

## Research Paper

## Economics of Lemongrass Cultivation in Jharkhand State

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Received: 11-05-2022

Revised: 24-08-2022

Accepted: 03-09-2022

### ABSTRACT

The present study was carried out to study the cost of cultivation and returns from lemongrass, oil bearing aromatic crop using different cost concepts, estimated from primary data collected from 75 cultivators. The cost of cultivation was calculated using operating expenses (Cost  $A_1$ ) at ₹ 51,713, while considering all types of costs (Cost  $C_3$ ) it reached to ₹ 68691 per hectare. The gross returns from cultivation of lemongrass in a hectare was found at ₹ 1,40,000 hectare, while net return over Cost  $A_1$  and Cost  $C_3$  was estimated at ₹ 71309 and ₹ 88287, respectively. The B: C ratio over cost  $A_1$  and cost  $C_3$  was calculated as ₹ 1.71 and ₹ 1.04, which indicated that lemongrass cultivation is profitable venture in the study area. Estimation of a regression model indicated positive and significant influence of expenditure on machine use, lemongrass slips and manures/ fertilizer on returns from lemongrass. There are two channels for marketing of lemongrass oil, i.e. (i) producer-local buyer-industry, and (ii) producer- industry. It was observed that marketing cost and price spread was higher in channel-I due to more number of intermediaries. The lemongrass cultivator can ease their marketing activities and enhance income through formation of cooperative society.

### HIGHLIGHTS

- ① Cost of cultivation of lemongrass considering all cost components (Cost  $C_3$ ) was found to be ₹ 68691 with net return of ₹ 88287 per hectare.
- ② The benefit cost ratio considering all cost concepts were found to be positive, indicating economic feasibility of lemongrass cultivation in the study region.
- ③ There are only two marketing channels involved in marketing of lemongrass in the study area.

**Keywords:** Cost and returns of lemongrass, marketing, oil production

*Cymbopogon flexuosus* and *C. pendulums* are the source of lemongrass oil in great demand in the country and is exported in large quantities. It is an ideal crop for cultivation in rainfed and erosion-prone areas. Lemongrass is a perennial, multi-cut aromatic grass cultivated in tropical and subtropical regions in India. Lemongrass oil is a good source of citral used in perfumery, pharmaceutical, cosmetics and aromatherapy industries and the production of vitamin A. The lemongrass is one of the important economically essential oil-bearing crops in Jharkhand, mainly grown in the unutilized land in the state. Oil is distilled from the leaves and flowering tops of Lemongrass. The scientific lemongrass (*Cymbopogon flexuosus*) cultivation is at its infancy among the state's tribal farmers.

Lemongrass is a tropical perennial plant that yields aromatic oil on a steam distillation of the herbage.

Lemongrass oil is used in culinary flavoring. It is used in most major categories of food, including alcoholic and non-alcoholic beverages, frozen dairy desserts, candy baked (Singh *et al.* 1998) foods, gelatins and puddings, and meat and meat products. Lemongrass oil is commonly used in soaps, perfumes, detergents, cosmetics, pharmaceuticals and candles. Most soaps and after shaves with a fresh lime fragrance uses as citral (Anonymous, 2006).

**How to cite this article:** Sharma, R.S., Kumar, Y., Bhise, R.N., Choudhri, H.P.S., Verma, D.K., Srivastava, R.K. and Kumar, S. (2022). Economics of Lemongrass Cultivation in Jharkhand State. *Econ. Aff.*, 67(04): 505-510.

**Source of Support:** None; **Conflict of Interest:** None



The plant is hardy and resistant to drought. It is observed that lower altitude and alkaline soil facilitate higher citral content of the oil. The variety with high citrate is in great demand. The plant prefers tropical and subtropical climates for proper lemongrass growth. The optimum temperature range should be around 10 to 30 °C (Aus Gyanya, 2020). It may be cultivated on less fertile and marginal land also, where no other crop cultivates. It is less caring, with a lower danger of crop loss from animals, illnesses, drought, hailstorms, and high wind speeds, among other things. This crop will also normally grow in sunny, warm, humid conditions of the tropics, on the low fertile soil, hilly areas, degraded forests, wasteland, and low rainfall with pH ranges 7.0 to 8.5. Lemongrass oil production in India has shown to be quite profitable for cultivators, especially those with less fertile and underused land.

