



# Economic Analysis of Cluster Bean Cultivation in Southern Haryana, India

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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## ABSTRACT

The present study aimed to determine the costs and returns of cultivating cluster bean in Southern Haryana during 2020-21 farming season. The study was based on primary data. A total of 80 farmers were interviewed from the purposively selected districts of Bhiwani and Mahendargarh. The findings revealed that the per hectare cost of cluster bean cultivation ₹40,241 and ₹44,553 in Bhiwani and Mahendargarh districts, respectively. On average, the per hectare yield, gross returns, and net returns from cluster bean cultivation in Bhiwani district were 10.82 quintals, ₹49,002, and ₹8,758, respectively. While that of Mahendargarh district were 11.02 quintals, ₹52,732, and ₹8,178, respectively. The benefit-cost (B:C) ratio and B:C ratio over variable cost were 1.21 and 2.34 for Bhiwani, while it was 1.18 and 2.32 for Mahendargarh district. The slightly lower B:C ratio in Mahendargarh district was primarily due to the higher cost of labor.

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## 1. INTRODUCTION

Cluster bean, (*Cyamopsis tetragonoloba* (L.) Taub) is popularly known as Guar in India. It has been cultivated for grain as well as for green vegetable purpose since ancient times in India (Singh, 2014). It can fix around 37- 196 kg atmospheric nitrogen/ha/year in soil and used as a soil fertility restorer [1].

Guar crop has experienced a remarkable journey from a traditional crop grown on marginal lands mainly for food, animal feed and fodder to a crop with various industrial usages ranging from food, cosmetics, printing, textile, paper, cosmetics, mining (petroleum, natural gas, well drilling and oil industries) and pharmaceutical industry [2]. Green pods are nutritionally rich and are routinely consumed as vegetable especially in northern and western parts of India. A natural hydrocolloid (galactomannan/guar gum) is obtained from the seed (endosperm) of cluster bean. The unique binding, thickening and emulsifying property of guar gum powder obtained from guar seed has made it a much sought, after product in the international market. The United States of America is the largest importer of guar and its derivatives from India [3,4]. The potential countries in present time for its production are India, Africa, Peru, Brazil, Java, Australia, Pakistan and the United States. Among these countries, India produces over 6 lakh tons of cluster bean annually and is the largest producer of cluster bean in the world with a contribution of nearly 75 to 80 per cent of the world's total production of cluster bean [5-7].

In India, cluster bean crop is cultivated mainly during Kharif season. It occupied an area of 31.40 lakh hectare with a total production of 15.19 lakh tons of guar seed during 2019-20 in the country [8]. The country exports over 1.17 lakh tons of guar and its derivatives annually, which is comprised by 0.33 lakh tons of refined split guar gum and 0.84 lakh tons of treated and pulverized guar gum. The net worth of the Indian exports is estimated over Rs 500 crores. India is the major exporter of guar gum to the world; it exports various forms of Guar products to a large number of countries. The country has exported 234,872 MT of guar gum to the world for the worth of Rs. 1949 Crores during the year 2020-21. USA, Norway, Germany, Russia, China were the major guar gum export destinations of the country during 2020-21 with a total contribution

of 61 per cent to total guar gum export of the country with export quantity of 142978 MT of guar gum [9].

Cluster bean is native to the India and has been cultivated in the country for ages and is mainly grown in the dry habitats of Rajasthan, Haryana, Gujarat, Punjab and to limited extent in the states of Uttar Pradesh and Madhya Pradesh. Throughout world, Rajasthan is the largest state in terms of guar production as it is on the top in the Indian production scenario of cluster bean with a contribution of nearly 4.2 lakh tons which is around 80 per cent of the total cluster bean production in India [10]. Haryana and Gujarat are placed at the second and third positions regarding the production of cluster bean in India with a contribution of around 12% and 11% respectively (CRNINDIA, Indian stock market).

Cluster bean crop occupied an area of 44.64 thousand hectare with a total production of 33.08 thousand tons in Haryana during the year 2021-22 [11]. Owing to its demand in the international market, it has been introduced in the non-traditional growing areas like Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra and Chhattisgarh. It is also being grown under irrigated conditions during the summer. Green pods are nutritionally rich and are commonly consumed as vegetable especially in northern and western parts of India.

Guar gum shows cholesterol and glucose lowering effects because of its gel forming properties. It also helps in weight loss and obesity prevention. Due to gel forming capacity of guar gum soluble fiber, an increased satiation is achieved because of slow gastric emptying. Diet supplemented with guar gum decreased the appetite, hunger and desire for eating [12]. Adequate intake of guar gum as dietary fiber helps in the maintenance of bowel regularity, significant reductions in cholesterol, control of diabetes, enhancement of mineral absorption and prevention of digestive problems like constipation, inflammatory bowel disease, abdominal pain etc., [13].

