



# ESTIMATING INPUT USE EFFICIENCY AND COST-RETURNS OF MARIGOLD CULTIVATION IN HARYANA

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## ABSTRACT-----

The current study analysed the prospects aspect in terms of cost & income and input use efficiency of marigold cultivation in Haryana in 2022-23. Within the field research, multistage purposive was adopted for the selection of 120 farmers from two districts which are preferred on the basis of the maximum area of marigold in Haryana. The results showed that the total cost and return incurred for small and large farm in marigold cultivation was Rs. 190863 & Rs. 197579 and Rs. 444937 & 456561 respectively. The return per rupee of investment or benefit-cost ratio (B-C Ratio) evaluated for small and large farm to the Rs. 3.33 and Rs. 3.34 respectively which reflections profitability in marigold cultivation in Haryana. Cobb-Douglas production function revealed that marigold output is significantly increased by irrigation, manure and fertilizer, machine labour, and human labour. In concern study area, the return to scale was found 2.11 which showed that output will more increase in comparison to all the variable inputs. It is also concluded that the input variables such as human labour and manure & fertilizer, seed cost and plant protection chemicals were found over utilized. The machine labour and use of irrigation was found under-utilize such as essential for raising the use of these resources from the present mean level.

**KEY WORDS:** Marigold, Input use Efficiency, B-C Ratio, Cobb-Douglas Production Function-----

## 1. INTRODUCTION

Floriculture is lucrative and fast rising branch of horticulture in term of family labour employment & development, poverty alleviation, regular income from agriculture sector in developing countries (Kaur *et al.*, 2022). Different kind of flowers and ornamental plants are cultivated for trade at national and international level in developed and developing countries (Shivayogi Honyal, *et al.*, 2019). Social and economic aspect of flowers growing in the last thirty years due to increase urbanization and changing life styles of people. Thus its commercial status is increased as a potential agribusiness (Singh *et al.*, 2013). Marigold is grown not only for their beauty as cut flowers and landscaping plants but also for their natural carotenoid pigment used in chicken feed (Tigga *et al.*, 2023). Marigold cultivation is attracting for flowers growers for its easy culture, short duration to produce, low cost and wide adaptability and popularity among consumers account for its forms, colour and good keeping quality (Mehta *et al.*, 2022) & (Bhadaraka *et al.*, 2024). So there is high demand for this flower especially khariff and rubi season during religious ceremony, festivals and family functions (Patade *et al.*, 2020)

India stands second position in flowers production after china (Kaur *et al.*, 2020), (Wali *et al.*, 2024). India's total export of floriculture USD 86.63 million in 2023-24. The major India exporting countries were Netherlands, USA, UK, U Arabs Emts and Canada (APEDA). The area under floriculture production were 322 thousand hectares with a production of 2980 thousand Metric Tonnes flowers (As per National Horticulture Database 2021 published by National Horticulture Board, 13-12-2023). The floriculture plays a key role in the agrarian economy with having largest area under floriculture in such states; Karnataka, Tamil Nadu and west Bengal, Andhra Pradesh, Maharashtra, Rajasthan, Punjab and Haryana (Mehta *et al.*, 2007) & (Raut and Sarawgi, 2019).

In recent it is noted that Haryana has rapid growth in area owing to flowers crop under field and protected conditions. Though many varieties of flowers like gladiolus, Rose, Tuberose and Chrysanthemum are grown in the state but the highest area confined under marigold cultivation because of its low cost, attractive colours and long vase life (Kumar and Malik, 2024). In Haryana flowers cultivation covered 1692.2 hectare area and gained total flowers



production 19613 metric Tonnes and 73295960 sticks (CF) but highest area under marigold cultivation was covered by the Gurugram and Sonipat District of Haryana such as; 388 and 180 hectare respectively. **(Final Area and Production 2023-24, Horticulture Development, Government of Haryana).**

Marigold named as 'Gandaphula' main decorative herb is known for its very attractive and vase life flower (**Panda et al., 2022**). Marigold, family of Asleraceae stands third rank after Rose and Chrysanthemum in India. Most of farmers depends on the solely on the income from marigold cultivation (**Verma et al., 2019**). (**Sei et al., 2018**) reported the increasing trend in the cost of cultivation from marginal to small farmers and overall Benefit cost ratio was 1:1.2 for marigold crop after Surveyed in Surajpur district of Chhattisgarh. Proper understanding the structure of cost and returns and input use efficiency enables the grower's of marigold farming in profitable manners using available resources (**Kumar & Malik, 2024**). The efficient use of resource influence the income of farmers as farmer can gain more income by using available resources more efficiently (**Kumar et al., 2023**). But for the success of business, well develop market system is necessary (**Kumari et al., 2023**).

