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# An Economic Analysis and Resource Use Efficiency of Sesame (*Sesamum indicum L.*) and Its Competing Crops Cultivation in 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 has been conducted in the Mahendergarh and Nizampur blocks of Mahendergard district and Rewari block from Rewari district of Haryana state. In order to draw meaningful inferences from data, the descriptive statistics, resource use efficiency worked out by Cobb-Douglas production function technique and constraints were identified on the basis of their rating (severe, moderate and least) in production of sesame. The results of the study showed that gross returns and return over variable cost per hectare were Rs. 47,048, Rs. 56,349, Rs. 54,948 and Rs. 26,697 Rs. 27,902, Rs. 32,575 in sesame, bajra and cluster bean, respectively. Benefit cost ratio (BCR) over total cost was accounted 1.16, 1.09 and 1.21 in sesame, bajra, and cluster bean crops respectively. It has been found that sesame provides lower returns in term of gross returns as well as returns over variable cost as compared to its major competing crops bajra and

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cluster bean. The regression analysis has brought out that the ratio of MVP/MFC is (>1) there exists sufficient potential in spending on fertilizers, irrigation and plant protection measures. The constraints faced by farmers indicated that the technological up gradation, effective market support (for inputs & output) were required to make sesame production a remunerative enterprise.

*Keywords: Resource use efficiency; cobb-douglas; constraints; sesame; B: C ratio.*

## 1. INTRODUCTION

Sesame (*Sesamum indicum L*.) commonly known as til, is also called as “queen of oilseeds” and has been known to be one of the earliest domesticated edible oilseeds used by the mankind next to the groundnut, rapeseed and mustard. The oil seed crop is grown in a variety of climates, from temperate to semi-arid tropical and subtropical areas. The Indian economy is heavily dependent on the oil seed harvests. Its protein and oil contents typically range from 20 to 26 and 46 to 52 per cent, respectively [1]. About 70 per cent of the nation's sesame production is utilised to extract the oil, 20 per cent is used domestically for reasons such as making sweets for culinary and confectionary uses, about 2-3 per cent is hydrogenated, and 4.2 per cent is used industrially to make paints, perfumed oils, medicines, and insecticides (Maiti et al., 2005) [2]. Sesame is significant because it contains a lot of oil, protein, calcium, iron, and methionine (Gupta *et al.,* 1998). Because of its excellent quality characters, sesame oil is also sometimes referred to as poor man’s “ghee”. Sesame cake is also a valuable nutritious feed for cattle especially for milch animals and is ingredient of poultry feed because of its high methionine content. The cake contains 6.0-6.2 per cent nitrogen, 2.0-2.2 per cent phosphorus and 1.0-1.2 per cent potassium and can also be used as manure [3].

Sesame is grown on 6.57 million hectares around the world, with a productivity of 448 kg $ha^{-1}$ and a production of 2.94 million tonnes. India is the world's top producer and landowner of sesame (26% of total production). With a total production of 657.50 thousand million tonnes, it is grown on 1622.60 thousand hectares in India [4]. Crop productivity was 405 kg $ha^{-1}$ on average [5]. Over the years along with its increasing demand, production of sesame is also increasing. Sesame seed has growing popularity due to its ability to facilitate digestion and reduce hypertension in several foods as a driving factor in the market. Furthermore, it has rising application as an antioxidant product in various pharmaceutical formulations which drives the growth of Indian sesame seeds market in the upcoming years.

The cultivation of sesame, an indigenous oil-producing crop, dates back to Haryana as well. However, the average productivity is quite low when compared to both the national and global levels. The main causes of the crop's low productivity include low and infrequent rainfall, the cultivation of crops on marginal and submarginal areas with low fertility while using very poor agronomic practises, and little or even no usage of fertilisers. Sesame now has more potential markets thanks to rising worldwide demand. This oil seed crop can be produced sustainably with increased productivity and higher quality levels mineral fertilisers and organic manures are used in a balanced amount. The amount of fertiliser needed must be adjusted for other vital inputs to be used as effectively as possible. The present study has been conducted keeping in view the importance of an oilseed crop, sesame with the following objectives:

1. To workout the profitability of sesame, bajra and cluster bean.
2. To analyse the contribution of various resources in cultivation of sesame.
3. To study the constraints in cultivation of sesame.