## 2. MATERIALS AND METHODS

The study was conducted in Haryana state to achieve well-defined objectives for cluster bean crop. Bhiwani (23,040 ha) and Mahendargarh (20225 ha) districts were deliberately selected

based on the highest area under cluster bean cultivation in Southern Haryana. From both districts, four blocks (two blocks from each district) were purposively selected: Bahal and Kairu blocks from Bhiwani district, and Kanina and Satnali blocks from Mahendargarh district. From each selected block, two villages were randomly selected, with 10 farmers from each village. Ultimately, a total of 80 farmers were interviewed to gather all the desired information.

The study used primary data collected directly from the farmers. The data was related to year 2021-22 farming season and was obtained through personal interviews using a carefully crafted and pre-tested questionnaire designed specifically for this study.

## 2.1 Analytical Framework

Descriptive statistics like Average, Percentage, Benefit-Cost ratio (B:C ratio) etc. were employed to draw valid inferences from the study.

**Cost and returns in production of cluster bean:** Following tools or formulae were employed to work out the cost and returns in the cultivation of cluster bean:

- Gross return = Main product value + By product value
- Return over variable cost = Gross return – Total variable cost
- Return over total cost (Net return) = Gross return – Total cost
- Benefit – cost ratio =  $\frac{\text{Gross return}}{\text{Total cost}}$
- Cost of production per quintal without by – product =  $\frac{\text{Total cost}}{\text{Main product quantity in quintals}}$
- Cost of production per quintal with by – product =  $\frac{\text{Reduced Total cost}}{\text{Main product quantity in quintals}}$   
(Reduced Total Cost = Total Cost – Value of by-product).
- Working capital / variable cost = Total preparatory tillage cost + pre sowing irrigation charges + sowing value + FYM value + total fertilizer cost + irrigation value + pesticide cost + herbicide cost + manual weeding charges + Harvesting value + Threshing value + Miscellaneous charges.
- Management charges (10%) = Total variable cost \*0.1
- Risk factor (10%) = Total variable cost \*0.1

- Total fixed cost = Transportation charges +Rental value of land+ Management charges+ Risk factor.

## 3. RESULTS AND DISCUSSION

### 3.1 Resource Use Pattern

The use of inputs and adoption of various cultural practices in the cultivation of cluster bean crop in Bhiwani and Mahendargarh district are presented in Table 1.

The field preparation for cluster bean sowing in Southern Haryana starts in May month. On an average, 2.97 preparatory tillage operations in Bhiwani district and 2.55 in Mahendargarh district were done to prepare the fields. Fields were prepared with the help of tractors. The per hectare seed rate used was 12.84 kg, 12.92 kg and 12.97 kg on small, medium and large farms in Bhiwani district. The corresponding figures for Mahendargarh district were 12.65 kg, 12.52 kg and 12.35 kg respectively. On an average the seed used by the sample farms were 12.89 kg in Bhiwani and 12.55 kg per hectare in Mahendargarh district. The quantity of Farm Yard Manure applied to the field in Bhiwani district was 49.65, 51.13 and 55.58 quintal per hectare on small, medium and large farms, respectively, no Farm Yard Manure was used in Mahendargarh district. Quantity of Nitrogen fertilizer used in Bhiwani district was 8.89, 8.55 and 12.05 kg per hectare on small, medium and large farms, the corresponding figures for Mahendargarh district were 11.12 kg, 11.95 kg and 20.21 kg respectively. Quantity of Phosphate fertilizer used in Bhiwani district was 22.72, 21.84 and 30.78 kg per hectare on small, medium and large farms, the corresponding figures for Mahendargarh district were 28.41 kg, 30.58 kg and 51.62 kg respectively. The average number of plant protection sprays applied to the crop was 0.67 per hectare for Bhiwani district and 0.65 for Mahendargarh district. The average number of weeding done manually was 0.65 in Bhiwani district during growing season and 1.28 in Mahendargarh district. On an average, 0.30 irrigations were given to the cluster bean crop in Bhiwani district and 1.98 irrigations were given in Mahendargarh district by sample farmers.