## 2. MATERIAL AND METHODS

### 2.1 Sample Selection Techniques

The study is presented on the marigold flower cultivation in Haryana state. The data was collected for the study from designated marigold cultivators through the individual interaction by the use of the questionnaire pertaining to the year 2022-23. The primary data is based on the survey of 120 respondents from Sonipat and Gurugram district of Haryana. These Districts were chosen on the basis of highest area and production in under marigold crop 2021-22. A multistage sampling strategy has been adopted for data collection technique. First, two districts were chosen, and the Horticulture Department of the concerned district provided the village-by-village list of marigold growers. Three villages having maximum number of marigold from these villages were chosen at second phase. Third, in order to arrange the sample of 120 marigold growers, 20 growers from each village were chosen randomly from the sample area.

### 2.2 Cost and Returns

The Commission on Agricultural Costs and Prices' policy was used to analyze the cost and return analysis. The Indian Ministry of Agriculture and Farmers Welfare is associated with the Commission of Agricultural Costs and Prices.

According of the Methodology, there are "A", "B" and "C" cost concepts whereby cost "A" comprises hired human labour, seed, machine labour, manure & fertilizer, irrigation, plant protection chemicals, land revenue, depreciation on implements & repairs, Interest on working capital. Cost "B" covers all component of cost "A" plus interest on fixed cost. Cost "C" is made up of cost "B" plus the estimated value of family labor. (**Deshlahre et al., 2023**).

Gross returns per hectare were computed by the multiplication of average yield and prices collected by the farmers. The benefit cost ratio, or return per rupee invested, was calculated by dividing the total returns by the cost of cultivation, and the net returns were calculated by subtracting the cost from the total returns.

### Regression Analysis and Input-output relationship

Cost concepts- including costs "A," "B," and "C," were examined in order to determine the cost of producing marigold flower production. The Cobb Douglas function was used in the marigold flower production process to assess the resource use efficiency. (**Ariputhiran et al., 2022**)

$$Y = AX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} e^{\mu}$$

Where,

Y = Gross income (Rs./ha.)

X<sub>1</sub> = Hired human labour (Rs./ha.)

X<sub>2</sub> = Machine labour (Rs./ha.)

X<sub>3</sub> = Seed/planting material (Rs./ha.)

X<sub>4</sub> = Manure & fertilizers (Rs./ha.)

X<sub>5</sub> = Plant protection chemicals (Rs./ha.)

X<sub>6</sub> = Irrigation (Rs./ha.)

A = Intercept

μ = Stochastic disturbance term

b<sub>1</sub> to b<sub>6</sub> partial elasticity coefficients of x<sub>1</sub> to x<sub>6</sub>

It can be presented in logarithmic form as



$$\ln y_i = \ln A + b_1 \ln x_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + \mu$$

The elasticity of Y with respect to the  $x_i^{th}$  input was estimated by parameters b1 to b6. The following formula was used to determine the values of the marginal product of major inputs.

$$MVP \text{ of } x_i^{th} \text{ resource} = b_1 \frac{Y}{x_i}$$

Y = G. M. of gross returns in marigold flower crop. (G.M. means Geometric mean)

$x_i$  = G. M. of  $x_i^{th}$  variable (G.M. means Geometric mean)

$b_i$  = Elasticity of Production or Regression Coefficient  $x_i^{th}$  independent variable

To assess the efficiency of resource usage, each input marginal value was linked to the marginal factor cost; the equivalence of MVP and MFC indicates the best possible use of resources (**Anbarassan et al., 2016**). The degree of resource use efficiency is thus indicated by the MVP to MFC ratio. Then marginal value of product (MVP) is divided with marginal factor cost (MFC) and conclusions are drawing as: (**Kaur et al., 2022**).