In India, it is cultivated in Maharashtra, Andhra Pradesh, Kerala, Karnataka, Tamil Nadu, Chhattisgarh, Haryana, Punjab, Rajasthan, Gujarat, Jharkhand, Uttar Pradesh, Madhya Pradesh, Bihar, Arunachal Pradesh, Assam, and Sikkim (Handa and Kaul, 2001) on around 4000 acres with an annual yield of 250-300 tonnes. Lemongrass oil is produced in small quantities across the world, with an annual production of estimated 1000 tonnes from a 16000 ha area (Gawali and Meshram, 2019). Lemongrass is essential among aromatic plants in the international market because its oil contents are about 75-80 percent citral (Joy *et al.* 2001). Lemongrass leaves are used after drying in herbal tea also. CSIR-CIMAP has developed wide high lemongrass citral content varieties like Krishna, CIM- Shikhar, Chirharit, Nima, Pragati, Praman, and Cauvery. The study of costs and returns analysis in different aromatic crops like mint, palmarosa, tulsi and vetiver (Suresh *et al.* 2011, 2012, 2014 and 2019). The essential oil of lemongrass from India is being exported to the countries like West Europe, the U.S.A., Japan, Belgium, Brazil, France, Germany, South Africa, Singapore, Spain, Switzerland, and the U.K., etc.

The production technology for lemongrass cultivation developed by CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow, was demonstrated through hands-on training in the farmers' field. The present study was mainly focused on the following aspects of lemongrass

cultivation: (1) socio-economic profile and resource structure of the farmers, (2) To analyze the costs and returns of lemongrass cultivation, (3) estimated the resource use efficiency in lemongrass cultivation.

## MATERIALS AND METHODS

CSIR-Central Institute of medicinal and aromatic plants (CSIR-CIMAP) Lucknow undertook the technology demonstration on scientific cultivation of lemongrass in Ranchi, Khunti, Simdega, Hazaribagh, Gumla, and Bokaro districts of Jharkhand during 2018-20. The random sampling technique was used for comprised of 75 farmers through a personal interview using a pre-tested interview survey schedule on the socio-economic profile of the farmers and cultivation aspects. The technology demonstration was carried out under a collaborative project of CSIR-CIMAP, Lucknow, and Jharkhand Livelihood Promotion Society, Department of Rural Development, Government of Jharkhand. The cost and return were calculated at the prevailing market prices. A simple analytical tool and technique used for the data analysis method were followed to examine the costs, and returns and comparisons were made. The Multiple Linear Production function was used to evaluate the efficiency of resource use in lemongrass cultivation production.

### Cost Concepts

Cost A<sub>1</sub>: All paid-out expenses incurred in the lemongrass cultivation + depreciation on fixed assets + interest on working capital.

Cost A<sub>2</sub>: Cost A<sub>1</sub> + rent paid for leased in land.

Cost B<sub>1</sub>: Cost A + interest on value of owned fixed capital (excluding land).

Cost B<sub>2</sub>: Cost B<sub>1</sub> + rental value of owned land.

Cost C<sub>1</sub>: Cost B<sub>1</sub> + imputed value of family labour.

Cost C<sub>2</sub>: Cost B<sub>2</sub> + imputed value of family labour

Cost C<sub>3</sub>: Cost C<sub>2</sub> + managerial cost @10% of Cost C<sub>2</sub>

### Profitability concepts

Total production = Main product

Gross income = Value of main product

Net income = Gross income – Cost C

$$B:C \text{ ratio} = \frac{\text{Net Income}}{\text{Cost C}}$$

## Production function

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \dots + \beta_7 X_7$$

$\alpha$  = Intercept

$Y$  = Oil yield in kg

$X_1$  = Human labour charges (₹/ha)

$X_2$  = Expenditure on machinery (₹/ha)

$X_3$  = Expenditure on slips (₹/ha)

$X_4$  = Expenditure on manure & fertilizer (₹/ha)

$X_5$  = Irrigation charges (₹/ha)

$X_6$  = Distillation charges (₹/ha)

$X_7$  = Transportation charges (₹/ha)

## Estimation of Price Spread:

### Marketing margin

This is the difference between the middleman's receipts (sale price) and the total payment made (purchase price + expenses incurred) by the middleman during the marketing of produce.

### Price spread

The difference between the price paid by the consumer and the net price received by the producer was taken as the concept of spread. The model prices at different levels were obtained to work out the gross margins of various agencies. The deduction of the costs incurred by the concerned agencies from the gross margin gave rise to the net margin.

$$\text{Price Spread} = \frac{\text{Consumer Price} - \text{Net Price of producer}}{\text{Consumer price}} \times 100$$

## RESULTS AND DISCUSSION

### Socio-economic profile of the farmers

Data from the selected farmers were collected and analyzed regarding average family size, literacy status, occupation, caste, land holding, cropping pattern, average farm assets, etc., as discussed in Table 1. These results revealed that the overall average family size was 5.95 persons, the literacy status of the family member was 72.58 percent,

and more than 85 percent of the respondents were solely dependent on agriculture. The average landholding of the sample farmers was found to be 1.38 hectares. Lemongrass occupied an essential position in the cropping pattern by representing about 22.54 percent area during the year. The farmers made significant investments in farm assets like farm building, irrigation structures, tractors, farm equipment, and distillation units, etc.

