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Economics analysis in Mungbean (*Vigna radiata* L.) in the Malwa Region of Madhya Pradesh

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Abstract

The productivity of Mungbean (*Vigna radiata* L.) is strongly influenced by agronomic practices, particularly sowing method and plant spacing. An experiment entitled “Effect on growth and yield of Mungbean (*Vigna radiata* L.) using different treatment combinations of sowing method and spacing in the Mandsaur region of Madhya Pradesh” was conducted during the kharif season to evaluate suitable combinations for improving economic returns under Malwa agro-climatic conditions. A field experiment was conducted to assess the economics of mungbean.

The economics of greengram cultivation was significantly influenced by sowing methods and spacing treatments. The cost of cultivation varied widely, ranging from ₹24,200 ha⁻¹ under flat bed + broadcasting (T₁) to ₹30,891 ha⁻¹ under flat bed + wider row spacing (T₂), mainly due to differences in land preparation, seed rate, and labor requirements. Raised bed treatments generally incurred moderate cultivation costs, reflecting more efficient input use. Gross returns were highest under raised bed + 30 × 20 cm spacing (T₇; ₹78,500 ha⁻¹), followed by flat bed + line sowing and other raised bed spacings, owing to better crop establishment and higher yield realization. Consequently, net returns were maximized in T₇ (₹51,700 ha⁻¹), while the lowest net return was recorded under flat bed + broadcasting (T₁). The benefit–cost ratio further confirmed the economic superiority of raised bed planting with optimum spacing, with the highest B:C ratio (2.93) under T₇. Overall, raised bed sowing combined with appropriate spacing proved to be the most profitable and economically sustainable practice for greengram cultivation.

Keywords: B:C ratio, Mungbean, net return, raised bed, seed yield.

Introduction

Mungbean (*Vigna radiata* L. Wilczek), commonly known as green gram, is an important pulse crop belonging to the family Leguminosae (Fabaceae), subfamily Papilionaceae, and genus *Vigna* (Nair *et al.*, 2024) [18]. Mungbean occupies a significant place in Indian agriculture due to its short duration, wide adaptability to diverse agro-climatic conditions, and ability to enrich soil fertility through biological nitrogen fixation (Giri *et al.*, 2024) [7]. Mungbean is a diploid, self-pollinated C₃ plant with a chromosome number of 2n = 22 (Bhattacharjee, 2024) [3]. It is an annual herbaceous crop characterized by a well-developed taproot system with numerous lateral roots bearing effective nitrogen-fixing nodules (Singh, 2013). A soil pH range of 6.0 to 7.5 is considered optimal for its growth and development (Sahni *et al.*, 2016). From a nutritional standpoint, mungbean is a rich source of high-quality plant protein, containing about 23–25% protein, 55–60% carbohydrates, 1–1.5% fat, 3–4% minerals, and 4–5% crude fiber (Kole *et al.*, 2002) [15]. India is the largest producer and consumer of mungbean in the world. Major mungbean-growing states include Rajasthan, Maharashtra, Madhya Pradesh, Uttar Pradesh, Karnataka, Andhra Pradesh, and Tamil Nadu, (Chavan *et al.*, 2025) [5]. In Maharashtra, mungbean is predominantly cultivated during the Kharif season under rainfed conditions in regions such as Vidarbha and Marathwada, where soil and climatic conditions are favorable (Nair *et al.*, 2024) [18]. Mungbean (*Vigna radiata* L.) is one of the most important pulse crops grown in India due to its short duration, low input requirement, and high nutritional value. It plays a crucial role in ensuring nutritional security, improving soil fertility through biological nitrogen fixation, and enhancing farm income, particularly under rainfed and semi-arid agro-ecologies, (Kesham *et al.*, 2021). In Madhya Pradesh, especially in the Malwa region, mungbean is widely cultivated during the *Kharif* and summer seasons owing to its adaptability to diverse

soil and climatic conditions, (Nair *et al.*, 2024) ^[18].

