



The economic landscape of clove production in India: challenges and opportunities

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Received 24 October 2023; Revised 07 March 2024; Accepted 11 March 2024

Abstract

Clove is a valuable spice commodity with high demand in India, yet domestic production has remained stagnant, leading to import dependency. This study analyzed the clove economy in India, focusing on production trends, trade patterns, cost of production, and returns from clove farming. The data from primary survey of 40 clove plantations from five clove growing regions of Kerala (Idukki, Kozhikode and Kollam districts) and Tamil Nadu (Kanyakumari and Tenkasi districts) were used to estimate the cost of production and profitability of clove farming. The cost of production was estimated to be Rs 581 per kilogram of dry clove. The study reveals that clove cultivation faces challenges such as low genetic variability, poor agronomic practices, inadequate soil fertility management, biotic stress factors, senile plantations, unorganized markets, and labour shortages during harvest. These challenges constrain domestic production and hinder profitability. Intervention opportunities include developing high-yielding, disease-resistant varieties, enhancing extension services and training, strengthening disease and pest control measures, encouraging replanting and rejuvenation of senile plantations, establishing organized markets and price stabilization mechanisms, and addressing labour shortages during harvest. Addressing these challenges and implementing suggested interventions can increase domestic clove production, reduce import dependency, and improve the profitability and sustainability of clove farming in India.

Keywords: Clove plantation, India, cost of cultivation, import, trade, self sufficiency

Introduction

Clove is one of the most widely traded spice commodities in the world with various medicinal and culinary properties. The clove of commerce is the aromatic, dry, fully grown but unopened flower buds of clove tree (*Syzygium aromaticum*; Family Myrtaceae). It is commonly used as a spice, and for imparting distinct flavour or fragrance in products, such as toothpaste, soaps and cosmetics (Danthu *et al.*, 2020). The plant is indigenous to North Molucca Islands of Indonesia. It is also grown in Zanzibar, Comoros, Tanzania, Madagascar, Malaysia, Sri Lanka and India (Spices Board, 2023). The estimated global production of clove was 1,96,795 tonnes from an area of 6,75,685 ha during 2021 (FAO, 2023). Indonesia is the largest producer of clove in the world accounting for 85 per cent of the area and 74 per cent of the total output.

Clove is considered as one of the major tree spices in India along with cinnamon, nutmeg and tamarind. The cultivation of clove is mainly restricted to the hilly tracts of Tamil Nadu, Kerala and Karnataka. During 2020-21, clove was cultivated in 2179 ha in the country with an estimated output of 1183 tonnes (Malhotra *et al.*, 2021). The current level of production is insufficient to meet the domestic household demand and the demand from the spice processing and extraction industry. India depends on imports of clove to meet the gap between domestic demand and production. During 2021-22 alone, India imported cloves and its associated products worth 160 million USD contributing about 15 per cent of the total spice imports in value terms.

Increasing the domestic production of clove is important for enhancing the self-sufficiency of the country in spices. The clove production economy needs to be studied with primary focus on the cost of production and returns from farming. In this study we analyse the clove economy with a focus on production trends, pattern of trade, cost of production and returns from clove farming.

Data and methodology

The clove cultivation in India is concentrated in the states of Tamil Nadu and Kerala. Together, they account for more than 90 per cent of the area under clove cultivation in India (Spices Board, 2022). In both these states, clove is cultivated on a commercial scale in a few districts only. In this study we used the primary data from clove farmers of five districts (Kanyakumari and Tenkasi districts of Tamil Nadu and Kollam, Idukki and Kozhikode districts of Kerala). From each district, 8 established clove plantations were selected randomly and data on various parameters like input usage, labour use, productivity and management practices was collected using a structured schedule. The total sample size was 40.