### 3.2 Cost Implications of Cultivation of Cluster Bean in the Study Area

The various expenses incurred in the cultivation of cluster bean in Bhiwani and Mahendargarh

districts from Southern Haryana are presented in Table 2. In Bhiwani district, the variable cost was found to be around ₹20957 ha<sup>-1</sup> and fixed cost was ₹19284 ha<sup>-1</sup>. Whereas, in Mahendargarh district the corresponding figures were ₹22731 ha<sup>-1</sup> and ₹21823 ha<sup>-1</sup>. Thus, the total cost of cluster bean cultivation in both districts was ₹42397.5 ha<sup>-1</sup> and the total variable cost was ₹21844 ha<sup>-1</sup>, which accounted for 51.52 per cent of the total cost of production. In the variable cost for Bhiwani district, cost incurred on the Harvesting was highest accounted for 13.41 per cent of the total cost followed by preparatory tillage, which accounted for 10.08 per cent. Similar trend was observed for Mahendargarh district, which has a corresponding figure of 11.98 and 8.04 per cent. Similarly, in the fixed cost in both districts, rental value of owned land was found to be highest, accounting about

34.38 per cent and 36.92 per cent, followed by management charges and risk factor.

Table 3. and Fig. 1 provides a comparison of various factors related to cluster bean cultivation in selected districts of Haryana. In Bhiwani district, the variable cost was around ₹20957, while Mahendargarh district has a slightly higher cost of ₹22731 and overall from both the districts of Haryana was ₹21844. The average yield was observed to be around 10.82 quintals in Bhiwani district, while Mahendargarh district produces 11.02 quintals on an average basis and in all the regions achieves a production of 10.92 quintals. The gross return was found to be ₹49002 in Bhiwani, ₹52731 in Mahendargarh and ₹50866.5 in both districts.

**Table 1. Resource use pattern in cluster bean on different land size holdings in Bhiwani and Mahendargarh district, during 2021-22. (per hectare)**

S. N.	Input	Bhiwani				Mahendargarh			
		Size of holdings				Size of holdings			
		*S	*M	*L	*O	S	M	L	O
1.	Preparatory tillage (No.)	2.86	2.92	3.16	2.97	2.43	2.53	2.72	2.55
2.	Seed (kg)	12.84	12.92	12.97	12.89	12.65	12.52	12.35	12.55
3.	Hoeing & Weeding								
	(a) Manual (No.)	0.73	0.53	0.67	0.65	1.37	1.07	1.36	1.28
4.	Fertilizer								
	(a) Nitrogen (kg)	8.89	8.55	12.05	9.71	11.12	11.95	20.21	13.91
	(b) Phosphates (kg)	22.72	21.84	30.78	24.85	28.41	30.58	51.62	35.52
5.	FYM (qt)	49.65	51.13	55.58	51.87	0.00	0.00	0.00	0.00
6.	Plant Protection (No. of spray)	0.66	0.69	0.67	0.67	0.56	0.76	0.63	0.65
7.	Irrigation (No.)	0.26	0.38	0.25	0.30	1.8	1.99	2.17	1.98

\*Abbreviations: S: Small, M: Medium, L: Large, O: Overall

**Table 2. Comparative Economics of cluster bean cultivation in Bhiwani and Mahendargarh District during 2021-22 (₹/ha)**

S.N.	Particulars	*Qty.	Bhiwani		Mahendargarh		Overall (Haryana)			
			Value *(Rs.)	% of TC	Qty.	Value (Rs.)	% of TC	Qty.	Value (Rs.)	% of TC
<b>I. Operational cost</b>										
1.	Preparatory tillage	2.97	4057	10.08	2.55	3585	8.04	2.76	3821	9.01
2.	Sowing		1297	3.22		1408	3.16		1352.5	3.19
3.	Operational charges for weedicides and pesticides		1075	2.67		803	1.80		939	2.21
4.	Hoeing & Weeding									
II	Manual	0.65	834	2.07	1.28	1720	3.85	0.97	1277	3.01
5.	Harvesting		5397	13.41		5341	11.98		5369	12.66
6.	Threshing		3365	8.36		2921	6.55		3143	7.41