## 2. METHODOLOGY

The study was carried out during 2021-22 in two districts (Rewari and Mahendergarh) from southern zone of Haryana. The purposive and random sampling techniques were used to select districts, villages and farmers. Further sixty farmers were selected on random basis to extract relevant information pertaining to the extent of use of various inputs. The prevailing market prices of purchased inputs, hired labour, imputed value of family labour were taken into account to work out economic viability of seasame, bajra and cluster bean cultivation. Two blocks were selected from Mahendergarh i.e. Mahendergarh and Nizampur and one block from Rewari i.e. Rewari. Further villages namely Pali and Palri-Pannihari from Mahendergarh block

and Bigo-pur, Bharmanwas from Nizampur block were selected and Khatwali, Khuliyawas, Tatarpur, Dungarwas, Rusgen, Bhatsana and Nayagaon from Rewari block. From each block thirty farmers were selected randomly. In order to draw meaningful inferences from data theDescriptive statistics, Cobb-Douglas production function technique were used. Constraints were identified on the basis of their rating (severe, moderate and least) in production of sesame.

The Cobb-Douglas production function was used for estimating the resources used in sesame

$$Y = aX_1\ b_1 * X_2\ b_2 * X_3\ b_3 * X_4\ b_4 * X_5\ b_5 * X_6\ b_6$$

Where,

Y = Dependent Variable (Gross income Rs./ha)
a = Constant
$X_1$ = Human labour (Rs./ha)
$X_2$ = Machinery (Rs/ha)
$X_3$ = Seed cost (Rs./ha)
$X_4$ = Fertilizer cost (Rs/ha)
$X_5$ = Irrigation cost (Rs./ha)
$X_6$ = Plant protection (in Rs/ha)

From the above production function the M.V.P. of each resource was worked out. The marginal value and productivity of particular input '$x_i$' as geometric mean of input and output is expressed in following equation:-

$$MVPXi = bi\frac{\overline{Yi}}{\overline{Xi}}Pxi$$

Where,

MVP = Marginal Value Productivity
$\overline{Y}i$ = Gross value of out- put (Rs.)
$\overline{Xi}$= Factor of production
bi= Regression coefficient of $x_i$
$Px_i$= Price of $x_i$

## 3. RESULTS AND DISCUSSION

### 3.1 Economics of Sesame and its Competing Crops (Bajra & Cluster Bean) Cultivation in Haryana

The comparative Economics of sesame and its major competing crops *viz.* bajra and cluster bean has been displayed in Table 1. The total variable cost per hectare on sample farms was found to be Rs. 20351 in sesame, Rs. 28447 in Bajra and Rs. 22409 in cluster bean. The total cost per hectare was Rs. 40613 in sesame, Rs. 51362 in Bajra and Rs. 45380 in cluster bean crops. Gross income came out to be Rs.47048 in sesame; Rs. 56349 in bajra and Rs. 54984 in cluster bean crop, while return over variable cost were Rs. 26697, Rs 27902 and Rs. 32575, respectively. The benefit cost ratio was 1.16 in sesame, 1.09 in Bajra and 1.21 in cluster bean crop. Thus, returns over variable cost were higher in Bajra and Cluster bean than sesame due to higher gross returns. Similar findings were also reported by Dossa et al., [6].

### 3.2 Marginal value Productivity

The efficiency level of individual resource used in Mahendergarh, Rewari and overall were determined with the help of Cobb Douglas production function based on the collected data from sesame cultivation. The resources like human labour, fertilizer, seed and plant protection chemicals were the major contributing exogenous variables in cultivation of sesame crop. The production function analysis fitted for resource use in the selected districts reveals that the regression co-efficient of machine hrs., fertilizer cost, irrigation and plant protection cost were positive for both the districts. Human labour and seed costs were negative in both the districts but positive for human labour in Rewari district. In case of overall all these variables were positive (Table 2).