The usual cost concepts used for field crops cannot be directly used in case of perennial crops like clove with a long gestation period (usually 5-7 years) before the crop reaches bearing age. In this study our objective was to arrive at a realistic cost of cultivation for a functioning plantation. In the absence of suitable sample with trees in various categories of pre-bearing and bearing stage, this would serve as an indicative cost of

cultivation. Most of the farms do employ managers for a period of 4 to 6 months in an year. The average wages paid to the managers across the sample farms was included in the cost of cultivation. We also identified the cost components of crop management for bearing trees and the cost of establishment of clove plantation till it reaches the productive phase. The cost incurred for the establishment of the plantation was treated as an overhead cost. The annuity value of the cost incurred on establishment for the expected bearing period of the trees was included as a component of the annual cost of cultivation. The inclusion of annuity value of the establishment cost will result in more realistic assessment of the cost of production of clove by the primary producer.

The annuity value of the establishment cost was worked out using the following formula.

$$P = \frac{w \left(1 - \left(1 + \frac{r}{k} \right)^{-kt} \right)}{\left(\frac{r}{k} \right)}$$

where, 'P' is the cumulative establishment cost, 'w' is the annuity value of the

establishment cost added to the annual cost of cultivation, 'r' is the rate of interest, 'k' is the number of compounding periods in one year and 't' is the expected life span of the plantation.

Secondary data on area, production and productivity of clove was collected from publications of Directorate of Arecanut and Spices Development, Ministry of Agriculture and Farmers Welfare, Government of India and the Spices Board of India. Trade information was compiled from the Export-Import data bank (Ministry of Commerce and Industries, Government of India, 2023).

Results and discussion

Production trends in clove

The cultivation of clove is spread over limited geographies with specific climatic parameters. Tamil Nadu is the major producer of the crop. The crop is commercially cultivated in Karnataka, Kerala and Andaman and Nicobar Islands. The state wise area under clove cultivation is presented in Table 1.

Table 1. State-wise distribution of area under clove (2020-21)

State	Area (ha)	Share (%)
Tamil Nadu	1039	47.6
Kerala	1001	45.9
Karnataka	97	4.5
Andaman & Nicobar Islands	42	2.0
Total	2179	100

The area under clove and its production has remained stagnant during the last two decades (Table 2). Since 2000-01, the crop has not registered any significant growth in terms of area, and yield, the two important variables determining the domestic availability of the commodity. This stagnation has occurred against a backdrop of robust growth in area and output of several other spice crops. For example, the area under nutmeg increased by nearly three times during the last two decades, from 7853 hectares during 2001-02 to 23353

hectares in 2021-22. The total area under spice crops increased from 2.8 million hectares to 4.4 million hectares whereas the total spice output and yield increased by 233 and 112 per cent respectively during the same period. The stagnant growth in domestic supply of clove is especially noteworthy in the context of increasing dependence on imports for meeting the rising domestic demand for the commodity. This indicates that clove cultivation has been constrained by technical challenges and /or uncertain economic viability.

Table 2. Trend in area, production and yield of clove in India

Year	Area (ha)	Production (tonnes)	Yield (kg ha ⁻¹)
2000-01	1900	1000	526.3
2010-11	2195	963	438.7
2020-21	2179	1183	542.9
Annualized growth rate	1.007	1.008	1.002

Trade performance

India is dependent on import of clove for meeting the domestic household demand and the demand from spice extraction industry. The trade profile of clove for the year 2021-22 is presented in Table 3. The value of clove imports was more than 13 times the value of clove exports. Due to low domestic availability of produce, India was never a major exporter of clove and its value added extracts. Extracted cloves (cloves after partial extraction of essential oil) constitute the major item of import with a share of 57.8 per cent in total value of clove imports. This is followed by cloves (not extracted) with a

share of 22.7 per cent in value of clove imports. The extracted cloves could be used as a substitute for non-extracted cloves to meet household demand for cloves as it is difficult to distinguish between them by consumers, especially in packaged form. Another feature of clove trade is that the import unit value is lower than the export unit value across the various product categories. This would indicate that India is able to source cloves from the international market at cheaper rates. This also creates an opportunity for re-export of cloves and its value added extracts after processing and value addition in India.

