Analysis of the Cost of Cultivation and Returns for Cluster Bean in the Gird Region of Madhya Pradesh, India

ABSTRACT

Cluster bean or guar (*Cyamopsis tetragonoloba*) (2n=14) is an annual legume plant widely grown for its gum, vegetable, fodder and green manure values. India produces around 80% of the world's cluster beans. It is the most important crop of drought region, because it has a deep root system and excellent in surviving water stress condition. This research paper was carried out to identify the cost of cultivation and returns of grid region of Madhya Pradesh of cluster bean for the year 2019-20. Multi-stage sampling was used for the selection of the farmers for the present research. Morena district of Madhya Pradesh was selected purposively as its first rank in the area and production of cluster bean in the state. Total 90 farmers were selected and the nearest organized grain mandi of Sabalgarh was selected purposively for this research. Both the primary and secondary data were collected. The results showed that at overall farm level per hectare cost of cultivation of Cluster bean in Morena district was noted ₹ 26772.60, Cost A1 at overall farm level was seen ₹ 16753.22/ha, has been that overall cost of production at cost A1/ A2 was observed ₹ 1355.50/qt average yield of guar were achieved 12.38 qt/ha Net return at aggregate level under cost A1 A2, B1 ,B2, C1, C2 and C3 were reported ₹ 39882.77/ha, ₹ 39882.77/ha, ₹ 39276.03/ha, ₹ 29863.36/ha, ₹ 37079.88/ha, ₹ 27667.21/ha and ₹ 27377.52 /ha, the B;C ratio over cost A1 Rs3.37, A2 Rs3.37, B1 3.25, B2 2.10, C1 2.88, C2 1.94, and C31.92 was observed. B; C ratio overall farm level was seen 1.92 referred crop is under profitable situation.

Key words: Cultivation, Cluster bean, crop, farmers

INTRODUCTION

Cluster bean, or guar (*Cyamopsis tetragonoloba*, 2n=14), is an annual legume cultivated for its diverse uses, including gum extraction, as a vegetable, fodder, and green manure. Recognized for its drought tolerance, cluster bean thrives in arid regions due to its deep root system, enabling it to withstand water stress. The crop is widely grown in India, Pakistan, Indonesia, Myanmar, parts of Central Africa, and the arid southwestern United States, with India producing around 80% of the world’s cluster beans. Two main cultivars are cultivated in India: the Giant type, characterized by large pods, seeds, and vigorous growth, and the Dwarf type. Cluster bean serves multiple purposes,

such as human food, cattle feed, and industrial uses, including applications in food, cosmetics, printing, and textiles. The gum extracted from guar seeds, known as guar gum, is a key export product. In India, cluster beans are primarily grown during the Kharif season and play a significant role in the economic growth of traditional farming systems. The crop is cultivated on approximately 4.26 million hectares, with an annual production of 2.2 million tons and an average yield of 567 kg/ha (Anonymous, 2018). In Madhya Pradesh, cluster bean cultivation spans 70,622 hectares, including 70,566 hectares as a sole crop and 54,782 hectares as a mixed crop. It is predominantly grown in the Gird region, covering major districts such as Gwalior (2,500 hectares), Shivpuri (3,000 hectares), Morena (3,500 hectares), and Bhind (2,100 hectares). Farmers in these areas favor cluster bean for its adaptability to drought conditions and increasing demand for guar gum. However, challenges remain. The National Seed Corporation produces limited quantities of seeds, as guar is not classified as a major crop. Farmers often rely on privately sourced seeds or recycled seeds, which yield suboptimal results. Additionally, industrialization and urbanization have contributed to a decline in cultivated areas. To meet the rising demand for guar gum, expanding the acreage under cluster bean cultivation has become essential.

METHODOLOGY

Multi-stage sampling was used for the selection of the farmers for the present study. The sampling in the first three stages was purposive while the selection of farmers was random. Morena district of Madhya Pradesh was selected purposively as its first rank in the area and production of cluster bean in the state. Morena district comprises seven blocks namely Ambah (78), Morena (533), Porsa (161), Joura (2444), Kailshgrah (146), Pahargarh (466), and Sabalgarh (3828), ha. Out of which, Sabalgarh block has maximum area under of cluster bean so that Sabalgarh block was selected for this study. A list of cluster bean grower villages was prepared with the help of revenue department. Then (10) villages from the selected block were randomly selected for the present study. Separate list of all the cluster bean growers of each of the selected villages along with their size of operational holdings was prepared. After that 3 farmer from each category (small <2 ha, Medium 2-4 ha, large >4 ha) i.e., 9 farmers (3×3) from each village was selected randomly. So that total 90 farmers (10×9) were selected for present study. The nearest organized grain mandi of Sabalgarh was selected purposively for present research purpose of marketing cost. Two village traders from each village and two wholesalers from regulated market of Sabalgarh were selected on the basis of their responsiveness. The