**Table 1:** Socio-economic profile of the farmers

Particulars	Averages
Average family size (No.)	5.95
Literacy status of family members (per cent)	72.58
Occupation (per cent)	
Agriculture	85.33
Allied sector (dairy plus services)	14.67
Caste composition (per cent)	
General	2.70
Other backward castes	6.70
Scheduled castes	48.00
Schedule tribes	42.70
Average landholding (ha)	1.38
Agriculture crops (per cent)	
Paddy	17.98
Wheat	3.71
Maize	19.91
Potato	8.17
Mustard	2.82
Pigeonpea	14.56
Chili	0.74
Pea	2.53
Medicinal and Aromatic crops (MACs) (per cent)	33.52
Kalmegh	0.14
Satavar	0.85
Tulsi	4.37
Lemongrass	22.54
Vetiver	3.10
Palmarosa	2.54
Average farm assets (₹) (farm building, irrigation structure, farm equipment and distillation units)	304940

### Cost Structure of Lemongrass Cultivation

The cost structure of lemongrass cultivation calculated at the current price prevailing in the market has been presented in Table 2. The observed

operation cost of lemongrass cultivation was ₹ 51713 (75.28 per cent) per ha per year. In operational costs, the maximum expenditure incurred was slips charges at ₹ 21046/ha (30.64 percent), followed by distillation charges at ₹ 8050/ha (11.72 percent), hired workforce charges at ₹ 7900/ha (11.50 percent), machine charges at ₹ 3611/ha (5.26 percent) and expenditure for manure and fertilizers at ₹ 3557 (5.18 percent), respectively in the study area.

**Table 2:** Cost structure of lemongrass cultivation in Jharkhand (₹ /ha)

Particulars	Amount (₹)	%
Hired manpower charges	7900	11.50
Machine	3611	5.26
Slips	21046	30.64
Manures and fertilizers	3557	5.18
Irrigation	3006	4.38
Transportation	1160	1.69
Distillation charges	8050	11.72
Interest on working capital @7 per cent per annum	3383	4.92
Cost A <sub>1</sub>	51713	75.28
Rent paid in leased land	—	—
Cost A <sub>2</sub>	51713	75.28
Interest on fixed cost capital @10 per cent	2670	3.89
Cost B <sub>1</sub>	54383	79.17
The rental value of own land	3000	4.37
Cost B <sub>2</sub>	57383	83.54
Cost of family labour charges	5063	7.37
Cost C <sub>1</sub>	59446	86.54
Cost of family labour charges	5063	7.37
Cost C <sub>2</sub>	62446	90.91
Managerial cost @10 per cent of Cost C <sub>2</sub>	6245	9.09
Cost C <sub>3</sub>	68691	100.00

### Returns from lemongrass cultivation

The cost and return from lemongrass cultivation are presented in Table 3. It was found that the farmers have got 112 kg of lemongrass oil from ha of land, which amounted to a total return were ₹ 1, 40,000 per ha per year. The net return of farmers from lemongrass oil production over different types of costs is presented in Table 4. The net income over cost A<sub>1</sub> was ₹ 88287/ha, and cost C<sub>3</sub> was ₹ 71309 per ha. The B-C ratio over cost A<sub>1</sub> and C<sub>3</sub> were ₹ 1.71 and ₹ 1.04, respectively. Thus, profitable returns through the cultivation of lemongrass may attract

many farmers to cultivate this crop to enhance their income and employment in the study area with traditional crops.

**Table 3:** Net return over cost (₹ per hectare per year)

Particular	Amount (₹)
Oil production (kg.)	112
Price Rate (₹ per kg)	1250
Total return (₹)	140000
Net return over the cost	
Cost A <sub>1</sub>	88287
Cost A <sub>2</sub>	88287
Cost B <sub>1</sub>	85617
Cost B <sub>2</sub>	82617
Cost C <sub>1</sub>	80554
Cost C <sub>2</sub>	77554
Cost C <sub>3</sub>	71309
B-C ratio	
Cost A <sub>1</sub>	1.71
Cost A <sub>2</sub>	1.71
Cost B <sub>1</sub>	1.57
Cost B <sub>2</sub>	1.44
Cost C <sub>1</sub>	1.36
Cost C <sub>2</sub>	1.24
Cost C <sub>3</sub>	1.04

### Estimated Resource Use Efficiency for lemongrass cultivation

The estimated resource use efficiency in lemongrass production is presented in Table 4. The multiple determination of the regressions coefficient's (R<sup>2</sup>) value was estimated at 0.677, which indicates 68 percent of the variations in lemongrass yield were influenced by the explanatory variables included in the model. The independent variables like machine/ tractor, slips /planting material, and manures & fertilizers were positive, indicating a significant impact on lemongrass oil returns in the study area. The coefficients of these variables imply that there is a scope to further increase the output by using one or more of these inputs at a higher amount.

