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# Economic Analysis of Cluster Bean [*Cyamopsis tetragonoloba* (L.) Taub] Entrepreneurs in Karnataka

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## ABSTRACT

**Background:** Karnataka is predominantly known for cluster bean production. The evidences claims that the cluster bean production is not a profitable option and has many constraints, which hinders farmers to take up this enterprise. The current study aims to analyze the growth in area, to forecast seed demand and to work out the economics of cluster bean production in Karnataka.

**Methods:** The current study was based on the field survey conducted in Karnataka during 2019-20, to collect the primary data from cluster bean entrepreneurs. The study has also used secondary data for analysis. Four major districts in Karnataka were selected for the study, based on the maximum area and highest production. From each district, 30 farmers were randomly selected for collection of primary data, constituting a total of 120 farmers. The Compound Annual Growth Rate and cost-returns techniques were employed for data analysis.

**Result:** The study indicated that Karnataka has registered a declined trend of 3.12 per cent per annum and the total estimated area under cluster bean would be 2,720 ha during 2021-22. Hence, the seed industry should cater seed demand to the tune of 544 quintals for the said period. Total cost of cultivation was worked out to be ₹ 35,176 per acre. The study emphasize that this enterprise provides higher gross and net returns to the tune of ₹ 70,851 and ₹ 35,675 per acre, respectively, with the Benefit-cost ratio of 2.01, indicating its profitability. Lack of availability of high yielding varieties/hybrid seeds and high wage rate were the major constraints notified in cluster bean enterprise.


**Key words:** Area, Cluster bean, Cost and returns, Forecast, Growth.

## INTRODUCTION

The annual leguminous crop guar [*Cyamopsis tetragonoloba* (L.) Taub] is also known as cluster bean. Due to its superior acceptance in unpredictable rainfall scenarios, as well as its resilience to high temperatures and drought, the crop has significant social and economic significance. Guar is an Indian subcontinent native plant mostly grown for gum extraction in Rajasthan, Haryana, Gujarat and Punjab and to a lesser level for vegetable purposes in Uttar Pradesh, Madhya Pradesh, Karnataka and Andhra Pradesh (Rai and Dharmatti, 2013). Guar is grown on a total of 1,76,853 ha in India (Anonymous, 2018). In Indian subcontinent, guar is primarily consumed as a vegetable also utilized in the preparation of pickles. The seed coat (14-17%), endosperm (35-42%) and germ (43-47%) make up the three sections of the guar seed (Kays *et al*., 2006). Cluster bean has evolved as a new industrial crop with strong foreign exchange earning potential due to its diverse uses (Bhatt *et al*., 2017). It works as an aperitif, a cooling agent, a digestive aid, a laxative and has anti-hyperglycemic and dyspepsia properties (Mukhtar *et al*., 2006). From 242 crores in 1994 to 2,100 crores in 2012-13, India's cluster bean exports have increased in value (Bhatt *et al*., 2017).

The state of Karnataka is one of the out-of-the-way places where cluster bean is grown for vegetable needs. The area trend will serve as a good indicator of crop growth. The cost-returns structure and problems are the most important things to look into. As a result, the current study was conducted to look at the growth in area, forecast seed demand, assess profitability and determine the constraints in cluster bean production in Karnataka. Growers will be aided in making decisions on how to solve difficulties in the study area as a result of this research. The study would be timely and valuable in terms of providing facts and figures to planners, policymakers and extension workers.

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## MATERIALS AND METHODS

### Study area, sample farmers and data source

The state of Karnataka is known for its cluster bean production. Because these four districts cover the larger land

and produce the most, the study was limited to Belagavi, Haveri, Koppal and Bidar. After 30 farmers from each district were randomly selected and interviewed, a total of 120 farmers were questioned. Primary and secondary sources were used to compile the data. During 2019-20, primary data was collected from cluster bean entrepreneurs in Karnataka using an interview schedule created expressly for the study on the investment pattern and return structure. For the years 2010-11 to 2020-21, secondary data on area was acquired from the websites of several districts, the Department of Horticulture and Government of Karnataka reports.

### Analytical techniques

### Compound annual growth rate (CAGR)

An exponential model and CAGR computation were used to examine the growth in area under cluster bean production in Karnataka (Sathyendrakumar and Chandrashekar, 2015).

$$Y_t = \beta_0 \beta_1^t U_t$$

Where,

$Y_t$ = Area under cluster bean production during 't' time period.