primary data was collected from selected farmers and market intermediaries through pre-structured schedule on cost of cultivation, marketing costs, price spread and constraints faced by respondents in marketing of cluster bean. The secondary data were collected from agriculture Mandi of Sabalgarh and from Government publication of the Directorate of Economics and Statistics Government of Madhya Pradesh. The primary data was collected for the year 2019-20.

Analytical tools

The cost of cultivation of cluster bean crop was worked out by using various cost concepts defined below

Cost A_1: it include

1. Value of hired labour.
2. Value of owned bullock labour.
3. Value of hired bullock labour.
4. Value of owned machine labour.
5. Value of hired machine labour.
6. Value of owned seeds.
7. Value of purchased seeds.
8. Value of owned farm yard manure.
9. Value of purchased farm yard manure.
10. Value of fertilizer and insecticides.
11. Irrigation charges.
12. Land revenue.
13. Interest on working capital.
14. Depreciation.
15. Miscellaneous charges.

Cost A_2 : Cost A_1 + rent paid for leased in land.

Cost B_1 : Cost A_1+ interest of fixed capital (excluding land)

Cost B_2 : Cost B_1 + rental value of owned land + rent for leased in land.Cost

C_1 : Cost B_1 + imputed value of family labour.

Cost C_2 : Cost B_2 + imputed value of family labour.

Cost C_3 : Cost C_2 + 10 per cent of cost C_2 as management cost.

The Cost of Production will be worked out by using FollowingFormula:

It is the ratio of total cost incurred on cluster bean production and physical output obtained on the sample farms.

$$\text{Cost of production (Rs/ha)} = \frac{\text{Cost of cultivation (qt./ha)}}{\text{Quantity of main product (qt./ha)}}$$

Estimation of Return

Following income measure was used to work out the net return of Cluster bean cultivation in the study area.

Gross income:

The value of output (both main and by-product) evaluated at harvest prices.

GI = Qm x Pm + Qb x Pb

Where,

GI = Gross income
Qm = Quantity of main product
Pm = Price of main product
Qb = Quantity of by- product
Pb = Price of by- product

Net income = Gross income - Cost C_3 (Total cost of cultivation)

RESULT and DISCISSION

ESTIMATION OF COST AND RETURNS FROM CLUSTER BEAN PRODUCTION

The different cost incurred in the cultivation of Cluster beans in different sizes of farms is presented in table 1 the table depicted that at overall farm level per hectare cost of cultivation of Cluster bean in Morena district was noted ₹ 26772.60. It was found a maximum ₹ 28900.30 on large farm, followed by ₹ 26843.51 on medium, and ₹ 24574.10 on a small farm which indicated that the total cost of cluster bean production increase as increase size of the farm due to large farmer the spending more cash expense on variable inputs. In the cost of cultivation of cluster among variable cost highest cost shared by seed (₹ 6530/ha), followed by machine labor (₹ 3270.17/ha), the imputed value of family labor (₹ 1828.67/ha), manure and fertilizer (₹ 1416/ha), plant protection (₹ 194.72) and irrigation (₹ 62.96/ha) and less cost on irrigation due to crop mainly depends on rain for irrigation while in the fixed cost highest cost share by rental value of owned land. (₹ 9412.67/ha).