If MVP/ MFC = 1; then Optimum Resource use

MVP/ MFC >1; Less than optimum use of Resource

MVP/ MFC <1 Greater than optimum use of Resource

**Table 1: Cost of cultivation of Marigold in Small and Large Farms of Haryana (Rs./ha.)**

S. No.	Particulars	Small farm		Large farm	
		Qty	Value	Qty	Value
1	Hired human labour		24780 (12.98)		26080 (13.20)
2	Machine labour		10850 (5.68)		12756 (6.46)
3	Seed (Kg.)	0.75	3129 (1.64)	0.78	3265 (1.65)
4	Manure & fertilizer		19226 (10.07)		20280 (10.26)
5	Irrigation	7.6	2356 (1.23)	8.2	2542 (1.29)
6	Plant protection chemicals (Weeds, insect pests and disease control)		35890 (18.80)		37975 (19.22)
7	Land revenue		205 (0.11)		196 (0.10)
8	Depreciation on implements & repairs		4822 (2.53)		5155 (2.61)
9	Interest on working Capital		3375 (1.77)		3608 (1.83)
<b>10</b>	<b>Cost A</b>		<b>104633 (54.82)</b>		<b>111857 (56.61)</b>
11	Rental value of land		48750 (25.54)		50360 (25.49)
12	Interest on fixed cost		4875 (2.55)		5036 (2.55)
<b>13</b>	<b>Cost B</b>		<b>158258 (82.92)</b>		<b>167253 (84.65)</b>
14	Family labour		12390 (6.49)		9128 (4.62)
<b>15</b>	<b>Cost C</b>		<b>170648 (89.41)</b>		<b>176381 (89.27)</b>
16	Management & risk factor		17065 (8.94)		17638 (8.93)
17	Transportation		3150 (1.65)		3560 (1.80)
<b>18</b>	<b>Total Cost</b>		<b>190863 (100.00)</b>		<b>197579 (100.00)</b>



The cost of cultivation of marigold flower was performed in the table. 1. The per hectare total cost of production “A”, “B” and “C” in small were and large farm were 104633, 111857; 158258, 167253 & 170648, 176381 respectively. The higher part of labour cost in total cost i.e. in large and small farm to be (Rs. 24780 (12.98), 26080 (13.20) carried out in marigold cultivation was very costly and labour intensive. Similar results were found in (kumar and Malik, 2024) research. The total cost was large farm higher than the small farm. These results were confirmatory by (Verma *et al.*, 2019) (Deshlahre *et al.*, 2023). The foremost share of total cost land was rental value (25.54) and (25.49) and human labour (12.98) & (13.20) for small and large farm respectively. These results were founded by (Haque *et al.*, 2012).

**Table 2: Returns from Marigold Cultivation in Small and Large Farms in Haryana (Rs./ha.)**

S. No.	Particulars	Small farm	Large farm
1	Cost A	104633	110966
2	Cost B	158258	165262
3	Cost C	170648	174390
4	Average Yield (q.)	149.6	153.4
5	Average Price (Rs./q.)	4250	4250
<b>6</b>	<b>Gross returns</b>	<b>635800</b>	<b>651950</b>
7	Total cost cultivation (Rs./ha.)	190863	195389
<b>8</b>	<b>Net Returns</b>	<b>444937</b>	<b>456561</b>
9	Returns over Cost A	531167	540984
10	Returns over Cost B	477542	486688
11	Returns over Cost C	465152	477560
<b>12</b>	<b>B:C</b>	<b>3.33</b>	<b>3.34</b>

The return obtained from the marigold cultivation is showed in table 2. The average yield of per hectare of large farm (651950) is compared to higher than the small farm (635800). So the net return of large farm was found higher than the small farm (Deshlahre *et al.*, 2023). The return per rupee investment on large and small farm over overall cost was 3.34 and 3.33 respectively. The reason behind these gained batter market prices for marigold growers as they sold flowers nearby main market, Gajipur mandi, Delhi. The return per rupee was higher for large farm than small farm.