Despite its agronomic importance, mungbean productivity and profitability in the Malwa region remain constrained by inappropriate sowing methods, sub-optimal plant geometry, and inefficient resource utilization (Bansal *et al.*, 2024) ^[2]. Economic viability is a key factor determining the adoption of improved production technologies by farmers. Variations in land preparation, seed rate, labor use, and intercultural operations associated with different sowing methods and spacing directly influence the cost of cultivation, yield realization, and net economic returns, (Bhattacharjee, 2024) ^[3]. Economics analysis, encompassing cost of cultivation, gross return, net return, and benefit-cost ratio, provides a comprehensive assessment of the profitability and sustainability of mungbean production systems, (Mehta *et al.*, 2017) ^[16]. Improved sowing techniques such as raised bed planting and optimized row spacing have been reported to enhance resource use efficiency, crop growth, and yield, thereby improving economic returns (Mishra *et al.*, 2025) ^[17]. However, region-specific information on the economic performance of these practices under Malwa conditions is limited. Therefore, the present study was undertaken to evaluate the economic feasibility of different sowing methods and spacing treatments in mungbean cultivation in the Malwa region of Madhya Pradesh. The findings aim to identify economically efficient production practices that can enhance profitability, support informed decision-making by farmers, and promote sustainable mungbean cultivation in the region.

Materials and Methods

The present investigation titled “Economics analysis in Mungbean (*Vigna radiata* L.) in the Malwa Region (M.P.). The present experiment was conducted at Crop Research Cafeteria, under Mandsaur University, Mandsaur (Madhya Pradesh). Mandsaur (Madhya Pradesh) which is situated at latitude 24°N 4'36.61''N, longitude 75°E 9'46''E and at an altitude of 442.16 meters above the mean sea level. The experiment involved two main plot treatments: B₁ for flat bed sowing and B₂ for raised bed sowing. There were four sub-plot treatments based on spacing: S₁ for broadcasting, S₂ for 30×30 cm spacing, S₃ for 45×30 cm spacing, and S₄ for 60×30 cm spacing. The treatment combinations were as follows: T₁: Flat bed + Broadcasting (B₁S₁), T₂: Flat bed + 30×30 cm spacing (B₁S₂), T₃: Flat bed + 45×30 cm spacing (B₁S₃), T₄: Flat bed + 60×30 cm spacing (B₁S₄), T₅: Raised bed + Broadcasting (B₂S₁), T₆: Raised bed + 30×30 cm spacing (B₂S₂), T₇: Raised bed + 45×30 cm spacing (B₂S₃) and T₈: Raised bed + 60×30 cm spacing (B₂S₄). The experiment was laid out using a split plot design with three replications. There were eight treatments in total, and the experiment was conducted in 24 plots. The gross plot size was 3.60 × 3.90 meters, which equals 14.40 m², while the net plot size was 3.0 × 3.90 meters, totaling 11.70 m². The gross plot area was calculated to be 424.70 m². For the Mungbean crop, the recommended fertilizer doses were 20 kg N, 40 kg P, and 20 kg K per hectare. The seed rate used for the experiment was 80 kg per hectare.

Results and Discussion

Cost of Cultivation

The cost of cultivation varies across the different treatments as presented in Table-1, with the lowest cost of Rs 24,200 per hectare for T₁ (B₁S₁ - Flat bed + Broadcasting) and the highest cost of Rs 30,891 per hectare for T₂ (B₁S₂ - Flat bed + 30×30 cm spacing). The raised bed methods tend to have slightly lower costs compared to the flat bed methods, with T₅ (B₂S₁ - Raised