Table 1 Cost of cultivation of cluster bean at different size of farm Rs/ha

	Size of holdings

Item	Small	Medium	Large	Overall
Fertilizer	521.50 (2.12)	556.50 (2.07)	582.50 (2.02)	553.50 (2.07)
Hired labour	611.60 (2.49)	1160.40 (4.32)	1742.40 (6.03)	1171.47 (4.38)
Expenses on Machine labour	3076.50 (12.52)	3283.00 (12.23)	3451.00 (11.94)	3270.17 (12.21)
Farm yard manure	802.50 (3.27)	861.50 (3.21)	917.50 (3.17)	860.5.00 (3.21)
Seed	6065.00 (24.68)	6507.50 (24.24)	7017.50 (24.28)	6530.00 (24.39)
Impute value of family labour	2250.40 (9.16)	1873.60 (6.98)	1362.00 (4.71)	1828.67 (6.83)
Plant protection chemical	170.84 (0.70)	193.98 (0.72)	219.34 (0.76)	194.72 (0.73)
Expenditure on Irrigation	57.60 (0.23)	61.39 (0.23)	69.89 (0.24)	62.96 (0.24)
Depreciation	622.20 (2.53)	656.04 (2.44)	700.62 (2.42)	659.62 (2.46)
Land revenue	40.00 (0.16)	40.00 (0.15)	40.00 (0.14)	40.00 (0.15)
Other	500.00 (2.03)	650.00 (2.42)	750.00 (2.60)	633.33 (2.37)
Interest on working capital	883.08 (3.59)	950.64 (3.54)	1011.16 (3.50)	948.29 (3.54)
Interest on fixed capital	545.38 (2.22)	608.21 (2.27)	666.64 (2.31)	606.74 (2.27)
Rental value of land	8427.50 (34.29)	9440.75 (35.17)	10369.75 (35.88)	9412.67 (35.16)
Total cost	**24574.10 (100)**	**26843.51 (100)**	**28900.30 (100)**	**26772.60 (100)**

(Source: Primary data 2019-20 and Figure in parentheses shows % of total cost

Cost of cultivation under various cost concepts

The different costs are presented in table 2 it was depicted from data that Cost A1 at overall farm level was seen ₹ 16753.22/ha, it was found highest on the large farm ₹ 17863.91/ha and lowest on the small farm ₹ 15601.22/ha. It indicating that increasing trend observed in cost A1 Cost A2 was observed same in all farm sizes indicating leasing patterns were not adopted in the study area. Cost B1, B2, C1, C2 and C3 has been observed ₹ 17359.97/ha, ₹ 19711.63/ha, ₹ 29124.09/ha, and ₹ 29415.33/ha respectively.

Table 2: Cost of cultivation of cluster bean at different cost in Rs/ha

Cost	Small	Medium	Large	Overall
A_1	15601.22	16794.55	17863.91	16753.22
A_2	15601.22	16794.55	17863.91	16753.22
B_1	16146.60	17402.76	18530.55	17359.97
B_2	24574.10	26843.51	28900.30	26772.63
C_1	18397.00	19801.05	20470.31	19711.42
C_2	26824.50	29241.80	30840.06	29124.09
C_3	27092.75	29534.22	31148.46	29415.33

(Source: Primary data 2019-20)

Cost of production of cluster beans on different sizes of farms

The cost of production of cluster bean under different sizes of farm and the overall farm was calculated and the results are shown in Table It has been that overall cost of production at cost A1/ A2 was observed ₹ 1355.50/qtl and was increased as increase cost viz ₹ 1401.49 /qtl, ₹ 2164.30 /qtl, ₹ 1583.70/qtl, ₹ 2443.50 /qtl over cost B 1, B2, C1, C2 respectively.

Table 3: Cost of production of cluster bean in (Rs/qt)

Cost	Small	Medium	Large	Overall
A_1	1399.21	1348.95	1318.36	1355.50
A_2	1399.21	1348.95	1318.36	1355.50
B_1	1448.12	1397.81	1367.56	1404.49
B_2	2203.95	2156.10	2132.86	2164.30
C_1	1649.95	1590.44	1510.72	1583.70
C_2	2405.78	2348.73	2276.01	2343.50

(Source: Primary data 2019-20)

Profitability of cluster bean production

It was seen from table 4 that at average yield of guar were achieved 12.38 qt/ha which was maximum under large farm (13.55 qt/ha), followed by medium farm (12.45 quintals) and small farm (11.15 qtl/ha), and the gross income at overall level was observed ₹ 56636.00/ha which was highest on large farm after that by medium and small ₹ 62458.50/ha, ₹ 58884.50/ha, ₹ 50565.00/ha respectively.