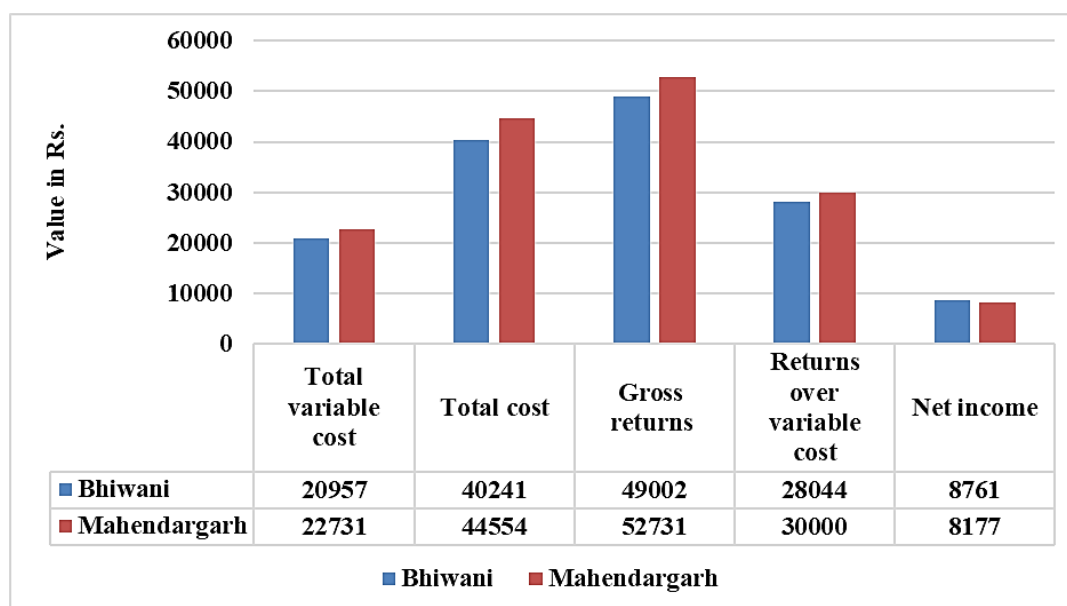
S.N.	Particulars	*Qty.	Bhiwani		Mahendargarh		Overall (Haryana)			
			Value *(Rs.)	% of TC	Qty.	Value (Rs.)	% of TC	Qty.	Value (Rs.)	% of TC
7.	Miscellaneous		334	0.82		290	0.65		312	0.73
	<b>Sub Total</b>		16357	40.64		16067	36.06		16212	38.24
	<b>II. Material Cost</b>									
1.	Seed (kg)	12.89	901	2.23	12.55	941	2.11	12.72	921	2.17
2.	Fertilizer (kg)									
(a)	Nitrogen	9.71	237	0.58	13.91	343	0.76	11.81	290	0.68
(b)	Phosphates	24.85	604	1.50	35.52	876	1.96	30.18	740	1.75
(c)	Potash									
3.	FYM	51.87	865	2.14				25.94	432.5	1.02
4.	Plant Protection (No. of spray)	0.67	914	2.27	0.65	1019	2.28	0.66	966.5	2.28
5.	Irrigation	0.3	371	0.92	1.98	2717	6.10	1.14	1544	3.64
6.	Interest @ 7% for crop period		709	1.76		769	1.72		739	1.74
	Sub Total		4600	11.43		6664	14.96		5632	13.28
	Total Working Cost (I+II)		20957	52.07		22731	51.01			51.52
	<b>III. Fixed Cost</b>									
1.	Risk factor		2095	5.20		2272	5.10		2183.5	5.15
2.	Management charges		2095	5.20		2272	5.10		2183.5	5.15
3.	Transportation charges		1257	3.12		828	1.85		1042.5	2.46
4.	Rental value of land		13838	34.38		16450	36.92		15144	35.72
	Sub Total		19284	47.92		21823	48.98		20553.5	48.48
	<b>Total cost (Rs.) (I+II+III)</b>		<b>40241</b>	<b>100</b>		<b>44554</b>	<b>100</b>		<b>42397.5</b>	<b>100</b>
	Production									
(a)	Main (qt)	10.82	46291		11.02	49551		10.92	47921	
(b)	By Product		2711			3186			2948.5	
	<b>Gross returns (Rs.)</b>		<b>49002</b>			<b>52731</b>			<b>50866.5</b>	
	Return over variable cost (Rs.)		28044			30000			29022	
	Net returns (Rs.)		8761			8177			8469	
	Cost of Production (Rs/qt) without by-product		3719			4043			3881	
	Cost of Production (Rs/qt) with by- product		3469			3754			3611.5	
	<b>Benefit Cost Ratio</b>		<b>1.22</b>			<b>1.18</b>			<b>1.20</b>	
	<b>Benefit Cost Ratio over variable cost</b>		<b>2.33</b>			<b>2.31</b>			<b>2.32</b>	

**Note:** Interest on working capital and interest on fixed capital are calculated for one cropping season. The figure in the parenthesis indicates per cent to total cost.

\*Abbreviations: Qty.: Quantity, %: Percentage, Rs: Rupees, TC: Total cost.