The MVP value of machine hrs., fertilizer cost, irrigation and plant protection were greater than unity in both the districts and overall which indicates that all these inputs were underutilized. On the other side, the value MVP were less than unity for human labour and seed cost were over utilized in both the districts and overall indicates that all these inputs were over utilized and use of these inputs needs to be curtailed for higher returns. The reduction in the use of over utilized inputs will help in reduction of expenses incurred. There is ample scope for exploitation the use of these underutilized resources to maximize the production and to increase the gross returns. It is imperative from the study that use of underutilized resources in the cultivation of sesame crops resulted into higher yield. Makama et al., [7] also reported the similar findings.

**Table 1. Comparative economics of sesame and competing crops (Bajra & Clusterbean) cultivation in Haryana (Rs. ha$^{-1}$)**

| Sr. No. | Items | Sesamum | Bajra | Difference (Sesamum-Bajra | Cluster bean | Difference (Sesame-Clusterbean) |
|---|---|---|---|---|---|---|
| **A. Variable Expenses** | | | | | | |
| 1 | Field Preparation and sowing | 4818 | 5725 | **-907** | 5613 | **-795** |
| 2 | Seed | 728 | 1019 | **-291** | 1138 | **-410** |
| 3 | Fertilizer Investment | 1453 | 2943 | **-1490** | 1611 | **-158** |
| 4 | Irrigation | 1119 | 1405 | **-286** | 1788 | **-669** |
| 5 | Plant protection | 4414 | 3356 | **1058** | 3063 | **1351** |
| 6 | Harvesting and Threshing | 6888 | 12800 | **-5912** | 8225 | **-1337** |
| 7 | Int. +miscellaneous | 933 | 1199 | **-266** | 971 | **-38** |
| 8 | Sub-Total | 20351 | 28447 | **-8096** | 22409 | **-2058** |
| **B. Fixed cost** | | | | | | |
| 9 | Management and risk charges | 4068 | 3684 | **384** | 4488 | **-412** |
| 10 | Rental value of land | 15413 | 18500 | **-3087** | 17816 | **-2403** |
| 11 | Transportation | 595 | 731 | **-136** | 675 | **-80** |
| 12 | Sub Total | 2263 | 22915 | **-2652** | 22971 | **-2708** |
| 13 | Total cost (A+B) | 40613 | 51362 | **-10749** | 45380 | **-4767** |
| **C. Gross Returns** | | | | | | |
| 14 | a)Main product | 45135 (4.46)* | 47736 (23.06)* | **-** | 51309 (10.5)* | **-** |
| | b) By-product | 1913 | 8613 | | 3675 | |
| 15 | Gross Return | 47048 | 56349 | **-9301** | 54984 | **-7936** |
| 16 | R.O.V.C | 26697 | 27902 | **-1205** | 32575 | **-5878** |
| 17 | Net Return | 6435 | 4987 | **-1448** | 9604 | **-3169** |
| **18** | **B:C(R.O.V.C)** | **2.31** | **1.98** | **-** | **2.45** | **-** |
| **19** | **B:C(T.C.)** | **1.16** | **1.09** | **-** | **1.21** | **-** |

*Note- Figure in parenthesis indicate the percentage to total cost, Benefit cost ratio (Return over variable cost (B:C (R.O.V.C), Benefit cost ratio (Total cost) B: C (T.C.)*
**Figures in brackets denote yield in terms of quintals*