Table 3. Trade profile of clove (2021-22)

	Particulars	Quantity (‘000 kg)	Value (Rs lakhs)	Unit value (Rs kg ⁻¹)
1	Export profile			
a	Extracted cloves	103.9	697.0	671.2
b	Cloves (not extracted)	106.1	573.8	541.0
c	Clove stem	114.9	256.4	223.1
d	Other parts of clove, neither crushed nor ground	565.6	3,802.5	672.3
e	Cloves (whole fruit, cloves & stems), crushed or ground	195.9	1,113.5	568.4
f	Clove leaf/stem oil	102.0	1,314.4	1,289.1
g	Clove bud oil	25.0	485.3	1,939.6
h	Clove oleoresin	23.2	693.0	2,992.4
i	Total clove exports	1,236.5	8,935.9	7.23
2	Import profile			
a	Extracted cloves	13,144.3	68,657.9	522.3
b	Cloves (not extracted)	5,086.4	26,925.6	529.4
c	Clove stem	2,792.1	2,052.2	73.5
d	Other parts of clove, neither crushed nor ground	1,488.4	7,443.5	500.1
e	Cloves (whole fruit, cloves & stems), crushed or ground	0.0	0.1	1,300.0
f	Clove leaf/stem oil	1,447.1	13,545.4	936.0
g	Clove bud oil	12.8	221.1	1,730.0
h	Clove oleoresin	0.4	11.3	2,753.7
i	Total clove imports	23,971.5	1,18,857.1	4.96

Source: Export Import Data Bank, Ministry of Commerce and Industries, GoI

India's increasing dependence on clove imports can be clearly identified from the rising import trend for clove. The average import quantity and value of clove for the triennium ending 2000-01, 2010-11 and 2020-

21 is presented in Table 4. Both the import quantity and value of imports increased manifold during the last two decades indicating robust domestic demand for the commodity.

Table 4. Import trend in clove

Period	Quantity (tonnes)	Value (Rs lakhs, nominal prices)
Triennium ending 2000-01	3346	15379
Triennium ending 2010-11	11296	50162
Triennium ending 2020-21	23769	97949

Cost of production and profitability of clove

The data from detailed field survey conducted across two crop seasons in Kerala and Tamil Nadu was used to estimate the cost of production of clove in plantation scale operational holdings. The summary is presented in Table 5. The sample was restricted to plantation scale farms under fair management to generate a realistic estimate of the profitability of commercial clove farming. Given the long gestation period, the cost of establishment was one of the major cost elements. The establishment cost was distributed across the normal economic lifespan of the crop.

The analysis of cost of cultivation of clove indicates that the expenditure on labour involved in timely harvesting of clove along

with the processing cost was one of the major items of expenditure. The high establishment cost and cost of cultivation might deter small scale farming of the crop. The long gestation period is an additional factor which possibly makes clove farming unattractive to primary producers with limited financial resources. At the average expected yield under fair management (1632 kg dry clove per hectare), the cost of production of dry clove was found to be Rs 581/kg. The average price for the last two seasons (2021-22 and 2022-23) was Rs 754 per kg. Though the current price scenario was found to be favourable, the profitability of clove cultivation is highly sensitive to the price scenario. The operating margins can be very slender and the labour efficiency and managerial skills can play a decisive role in determining the economic viability of farms.

Table 5. Cost of production and returns from clove farming (2021-22 nominal prices)