**Table 3. Returns from cluster bean cultivation in Bhiwani and Mahendargarh (₹/ha)**

Sr. No.	Particulars	Bhiwani	Mahendargarh	Overall (Haryana)
1.	Variable cost	20957	22731	21844
2.	Total cost	40241	44554	42397.5
3.	Returns from Production			
	Main product	46291	49551	47921
	By product	2711	3186	2948.5
4.	Gross return	49002	52731	50866.5
5.	Returns over variable cost	28044	30000	29022
6.	Net returns	8761	8177	8469
7.	B:C Ratio (VC)	2.33	2.31	2.32
8.	B:C Ratio	1.22	1.18	1.20

**Fig. 1. Cost and returns from cluster bean cultivation from Bhiwani and Mahendargarh District**

Bhiwani district farmers achieved a net income of ₹8761 whereas, the farmers of Mahendargarh earned ₹8177 from cultivation of cluster bean and the overall net income in both districts from Haryana was ₹8469. The B:C Ratio considering all costs was computed to be 1:22 in Bhiwani, 1:18 in Mahendargarh and 1.20 in both districts of Haryana. The cost of production per quintal was ₹3719 in Bhiwani district and ₹4043 in Mahendargarh district. Cost of labour, frequency of irrigations and the rental value of land were higher in Mahendargarh district compared to Bhiwani district and these contributed to the higher cost of cultivation in Mahendargarh district than in Bhiwani district.

#### 4. CONCLUSIONS

From the findings of the study, it was observed that, the total cost and returns from cluster bean cultivation in overall chosen districts of Haryana

was ₹42397 ha<sup>-1</sup> and ₹50866.5 ha<sup>-1</sup> with an average yield of 10.92 quintals ha<sup>-1</sup>. The returns over variable cost were ₹29022 ha<sup>-1</sup>. Farmers obtaining a net return of ₹8469 ha<sup>-1</sup> with a benefit-cost ratio of 1:20. So, it is concluded from the study that cultivation of cluster bean is highly beneficial in both the districts of Haryana.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Bhawariya A, Pareek NK, Sunda SL, Singh B, Rathore MKR, Dhayal S, Kanwar A. Quality parameters of cluster bean (*Cyamopsis tetragonoloba* L. Taub.) as influenced by organics and fertilizers. The Pharma Innovation Journal. 2022;11(4):1454-1457.
2. Gresta F, De Luca AI, Strano A, Falcone G, Santonoceto C, Anastasi U, Gulisano G. Economic and environmental sustainability analysis of guar (*Cyamopsis tetragonoloba* L.) farming process in a mediterranean area: Two case studies. Italian Journal of Agronomy. 2014;9(1):20-24.
3. Singh D. Marketing of cluster bean (Guar) (*Cyamopsis tetragonoloba*) in Churu District of Rajasthan. The Journal of Rural and Agricultural Research. 2015;15(2):8-12.
4. Bhatt RK, Jukanti AK, Roy MM. Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.], An important industrial arid legume: A review. Legume Research: An International Journal. 2017;40(2).
5. Yadav A, Burark SS, Yadav LC, Garhwal JM. Study on economic analysis of cost and return of rabi maize (*Zea mays* L) in Rajasthan, India. J. Exp. Agric. Int. 2023, Nov 20;45(11):168-77. [cited 2024 May 22] Available: <https://journaljeai.com/index.php/JEAI/article/view/2246>
6. Channamma, Satihal DG, Joshi AT, Ganigara BS, Naik KV. Study the input use pattern and cost and returns of hybrid cotton seed production in Karnataka, India. AJAEES. 2024, Apr 13;42(5):241-8. [cited 2024 May 22] Available: <https://journalajaees.com/index.php/AJAEES/article/view/2433>
7. Fausti S, Wang T. Cost of crop production. Practical mathematics for precision farming. 2017, Oct 23:191-9.
8. Anonymous. Directorate of Economics and Statistics, Department of Agriculture Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India; 2020.
9. APEDA. Agri Export Statistics. Agriculture and Processed Food Products Export Development Authority, Ministry of Commerce and Industry, New Delhi; 2020-21.
10. Jukanti AK, Pathak R, Mushyam C. Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub] breeding. Advances in Plant Breeding Strategies: Legumes. 2019;7:113-149.
11. Anonymous. Statistical Abstract of Haryana. Department of Economic and Statistical Affairs (Planning Department, Government of Haryana); 2022-23.
12. Butt MS, Shahzadi N, Sharif MK, Nasir M. Guar gum: A Miracle Therapy for Hypercholesterolemia, Hyperglycemia and Obesity. Critical Reviews in Food Science and Nutrition. 2007;47:389–396. DOI: 10.1080/10408390600846267.
13. Rao TP, Quartarone G. Role of guar fiber in improving digestive health and function. Nutrition. 2019;59:158-169.

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