bed + Broadcasting) at Rs 28,600 and T₆ (B₂S₂ - Raised bed + 30×10 cm spacing) at Rs 26,800. The cost of cultivation varied considerably among treatments due to differences in land preparation, seed rate, and labor requirements associated with sowing methods and spacing. The lowest cost was recorded under flat bed + broadcasting (T₁), mainly due to minimal field operations and lower labor input. In contrast, flat bed + wider row spacing (T₂) incurred the highest cost, attributed to increased labor and operational inputs for line sowing. Raised bed treatments generally exhibited moderate cultivation costs, reflecting efficient land preparation and optimized input use. Similar variations in cultivation cost due to sowing geometry and bed preparation have been reported earlier in greengram and other pulse crops, (Chaudhary *et al.*, 2015; Keisham *et al.*, 2021 and Gavali *et al.*, 2023) ^[4, 14, 6].

Gross Return

Gross returns across the treatments show significant variation. The highest gross return of Rs 78,500 per hectare was achieved in T₇ (B₂S₃ - Raised bed + 30×20 cm spacing), followed by T₂ (B₁S₂ Flat bed + 30×10 cm spacing) with Rs 71,200 and T₈ (B₂S₄ - Raised bed + 30×30 cm spacing), also achieved substantial gross returns of Rs 65,930 and Rs 65,800, respectively. Gross returns showed substantial variation across treatments, largely influenced by differences in crop establishment, growth, and yield performance. The highest gross return recorded under raised bed + 30 × 20 cm spacing (T₇) can be attributed to improved plant stand, enhanced growth attributes, and superior yield realization. Raised bed treatments consistently produced higher gross returns than flat bed treatments, highlighting the advantage of improved soil physical conditions and better resource utilization. Lower gross returns under broadcasting treatments were likely due to uneven plant distribution and reduced yield efficiency. (Gurjar *et al.*, 2018; Pandey and Singh, 2022 and Gavali *et al.*, 2023 and Kankarwal *et al.*, 2025) ^[19, 6, 12].

Net Return

Net returns represent the difference between gross returns and the cost of cultivation. The highest net return was observed in T₇ (B₂S₃ - Raised bed + 30×20 cm spacing) at Rs 51,700, followed by T₈ (B₂S₄ - Raised bed + 30×30 cm spacing) at Rs 39,600. Other treatments with high net returns include T₂ (B₁S₂ - Flat bed + 30×30 cm spacing) with Rs 39,700 and T₃ (B₁S₃ - Flat bed + 30×20 cm spacing) with Rs 38,700. The lowest net return was in T₁ (B₁S₁ - Flat bed + Broadcasting) at Rs 13,800. Net return followed a trend similar to gross return but was further influenced by the cost of cultivation. The highest net return obtained in T₇ (raised bed + 30 × 20 cm spacing) indicates the economic superiority of this treatment Rao *et al.*, ^[20] where increased yield outweighed the moderate cultivation cost. Treatments such as T₈ and T₂ also recorded higher net returns due to reasonable production levels combined with controlled costs. Conversely, the lowest net return under flat bed + broadcasting (T₁) resulted from poor yield performance despite its low cultivation cost, demonstrating that minimum investment does not necessarily translate into higher profitability. (Yadav and Singh, 2014; Keerthi *et al.*, 2015; Vakeswaran *et al.*, 2016; Veeramani, 2019) ^[23, 13, 21, 22].

Benefit-Cost (B:C) Ratio

The B:C ratio provides an indication of the profitability of the treatments. The treatment with the highest B:C ratio was T₇ (B₂S₃ - Raised bed + 30×20 cm spacing) at 2.93, indicating that

this treatment provided the highest return for the investment. Other treatments such as T₈ (B₂S₄ - Raised bed + 30×30 cm spacing) and T₅ (B₂S₁ - Raised bed + Broadcasting) also performed well with B:C ratios of 2.55 and 2.36, respectively. In contrast, treatments with lower B:C ratios include T₁ (B₁S₁ - Flat bed + Broadcasting), with a B:C ratio of 1.57. The benefit–cost ratio clearly demonstrated the economic feasibility of raised bed planting combined with optimum spacing. The highest B:C ratio under T₇ indicates maximum profitability per unit investment, reflecting a balanced combination of input cost and output value.