Sn	Particulars	Value	Unit
1	Establishment cost (end of 6th year @ 8 % interest)	18,23,000	Rs
2	Annuity value of the establishment cost (Life span assumed at 30 years and interest rate of 7 per cent)	1,46,909	Rs/year
3	Cost of inputs like fertilizers & PP chemicals (@ Rs 125 per tree)	25,500	Rs/ha
4	Weeding and routine agronomic management (established plantation)	1,72,500	Rs/ha
5	Average yield per hectare (fair management) - kg dry clove	1632	kg/ha
6	Labour cost for harvesting and processing expenses	3,91,680	Rs/ha
7	Rental value of capital equipment and farm storage	20,000	Rs/ha
8	Wages paid for farm manager	1,20,000	Rs/ha
9	Cost of cultivation (Rs/ ha)	8,78,221	Rs/ha
10	Value of own managerial input @ 10 per cent of cost of cultivation	73,131	Rs/ha
11	Total cost of cultivation (Rs/ ha)	9,51,352	Rs/ha
12	Cost of production (Rs/kg dry clove)	582.9	Rs/kg
13	Output: By product - Dried stalk - Kg dry stalk	571	kg/ha
	Returns from clove farming		
A	Price of clove -Average for 2021-22 and 2022-23 season	754.13	Rs/kg
B	Price realized from sale of clove	12,30,740	Rs/year
C	Price of dry stalk - 2022-23 (Rs/kg dry)	130	Rs/kg
D	Price realized from sale of dry stalk	74,230	Rs/year
E	Total returns	13,04,970	Rs/ha
F	Total cost	9,51,352	Rs/ha
G	Net profit per hectare (Rs/ ha)	3,53,618	Rs/ha

Source: Data from primary survey of clove plantations (2020-21 and 2021-22)

The labour cost for harvesting and processing expenses together constitutes 41.3 per cent of the total cost of cultivation. Routine agronomic management and cost of inputs like fertilizers and plant protection chemicals constitute 21 per cent of the total cost of cultivation of clove. The average net profit from clove cultivation was estimated to be Rs 3,56,781 per hectare.

Price trends in clove

The price scenario in clove can be decisive in determining the profitability of cultivation.

In figure 1, the nominal monthly wholesale price of clove in Kochi market, Kerala for the period 2019-20 to 2022-23 is presented along with the average cost of production estimated from the primary data. It can be seen that the average wholesale prices have at times gone below the average cost of production. The output price risk is an important factor, which has limited the spread and adoption of the crop in more areas.

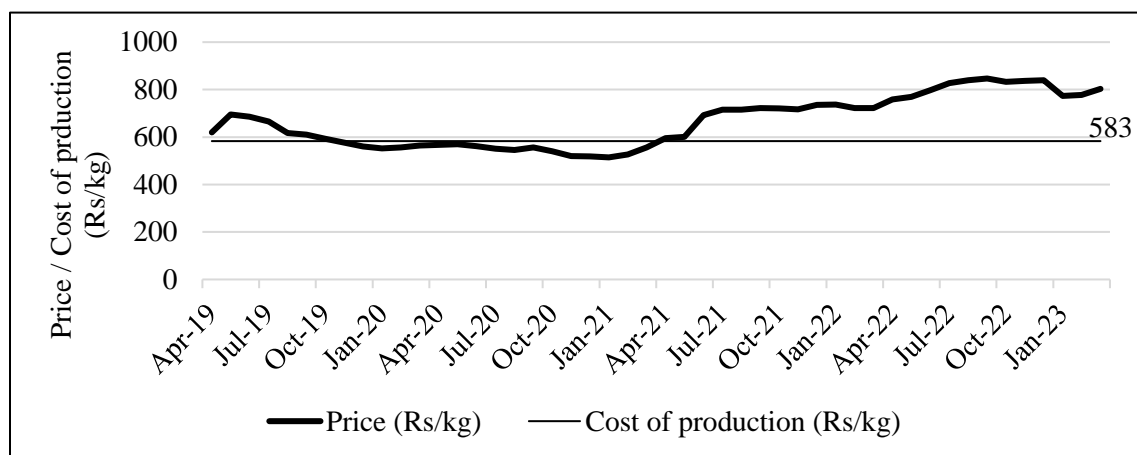


Fig. 1. Price trends in clove (2019-20 to 2022-23)

Challenges and intervention opportunities

The clove crop economy in India is unique due to its specific features. These include the limited geographic spread and the predominance of large plantations. More than 50 per cent of the total clove production in the country comes from Kanyakumari district of Tamil Nadu. This limited geographic spread along with the organized nature of plantation owners offer scope for focused and intensive technology dissemination efforts in the crop. The clove growers associations, which are active can

be leveraged to push appropriate technologies and to promote adoption of improved agronomic management strategies in the clove. Some of the key challenges identified in the clove ecosystem are

Low genetic variability and absence of good varieties: The genetic variability across clove plantations was very limited and there are no improved varieties in clove.