**Table 2. Resource use efficiency in sesame in Haryana**

| Variables | Mahendergarh District | | | | | |
|---|---|---|---|---|---|---|
| | **GM** | **b** | **MVP** | **MFC** | **MVP/MFC** | **Utilization** |
| Human labour (Rs./ha) | 9.49 | -0.19 | -0.22 | 1 | -0.22 | Over utilized |
| Machine (Rs./ha) | 9.36 | 1.73 | 2.02 | 1 | 2.02 | Under utilized |
| Seed cost | 6.94 | -1.65 | -2.60 | 1 | -2.60 | Over utilized |
| Fertilizer cost | 7.41 | 0.86 | 1.27 | 1 | 1.27 | Under utilized |
| Irrigation Cost | 7.73 | 1.04 | 1.47 | 1 | 1.47 | Under utilized |
| Plant protection cost | 8.03 | 0.93 | 1.27 | 1 | 1.27 | Under utilized |
| **$R^2$** | 0.9883 | | | | | |
| **Variables** | **Rewari District** | | | | | |
| | **GM** | **b** | **MVP** | **MFC** | **MVP/MFC** | **Utilization** |
| Human labour (Rs./ha) | 9.39 | 0.47 | 0.55 | 1.00 | 0.55 | Over utilized |
| Machine (Rs./ha) | 9.33 | 1.14 | 1.33 | 1.00 | 1.33 | Under utilized |
| Seed cost | 6.97 | -1.07 | -1.68 | 1.00 | -1.68 | Over utilized |
| Fertilizer cost | 7.24 | 0.85 | 1.28 | 1.00 | 1.28 | Under utilized |
| Irrigation Cost | 7.22 | 1.12 | 1.69 | 1.00 | 1.69 | Under utilized |
| Plant protection cost | 7.97 | 1.43 | 1.96 | 1.00 | 1.96 | Under utilized |
| **$R^2$** | 0.9827 | | | | | |
| **Variables** | **Overall** | | | | | |
| | **GM** | **b** | **MVP** | **MFC** | **MVP/MFC** | **Utilization** |
| Human labour (Rs./ha) | 9.44 | 0.38 | 0.44 | 1.00 | 0.44 | Over utilized |
| Machine (Rs./ha) | 9.34 | 1.28 | 1.50 | 1.00 | 1.50 | Under utilized |
| Seed cost | 6.96 | 0.23 | 0.36 | 1.00 | 0.36 | Over utilized |
| Fertilizer cost | 7.32 | 1.23 | 1.83 | 1.00 | 1.83 | Under utilized |
| Irrigation Cost | 7.47 | 0.78 | 1.14 | 1.00 | 1.14 | Under utilized |
| Plant protection cost | 8.00 | 0.87 | 1.19 | 1.00 | 1.19 | Under utilized |
| **$R^2$** | 0.8256 | | | | | |

*Note: GM: Geometric mean, b: Coefficient, MVP: Marginal value product, MFC: Marginal factor cost*

**Table 3. Constraints faced by sesame growers (N = 60)**

| S. No. | Constraints | Total | Percentage | Farmers Ranking |
|---|---|---|---|---|
| 1. | Low yielding varieties | 156 | 86.66 | I |
| 2. | Non-adoption of package of practice/low input used | 141 | 78.33 | II |
| 3. | Problem of seed shattering | 127 | 70.55 | IV |
| 4. | Price variability/lack of price information | 139 | 77.22 | III |
| 5. | Problem of irrigation/shortage of groundwater | 121 | 67.22 | V |
| 6. | High incidence of insect pest | 119 | 66.11 | VI |
| 7. | Non-existence of processing unit | 111 | 61.66 | VII |

### 3.3 Constraints Faced by Sesame Growers

Major production and marketing constraints highlighted by the growers (Table. 3) were low yielding varieties (86.66%) which are followed by low input used (78.33%) and problem of seed shattering (70.55%). Lack of price information, then followed by shortage of ground water, high incidence of insect-pest and non-existence of processing unit. Similar findings were also reported by Grover and Singh [8] & Sharma et al. [9].

## 4. CONCLUSION

The gross returns and return over variable cost per hectare were Rs. 47048, Rs. 56349, Rs. 54948 and Rs. 26697 Rs. 27902, Rs. 32575 in sesame, bajra and cluster bean, respectively. B: C ratio over total cost was accounted 1.16, 1.09 and 1.21 in sesame, bajra, and cluster bean crops respectively. It has been found that sesame provides lower returns in term of gross returns as well as returns over variable cost as compared to its major competing crops bajra and cluster bean. The regression analysis has brought out that the ratio of MVP/MFC is (>1) there exists sufficient potential in spending on fertilizers, irrigation and plant protection measures to further enhance the value productivity of sesame crop in the state. The major constraints faced by farmers were low yielding varieties, low input used, problem of seed shattering, price variability, high incidence of insect pest and lack of processing unit. To give a boost to sesame cultivation in the state two-dimensional efforts viz technological up gradation and effective market support are required.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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