Table 4: Per hectare profitability of cluster bean at different sizes of farm

Size of farm	Yield (qtl/ha)	Price (Rs/qtl)	Production of by product (qtl/ha)	Price of by Product (Rs/qtl)	Gross income (Rs/ha)
Small	11.15	3750	19.45	450	50565.00
Medium	12.45	3750	22.66	450	56884.50
Large	13.55	3750	25.88	450	62458.50
Overall	12.38	3750	22.66	450	56636.00

Net return over different cost in cluster bean production

Net return at aggregate level under different costs was calculated and results are presented in the table 5 Net return at aggregate level under cost A1 A2, B1B2, C1, C2 and C3 were reported ₹ 39882.77/ha, ₹ 39882.77/ha, ₹ 39276.03/ha, ₹ 29863.36/ha, ₹ 37079.88/ha, ₹ 27667.21/ha and ₹ 27377.52 /ha respectively. Across categories, net return was noted ₹ 23472.25/ha, ₹ 27350.28/ha, and ₹ 31310.04 /ha on small, medium, and large farm sizes respectively.

Table 5: Net return over different cost in cluster bean production

Cost	Small	Medium	Large	Average
A_1	34963.78	40089.95	44594.59	39882.77
A_2	34963.78	40089.95	44594.59	39882.77
B_1	34418.40	39481.74	43927.95	39276.03
B_2	25990.90	30040.99	33558.20	29863.36
C_1	32168.00	37083.45	41988.19	37079.88
C_2	23740.50	27642.70	31618.44	27667.21
C_3	23472.25	27350.28	31310.04	27377.52

(Source: Primary data 2019-20)

Benefit cost Ratio over different cost

Return from one rupees investment was calculated under the different sizes of farm and the results are presents in table 6 depicted that B; C ratio over cost A1 ₹ 3.37, A2 ₹ 3.37, B1 3.25, B2 2.10, C1 2.88, C2 1.94, and C3 1.92 was observed. Outcome from 1 rupee invest were found highest on large farm ie. ₹ 2.0 followed by on medium ₹ 1.92 and small farms rupay1.86.

Table 6: Benefit cost ratio over different cost in cluster bean

Cost	Small	Medium	Large	Average
A_1	3.24	3.38	3.49	3.37
A_2	3.24	3.38	3.49	3.37
B_1	3.13	3.26	3.37	3.25
B_2	2.05	2.11	2.16	2.10
C_1	2.74	2.87	3.05	2.88
C_2	1.88	1.94	2.02	1.94
C_3	1.86	1.92	2.00	1.92

(Source: Primary data 2019-20)

SUMMARY & CONCLUSION

In the Morena district, the per-hectare cost of cultivating cluster beans was noted to be ₹ 26,772.60 on average. The total cost varied by farm size, with the highest cost observed on large farms at ₹ 28,900.30, followed by medium farms at ₹ 26,843.51, and small farms at ₹ 24,574.10. This trend indicates that total cultivation costs increased with farm size, primarily due to higher expenditures on variable inputs. Among variable costs, seeds represented the largest expense at ₹ 6,530, followed by machine labor at ₹ 3,270.17. Other significant costs included the imputed value of family labor at ₹ 1,828.67, manure and fertilizers at ₹ 1,416.00, plant protection at ₹ 194.72, and irrigation at ₹ 62.96. Cost A1 (direct cash expenses) averaged ₹ 16,753.22 across all farms, with large farms incurring the highest at ₹ 17,863.91 and small farms the lowest at ₹ 15,601.22. An increasing trend in Cost A1 was observed with larger farm sizes. In contrast, Cost A2 (which accounts for leasing costs) remained consistent across all farm sizes, indicating that leasing was not a common practice in the study area. The overall cost of production at Cost A1/A2 levels was ₹ 1,355.50 per quintal, with an average guar yield of 12.38 quintals per hectare. Gross income across all farms was ₹ 56,636.00 per hectare, with the highest income recorded on large farms (₹ 62,458.50), followed by medium farms (₹ 58,884.50) and small farms (₹ 50,565.00). Net returns at the overall level over Cost A1, A2, B1, B2, C1, C2, and C3 were ₹ 39,882.77/ha, ₹ 39,882.77/ha, ₹ 39,276.03/ha, ₹ 29,863.36/ha, ₹ 37,079.88/ha, ₹ 27,667.21/ha, and ₹ 27,377.52/ha, respectively. By farm size, net returns were ₹ 23,472.25/ha for small farms, ₹ 27,350.28/ha for medium farms, and ₹ 31,310.04/ha for large farms. The Benefit-Cost (B:C) ratio at the aggregate level was 1.92, indicating that cluster bean cultivation is a profitable venture. In conclusion, the total cost of production increased with farm size due to larger farms incurring higher expenditures on variable inputs, particularly seeds, which represented the largest share of these costs. Large farms also achieved the highest production and gross income, outperforming small and medium farms in cluster bean cultivation within the study area.

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