$\beta_0$= Intercept.

$\beta_1$= Slope coefficient.

t = Time in years (2010-11 to 2020-21).

$U_t$= Stochastic term.

Natural logarithmic transformation and the ordinary least square approach were used to obtain the model's estimable form *i.e.*,

$$\ln Y_t = \ln \beta_0 + t \ln \beta_1 + U_t$$

The CAGR in area was obtained from the expression

$$CAGR = (\text{antilog } (\ln \beta_1) - 1) * 100$$

The growth in area under cluster bean for the following year, 2021-22, was calculated by multiplying the actual area under cluster bean in the preceding year by the CAGR, *i.e.*, in 2021-22, the area under cluster bean is equal to the area in 2020-21 + CAGR X area in 2020-21. For example, the CAGR in area was -3.12 per cent each year, while the area in Karnataka was 2,808 ha in the previous year. For the next year (2021-22), the incremental growth in area will be 2,808X-0.0312= -87. As a result, the overall area for the coming year will be 2,808-87=2,720 ha. The demand for cluster bean seed in major growing districts and state was forecasted using CAGR of area and per ha requirement of seed as recommended in the Package of Practices. The seed demand projection for an expected area of 2,720 ha (2021-22) was calculated using a seed requirement rate of 20 kg per ha, as specified in the package of practices (Anonymous, 2014; Patil *et al.*, 2017).

### Cost and returns analysis

The information gathered was used to estimate various costs, including Cost $A_1$, $A_2$, $B_1$, $B_2$, $C_1$, $C_2$ and $C_3$ (Meena *et al.*, 2016; Raju *et al.*, 2017). Gross returns were calculated using the total value of the main product at the market price and net returns were calculated by subtracting cost $C_3$ from gross returns. The benefit-cost ratio was calculated as the ratio of gross returns to cost $C_3$, which represents the investment returns per rupee. The earning power of the money invested is indicated by the ratio of net returns to the total cost of cultivation, which is known as the returns on investment (ROI).

## RESULTS AND DISCUSSION

### Growth in area of cluster bean

The CAGR of area was determined for the study period 2010-11 to 2020-21 (Table 1). Karnataka is one of the non-traditional states for cluster bean production, with a negative CAGR of 3.12 per cent per year. All of Karnataka's major districts, with the exception of Haveri (2.67%/year), have shown a similar decrease in growth rate over the study period. In Koppal, Belagavi, Bidar and other districts, negative growth rates of 10.13, 1.15, 1.33 and 3.89 per cent per year were recorded, respectively. Due to a lack of water, the farmers in these districts gradually reduced the area under cluster bean and switched to other field crops, according to the study. The study conducted by Ashoka *et al.* (2019a) backs up this conclusion. According to the estimated growth rates of area under cluster bean in major growing districts and Karnataka state, the incremental area and seed demand for the following year (2021-22) was estimated based on the estimated growth rates of area. Haveri district saw an increase in area of 13 ha for the following year (2021-22), as evidenced by a positive growth rate of 2.67 per cent each year. Districts like Koppal, Belagavi, Bidar and others witnessed their incremental area decline by 23, 5, 5 and 50 ha, respectively, for the next year (2020-21). Due to negative growth rates in the area covered throughout the study period, the state of Karnataka likewise observed a fall in incremental area of 87 ha. In the case of chilli production, Ashoka *et al.* (2019b) showed similar results. To estimate total area in 2021-22, the incremental area in the following year (2021-22) was added to the area in the prior year 2020-21. The projected area of 2021-22 was used to calculate the prospective seed demand in all of the major districts and states, based on per ha seed requirements as specified by the Package of Practices (Anonymous, 2014). As a result, the complete seed demand for the entire state of Karnataka, which covers an estimated 2,720 ha, would be met.

During 2021-22, the largest estimated demand for seed was observed in Haveri district (99 quintals), followed by Belagavi (94 quintals), Bidar (73 quintals) and Koppal (40 quintals). A total of 245 quintals of seed would be required for the remaining districts. The good growth rate in cluster bean area in Haveri district during the study period resulted in a higher seed demand. This conclusion agrees with Singh *et al.* (2019) and Ashoka *et al.* (2019c). Seed production is unavoidable in order to fulfill the vast demand, so the study expands the scope of cluster bean enterprise in the study area.