Table 1: Economics of the Mungbean

S. No.	Treatments	Treatment combination	Cost of cultivation (Rs ha ⁻¹)		Gross return (Rs ha ⁻¹)		Net return (Rs ha ⁻¹)		B:C ratio	
1.	T ₁	B ₁ S ₁ (Flat bed+Broadcasting)	24,200		38,000		13,800		1.57	
2.	T ₂	B ₁ S ₂ (Flat bed +30×10 cm spacing)	30,891		71,200		39,700		2.26	
3.	T ₃	B ₁ S ₃ (Flat bed +30×20 cm spacing)	30,200		68,900		38,700		2.28	
4.	T ₄	B ₁ S ₄ (Flat bed +30×30 cm spacing)	27,400		59,600		32,200		2.17	
5.	T ₅	B ₂ S ₁ (Raised bed + Broadcasting)	28,600		66,800		38,200		2.34	
6.	T ₆	B ₂ S ₂ (Raised bed + 30×10 cm spacing)	27,900		65,765		38,000		2.36	
7.	T ₇	B ₂ S ₃ (Raised bed + 30×20 cm spacing)	26,800		78,500		51,700		2.93	
8.	T ₈	B ₂ S ₄ (Raised bed + 30×30 cm spacing)	25,600		65,930		39,600		2.55	
Factors			C.D.	SE (m) ±	C.D.	SE (m) ±	C.D.	SE (m) ±	C.D.	SE (m) ±
Factor A (Sowing methods)			10234.56	3391.22	6721.45	2745.33	6721.45	2555.33	0.52	0.18
Factor B (Spacing)			9876.42	3275.11	5563.88	2821.45	5563.88	2791.47	0.52	0.19
Factor (A×B)			9621.88	3198.47	5510.22	2980.12	5510.22	2990.14	0.44	0.17

Conclusion

The economic assessment unequivocally revealed that sowing method and plant spacing exerted a significant influence on the cost of cultivation, returns, and profitability of greengram. Although the flat bed + broadcasting treatment (T₁) recorded the lowest cost of cultivation, its inferior crop performance resulted in the lowest gross return, net return, and benefit–cost ratio, indicating poor economic efficiency. In contrast, raised bed methods, despite involving relatively moderate cultivation costs, consistently generated higher economic returns due to improved crop establishment, better growth, and enhanced yield attributes. Among the evaluated treatments, raised bed planting with 30 × 20 cm spacing (T₇) proved to be the most economically advantageous, registering the highest gross return (Rs 78,500 ha⁻¹), net return (Rs 51,700 ha⁻¹), and benefit–cost ratio (2.93). Other raised bed treatments, particularly wider spacings such as 30 × 30 cm (T₈), also demonstrated superior economic performance compared to flat bed sowing methods. Overall, the findings conclusively establish that raised bed sowing combined with optimum plant spacing, especially 30 × 20 cm, enhances resource-use efficiency and profitability, thereby offering a sustainable and economically viable production strategy for greengram cultivation under the agro-climatic conditions of the Malwa region.

Competing Interest

The authors declare that there are no competing interests regarding the publication of this research. The study was conducted without any financial or personal relationships that could have influenced the results or interpretation of the findings.

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Raised bed treatments consistently exhibited higher B:C ratios compared to flat bed methods, emphasizing their economic advantage. Lower B:C ratios under broadcasting treatments suggest inefficient utilization of resources, leading to suboptimal economic returns. These findings confirm that appropriate sowing method and spacing are critical determinants of profitability in greengram cultivation. (Yadav and Singh, 2014; Gohil et al., 2017; Kalsaria et al., 2017; Hangsing et al., 2020 and Gavali et al., 2023) [23, 8, 11, 10, 6].

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