**Table 3: Production Elasticity of Marigold Resources in Haryana**

Particulars	Coefficients (b <sub>1</sub> )	Standard Error	t – Stat
Constant	13.1815	0.498	26.452
Human Labour	0.04**	0.014	2.641
Machine labour	0.87	0.026	-1.358
Seed cost	-0.03*	0.088	-0.376
Manure and fertilizers	0.05	0.048	0.949
Plant protection chemicals	-0.04	0.051	-0.803
Irrigation	1.23**	0.066	0.776
Σb <sub>1</sub> (return to scale)	2.11		

\*\* Significant at 1% level, \* Significant at 5% level

The production function's coefficient (b<sub>1</sub>), standard error, t-statistic, and return to scale are all shown in table 3. At the 1% level, the irrigation and human labor regression coefficients were determined to be positive and significant. At the five percent significance level, the seed cost regression coefficient was shown to be negative. However, there was no discernible effect on marigold production returns, and the regression coefficients for machine labour and plant protection chemicals were determined to be positive. (Kolambkar *et al.*, 2014). The model's return to scale, which was 2.11, indicates that if all explanatory input variables were raised by 100%, marigold production returns would rise by 21%. This results was confirmatory by (Kumar and Malik, 2024)



**Table 4: Resource use Efficiency in Marigold Cultivation in Haryana**

Particulars	Geometric mean	Coefficients	MVP	MFC	r = MVP/MFC	Level of resource use
Human Labour	10.25	0.04	0.05	1	0.05	Over utilized
Machine labour	9.27	0.87	1.25	1	1.25	Under utilized
Seed cost	8.04	-0.03	-0.06	1	-0.06	Over utilized
Manure and fertilizers	9.94	0.05	0.06	1	0.06	Over utilized
Plant protection chemicals	10.51	-0.04	-0.05	1	-0.05	Over utilized
Irrigation	7.79	1.23	2.11	1	2.11	Under utilized
<b>R<sup>2</sup></b>	<b>0.6707</b>					

### Input use efficiency in Marigold Production

The assessed CD function for the production of marigold is fitted in table-3. It is concluded the coefficient of the adjustable multiple determinations ( $R^2$ ) that was significant at the value of .67 which indicates the variables comprised in the model described 67 per cent distinction in the yield of marigold. With corresponding values of .04 and .87, the machine labor and human labor coefficients were both positive and significant at the 1% level. Similar results were found by (Anbarassan *et al.*, 2016). Manure and fertilizer and irrigation all had positive coefficients, meaning that increasing their use by 1% above the current mean level would increase marigold yield 0.05 and 1.23%, in that order. To determine the economic efficiency of factor utilization in marigold production, the marginal value of the product (MVP), the marginal factor cost (MFC), and the ratio between MVP and MFC were discussed for each input. Machine labour and irrigation's MVP to MFC ratios were found to be greater than one, indicating underutilization of these resources and the potential to increase marigold production by raising the corresponding factor from its existing mean level. The marigold production decreased with fewer irrigations frequency. (Machnoor *et al.*, 2023) Higher than optimum use of human labour, and manure & fertilizers were observed as MFC greater than MVP with ratios of 0.05 and 0.06 respectively. This demonstrated the need to reduce the current mean level of use of fertilizers, manure, and human labor. Similar results found by (Nandini *et al.*, 2020).

### CONCLUSION

It can be concluded that higher return over cost and higher benefit cost ratio in marigold production reflect the economic viability in the research area. The CD production function suggestions a powerful tool for resource use efficiency. However, human labour, and manure & fertilizers, use of seed cost and planting protection chemicals were observed over utilized and require compressing the usage of these factors. The MVP to MFC ratio was higher than one in case of use of irrigation and Human labour offered the possibility of raising yield by increasing the usage of these factors. The relatively small area i.e. two districts and small sample size 120 responders is the crucial limitations of the current study. Through a vast area and higher sample size provide demonstrative outcomes and take a broad view on total population. However this study can help as a motivation and more effective to promote further research in developing countries to understand a potential of raising farmer income from flower cultivation. The government schemes i.e. sustainable development goal, economic growth and no poverty can achieve by focusing on the commercialization of floriculture sector.

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