### Input use pattern and cost of cultivation

Cluster bean is mostly grown by farmers in Karnataka during the *Kharif* season, particularly in dryland areas. As a result,

it is critical to figure out the spending pattern as well as its economic viability. As a result, an assessment of the profitability of cluster bean farming in the research region was done. Table 2 shows the pattern of input usage and cost. It is worth noting that the average total cost ($C_3$) per acre was ₹ 35,176. The cost of manures and fertilizers was the highest operational cost at ₹ 4,293, followed by the cost of weeding and harvesting at ₹ 4,006.

The value of seed was the most important variable resource in cluster bean production, with a seed rate of 8 kg per acre. The seed cost of ₹ 2,336 on the other hand was found to be close to the hired human labour wage of ₹ 2,498. Cluster bean production required additional human labour, especially during peak seasonal activities such as weeding and harvesting, which begins 45 days after seeding. Hired human labour charges and pesticide charges totaled ₹ 2,498 and ₹ 2,134, respectively, as main cost components. As a result, a significant amount of money was spent on pest and disease control chemicals. Singh *et al.* (2020) had reported a similar explanation.

Similarly, machineries were utilized to some extent for soil preparation, sowing and threshing, resulting in expenses of ₹ 2,105. Interest on working capital charged at 7 per cent per year (₹ 1,399), irrigation charges (₹ 1,204), charges towards bullock (₹ 815) and depreciation charges (₹ 543) were the other minor costs incurred. Jyani *et al.* (2018) reported a similar trend of spending in cluster bean cultivation in Rajasthan's Bikaner district. Cost $A_1$ was calculated to be ₹ 21,389 based on comparative estimations of different costs spent (Table 2). Because no farmers had leased-in land for this entry, cost $A_2$ was the same as cost $A_1$. The realized costs of $B_1$ and $B_2$ were ₹ 21,800 and ₹ 25,978, respectively. The costs $C_1$ and $C_2$ were also accounted to be ₹ 27,800 and ₹ 31,978, respectively. Cost $C_3$ was calculated as the overall cost of cultivation (including the farmer's managerial costs) and was found to be ₹ 35,176.

### Cost and returns structure

Cluster bean growing for vegetable purposes was profitable in the research area, according to the cost and return structure (Table 3). Cluster bean output averaged 29.92 quintals per acre in the research area with an average wholesale price of ₹ 2,368 per quintal. The projected cost of cultivation was ₹ 35,176. The gross return was significantly

**Table 1:** Growth in area and estimated demand for Cluster bean seeds in Karnataka

| Districts | Area under cluster beans in 2020-21 (ha) | CAGR (%) in area from 2010-11 to 2020-21 | Increase / Decrease in area during 2021-22 (ha) | Estimated area in 2021-22 (ha) | Estimated demand for cluster beans seed (quintals) during 2021-22 |
|---|---|---|---|---|---|
| Koppal | 223 | -10.13 | -23 | 200 | 40 |
| Belagavi | 475 | -1.15 | -5 | 469 | 94 |
| Haveri | 483 | 2.67 | 13 | 496 | 99 |
| Bidar | 370 | -1.33 | -5 | 365 | 73 |
| Other districts | 1275 | -3.89 | -50 | 1226 | 245 |
| Karnataka total | 2808 | -3.12 | -87 | 2720 | 544 |

**Table 2:** Cost of cultivation of cluster bean in Karnataka.

| | Particulars | Cost (₹ /acre) |
|---|---|---|
| Cost $A_1$= | Value of hired human labour | 2,498 |
| | Value of machine power | 2,105 |
| | Value of bullock power | 815 |
| | Value of seed (hired+owned) | 2,336 |
| | Value of pesticides power | 2,134 |
| | Fertilizers + manures | 4,293 |
| | Depreciation on implements and farm building | 543 |
| | Irrigation charges | 1,204 |
| | Land revenue and taxes | 56 |
| | Miscellaneous expenses (weeding and harvesting) | 4,006 |
| | Interest on working capital | 1,399 |
| **Total** | | **21,389** |
| Cost $A_2$ = | Cost $A_1$ + Rent paid for leased-in-land | 21,389 |
| Cost $B_1$ = | Cost $A_1$ + Interest on value on owned capital (excluding land) | 21,800 |
| Cost $B_2$ = | Cost $B_1$ + Rental value of owned land (less land revenue) | 25,978 |
| Cost $C_1$ = | Cost $B_1$ + Imputed value of family labour | 27,800 |
| Cost $C_2$ = | Cost $B_2$ + Imputed value of family labour | 31,978 |
| Cost $C_3$ = | Cost $C_2$ + 10% of cost $C_2$ | 35,176 |