### Marketing of lemongrass oil

#### Marketing system and channels

This section investigates the marketing system and channel of lemongrass oil produced in the study area.



**Table 4:** Estimated production factors for lemongrass cultivation (N=75)

Variables	Coefficients	Standard Error	t-Stat	P-value
Intercept (I)	-17750.858	14102.700	-1.259	0.213
Manpower charges ( $X_1$ )	1.814 <sup>NS</sup>	1.531	1.185	0.240
Machine charges ( $X_2$ )	10.356 <sup>**</sup>	4.994	2.074	0.042
Slips charges ( $X_3$ )	2.305 <sup>***</sup>	0.679	3.396	0.001
Manures and fertilizers charges ( $X_4$ )	6.899 <sup>*</sup>	3.822	1.805	0.076
Irrigation charges ( $X_5$ )	3.646 <sup>NS</sup>	5.228	0.697	0.488
Distillation charges ( $X_6$ )	22.020 <sup>NS</sup>	24.580	0.896	0.374
Transportation charges ( $X_7$ )	0.584 <sup>NS</sup>	3.150	0.185	0.853
$R^2$	0.677			
N	75			

\*\*\*, \*\* and \* Significant at 1, 5 and 10 per cent level.

NS: Non-significant.

## Marketing channels

Based on data collected from the grower, it was observed that lemongrass oil reaches the ultimate industry through the following two channels.

### Producer-local buyers-industry

#### Producer-industry

**Table 5:** Marketing system (marketing channel) of lemongrass oil produced by farmers

Particular	No. of growers
Channel-I	61 (81.33)
Channel-II	14 (18.67)
Total	75 (100.00)

Out of these identified channels, Table 6 shows that the Channel-I was dominated in the study area as 81.33 percent of lemongrass growers were selling their oil through this channel, and only 18.67 percent used channel- II to sell their oil. The growers received a higher sell price by channel-II than channel-I. For grower's point of view, channel-II is the most feasible and easy to sell their oil to traders and is more profitable because of the lower market cost margin and price spread.

The analysis of marketing cost, price spread, and margin presented in Table 6. It is revealed that in channel-II, total ₹ 20 was spent by a producer to sum marketing functions, whereas in channel-I ₹ 35 was spent by producers. The total marketing cost incurred for lemongrass oil in channel-II was

₹ 20, whereas channel-I was ₹ 40. It implies that farmers who disposed of the oil on their own incurred relatively more cost in channel-I compared to channel-II farmers. The price spread under two prominent channel-II and channel-I, in the marketing of lemongrass oil; in the case of channel-II it was ₹ 20, whereas in channel-I it was ₹ 70. Since price spread is directly proportional to the number of intermediaries involved in marketing a product.

**Table 6:** Price spread for lemongrass oil marketing

Particular	Channel-I (₹/kg)	Channel-II (₹/kg)
Net price received by producer	1200	1250
Marketing cost incurred by producer	35	20
Producer sale price/local buyer purchase price	1235	1260
Marketing cost incurred by local buyer	25	00
Market margin	30	00
Local buyer sale price/ Industry purchase price	1290	1260
Total margin	30	00
Total marketing cost	40	20
Price spread	70	20

## CONCLUSION

It may be concluded that the farmers' primary livelihood source has been agriculture and allied activity in the study areas. In the selected area of Jharkhand, farmers are inclined to adopt new crop and technologies faster as lemongrass cultivation for their livelihood security and income enhancement.

The cost and return of lemongrass revealed more expenditure on planting material (slips) and human labor. The total cost per hectare was observed ₹ 51713, and in this respect, the total net return obtained from the cultivation of lemongrass ₹ 88287 with B:C ratio of 1:1.04, which implies that the farmers expense the Re.1 and get the profit ₹ 1.04. Therefore, lemongrass crop cultivation in Jharkhand is more profitable than other traditional crops. In lemongrass cultivation machinery charge, planting material (slips), manure, and fertilizers more significantly and positively role in affecting the yield and production was found decreasing return to scale. Channel I (Producer-local buyer-industry) is more dominant for selling of lemongrass oil. Therefore, lemongrass crop cultivation in Jharkhand is more profitable. However, it is recommended from this study that lemongrass cultivation can be promoted in Jharkhand and other states, where problematic areas like unutilized land, rainfed area, and animal-affected areas for improve their social and economic life.

## ACKNOWLEDGEMENTS

The authors are thankful to Director, CSIR-Central Institute of Medicinal and Aromatic Plants, for providing guidance and support to conduct this study. We thank all farmers who cooperated during the study and demonstration period. This work is under CSIR-Aroma Mission Project Phase-I.

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