Poor level of adoption of agronomic practices: Most of the clove plantations have limited

resources to spare for agronomic management. The low margins of profit and non-availability of labour during the off-harvest season are two important reasons for non-adoption of scientific management.

Low level of awareness about soil fertility management: Most of the plantations have not undertaken soil testing or fertilizer management based on soil fertility status. This has led to poor tree health in several plantations.

Prevalence of biotic stress factors: The fungal diseases are prevalent across the clove growing tracts and strategies for management of biotic stress are either absent or are very limited across plantations.

Senile plantations and improper tree spacing: Most of the plantations have a significant number of trees, which are past their prime yielding phase. The spacing adopted in several plantations was found to be inadequate. The close spacing and senile plantations act as a major barrier in realizing the potential yield from plantations.

Output price fluctuations and unorganized markets: The price of clove shows considerable intra-year and inter year fluctuations. The plantations mostly dispose the produce at the time of harvest itself in nearby local markets to meet the immediate expenses. The absence of organized markets and marketing systems have hurt the interest of the primary producers.

Short harvest window and labour availability: The economic produce of clove is the fully mature unopened flower bud, which needs to be harvested in a short window. The price

of opened flowers is less than half that of the unopened flower buds. The plantations, as a result has to complete the harvesting in a short period of time. This seasonal demand drives up the price of labour and increases competition among plantations for limited labour resources.

The extant nature of clove ecosystem and the stakeholder community offers the possibility for several technical and institutional interventions for improving the profitability of clove farming and enhancing domestic availability of the commodity. The improved economic viability of clove farming will help in augmenting the area under this tree spice other agro-climatic areas suitable for the crop. To address these challenges and enhance the self-sufficiency of clove production in India, the study suggests several intervention opportunities:

- Focused investment on varietal development in clove is required to address the low genetic variability through exotic varieties introduction and through use of new generation crop breeding strategies.
- Special support programme for replacing senile plantations need to be implemented in major clove growing regions.
- Promote the establishment of clove producer collectives with trading and processing capabilities. The limited geographic spread of the crop and relatively larger size of operational holding in clove is conducive for this initiative.
- Establishment of e-auction platform for ensuring efficient price discovery and to bring more transparency in clove trade.

- Focused capacity building programme for promoting adoption of scientific agronomic practices, plant protection strategies and soil nutrient management.
- Enhance research investment on interventions to reduce cost of harvesting by exploring possibilities for chemical induced harvesting.
- Deploy a strategic crop area expansion drive in identified regions with agro-climatic conditions analogous to extant clove growing regions. Crop introduction in non-traditional areas has the potential to enhance domestic availability of clove.

Conclusion

Clove is an important spice commodity with high demand in both domestic and international markets. However, the domestic production of clove in India has remained stagnant over the past two decades, leading to a growing dependence on imports. This study analyzed the clove economy in India, focusing on production trends, trade patterns, cost of production, and returns from clove farming. The findings reveal that clove cultivation in India faces several challenges, including low genetic variability, poor adoption of agronomic practices, inadequate soil fertility management, prevalence of biotic stress factors, senile plantations, unorganized markets, and labour shortages during the short harvest window. These challenges have constrained the growth of domestic clove production and hindered the profitability of clove farming. By addressing these challenges and implementing the suggested interventions, India can increase its domestic clove production, reduce

import dependency, and improve the profitability and sustainability of clove farming. This will not only contribute to the country's self-sufficiency in spices but also enhance the livelihoods of clove farmers and strengthen the overall clove economy in India.

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