**Table 3:** Cost and return structure of cluster bean cultivation in Karnataka.

| Particulars | Unit | Quantity |
|---|---|---|
| Cluster bean production | Quintal/acre | 29.92 |
| Price of cluster bean | ₹ /quintal | 2,368 |
| Total cost of cultivation | ₹ /acre | 35,176 |
| Gross return | ₹ /acre | 70,851 |
| Net returns | ₹ /acre | 35,675 |
| Benefit: cost ratio | - | 2.01 |
| Returns on investment | Per cent | 101.42 |
| Cost of production | ₹ /acre | 1,176 |
| Family labour income (Gross income-Cost $B_2$) | ₹ /acre | 44,872 |
| Farm business income (Gross income-Cost $A_1$) | ₹ /acre | 49,461 |

**Table 4:** Constraints faced by the farmers in cluster bean production in Karnataka.

| Particulars | No. of farmers | Percentage |
|---|---|---|
| Lack of availability of high-yielding varieties | 42 | 35.00 |
| Availability of irrigation water | 14 | 11.67 |
| High labour wages | 21 | 17.50 |
| High input cost | 18 | 15.00 |
| Less technical knowledge | 4 | 3.33 |
| Availability of market information | 9 | 7.50 |
| Availability of processing plant | 12 | 10.00 |
| Total respondents | 120 | 100 |

greater at ₹ 70,851, resulting in a solid net return of ₹ 35,675. This is reflected in the enterprise's greater benefit-cost ratio, which were 2.01. Kushwah *et al.,* 2017 and Rajput and Rawat (2019) both observed similar findings.

Cluster bean farming's returns on investment were likewise found to be quite strong, at 101.42 per cent. However, the majority of the farmers in the research area continued to cultivate using traditional methods, which resulted in increased cultivation costs. As a result, it is critical to educate cluster bean farmers on how to improve their farming procedures in order to reduce cultivation costs. This would make it easier to increase the cluster bean productivity and profitability. This finding is similar to Sharma's (2013) study of the profitability of cluster bean cultivation in India.

### Problems encountered

An attempt was made to compile a list of the issues that cluster bean growers in the research area encounter. The farmers were asked to list the most significant challenges they faced when growing cluster beans (Table 4). The main issues faced by farmers in the study area were a shortage of high yielding varieties, as reported by 42 farmers (about 35%) and high labour wages, as expressed by 21 farmers (17.5 per cent ). High input costs were cited by 18 farmers (15%), while lack of irrigation water during important periods was cited by 14 farmers (11.67%) as a major bottleneck. Lack of a processing plant was mentioned by 12 farmers (10%), while lack of market information was mentioned by nine farmers (7.5%) and lack of technical know-how was mentioned by four farmers as a serious concern related with cluster bean production. Ashoka *et al.* (2017) found similar results in tomato output in Karnataka.

## CONCLUSION

During the study period, the CAGR of area under cluster bean in Karnataka state has seen an alarming fall of -3.28 per cent each year. As a result, the Department of Horticulture, Government of Karnataka should place a greater emphasis on increasing the area under cluster bean production in the state by offering input subsidies such as free quality seeds and fertilizers, as these inputs account for a significant cost component. Seed production activities will be taken up on a substantial scale by seed production enterprises in Karnataka to deliver 544 quintal of cluster bean seeds for the coming year (2021-22). The study discovered that cluster bean seed production in the study area had a lot of potential. Cluster bean farming is profitable, as it generates a large return of ₹ 44,872 per acre in farm labour revenue, especially in the dryland region. During the *Kharif* season, cluster bean is the ideal alternative for small farmers, as it may be harvested from 45 days onwards. According to the majority of respondents, seed companies should focus more on generating high yielding types or hybrids.

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