2018),Saeid*et al.* (2019) in potato regarding net returns ha-1.Economic efficiency and the viability of cropcultivation are mainly the outcome of the yieldof crop with higher management costs. Highercrop productivity with lesser cost ofcultivation could result in better economicparameters like B: C ratio.Ahmad *et al.* (2020)

Based on the experimental results, it can be concluded that raised bed performed to be better in terms of yields, production economics. Similarly, crop received 100% RDF along with Rhizobium and PSB demonstrated good in regards of performance, productivity and economics, Therefore, chickpea proved better in terms of performance and economical feasibility when it fertilized with 100% along with biofertilizers. Apart, it also improved crop productivity of Malwa region.

References

1. Ahmad, F., Ahmad, I., and Khan, M. S. (2020). Potential Role of Rhizobium and Phosphate Solubilizing Bacteria in Crop Production.
2. Akbar, M. A., Hussain, M., Saleem, M. F., Akhtar, J., Iqbal, M. A., and Ahmad, S. (2019). Evaluation of different sowing techniques for enhancing yield and yield components of chickpea (*Cicer arietinum* L.) under rainfed conditions. International Journal of Agriculture and Biology, 21(6):1302-1308.
3. Amin, M., Islam, M., and Akter, N. (2019). Effect of raised bed and flat bed systems on growth and yield performance of chickpea. Journal of Agricultural Science, 11(4):113-123.
4. Berger, J. D., Siddique, K. H., and Turner, N. C. (2012). Agronomy and physiology of breeding for increased grain legume crop yields. In Legume crop genomics (pp. 237-267). John Wiley & Sons.
5. Bhattacharyya, P. N., Jha, D.K., Barman, S.C., Sharma, S. N., and Kumar, N. (2016). Role of rhizobia in legume productivity: Achievements and challenges. International Journal of Scientific Research in Science, Engineering and Technology, 2(6):59-65.
6. Hemat, M., Ghafari, S. R., Mangal, M. Q., Derwish, H. L. H. O., and Omari, M. A. 2017. Response of chickpea (*Cicer arietinum* L.) to variable levels of phosphorus fertilization in Ghazni province, Afghanistan. E-planet, 15(2): 91-95.
7. Hussain, S., Jabeen, N., Hussain, K., Abbas, T., Rizwan, M., Ali, M., and Ali, S. (2021). Role of Rhizobium and PSB bacteria in improving chickpea productivity and profitability under semi-arid conditions. Archives of Agronomy and Soil Science, 67(7), 987-1003.
8. Jalota, S.K., Sood, A., Arora, V., Chauhan, P. S., and Sharma, P. (2015). Raised bed planting of vegetable crops: A review. Journal of Soil and Water Conservation, 14(4):480-491.
9. Keshavarzi, H., *et al*. (2018). The effect of bed planting and irrigation management on water use efficiency, growth, and yield of chickpea. Journal of Agricultural Science and Sustainable Production, 28(2):155-167.

10. Kumar K., Pyare R., Niwas R., Tiwari K., Sachan R., Pal R.K., Patel V.K. and Ranjan A.R. (2022). Studies on the Root Architecture with Nodulation of the Chickpea (*Cicer arietinum* L.) as Influence by Different Moisture Management Practices along with Seed Inoculation and Level of Zinc. International Journal of Environment and Climate Change 12(11): 2896-2904.
11. Mandal, D.K., Barman, K., Das, A. K., Das, A., and Munda, G. C. (2020). Raised bed planting technique for resource conservation technologies and higher productivity. Journal of Crop and Weed, 16(1):34-39.
12. Panse V.G., Sukhatme P.V. (1985), Statistical methods for agricultural workers. ICAR publication, New Delhi p 6 359.
13. Saeid, A., *et al*. (2019). Effect of raised bed planting and mulching on soil moisture conservation, weed growth and yield of chickpea in rainfed areas. Soil and Tillage Research, 188:98-105.
14. Sharma, N., Sharma, S., Thakur, A., Sharma, V., and Bhunia, R. (2020). Effect of rhizobium inoculation and phosphorus levels on growth, yield, economics and energetics of chickpea (*Cicer arietinum* L.) under rainfed conditions. Legume Research, 43(6):875-881.
15. Singh, R. and Singh, A.P. (2017). Effect of phosphorus, sulphur and biofertilizer on yield quality and uptake of nutrients in cowpea (Vigna unguiculata). Annals of Plant and Soil Research, 19(2):175-179.
16. Singh, U. and Singh, B. (2014). Effect of basal and foliar application of diammonium phosphate in cognizance with phosphate solubilizing bacteria on growth, yield and quality of rain fed chickpea *(Cicer arietinum).Indian Journal of Agronomy*, 59(3): 427-432.
17. Singh, V., Bera, A. K., and Mondal, N. K. (2018). Effect of different bed planting on yield and economics of chickpea (*Cicer arietinum* L.). International Journal of Chemical Studies, 6(3):384-388.
18. Talukdar, S., Neog, P., Nath, D., Kalita, P., &Gogoi, R. (2021). Influence of integrated nutrient management on growth, yield, and economics of chickpea (*Cicer arietinum* L.). Legume Research, 44(1):57-63.
19. Thakur, S. K., Tomar, Y. K., Kour, A., & Kumar, R. (2015). Effect of land configurations and fertility levels on nodulation, yield, and economics of chickpea (*Cicer arietinum* L.) in rainfed conditions of western Himalayas. Legume Research, 38(1):33-39.
20. Verma, S. K., Kumar, V., Singh, D. K., Tiwari, R., Singh, A., and Singh, R. (2018). Yield, quality, and nutrient uptake of lentil (Lens culinaris Medikus) as influenced by Rhizobium inoculation and phosphorus application under rainfed condition. Indian Journal of Agricultural Sciences, 88(7), 1055-1061.
21. Yadav A.C., Husain K., Verma V.K., Tiwari U.S., Khan N., Siddiqui M.Z. (2019). Effect of land configuration and nutrient management on growth and yield of hybrid maize. *Journal of Pharmacognosy and Phytochemistry*; 8(4):602-606.
22. Yazdani, M., Barary, M., and Kholdebarin, B. (2016). Effect of waterlogging stress on some physiological traits in chickpea (*Cicer arietinum* L.) cultivars. Archives of Agronomy and Soil Science, 62(5):709-721.