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RESEARCH ARTICLE

Governance and strategies to address constraints for the revival of the Indian small cardamom sector

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ABSTRACT

A field survey was conducted from March 2021 to October 2021 to identify major constraints in the Indian small cardamom sector. A micro-macro approach was followed in the study using both primary and secondary data. The primary data from random sample farmers and market intermediaries were collected from Kerala and Tamil Nadu producing areas. In total, 180 farmers, 12 auctioneers, 50 dealers (30 village traders and 20 dealers), and five exporters were interviewed; thus, the primary data were collected. The secondary data on arrivals, prices, and cardamom trade were collected from different national and international sources. Several important constraints related to production, marketing and auction, market price, international trade, cardamom value chain, pesticide residue, climate change, degradation of forests, and market deregulation have emerged from our analysis. All the constraints were thoroughly studied in depth, and appropriate interventions and policies were suggested to revive the small cardamom sector in India.

Keywords: Climate change, Indian small cardamom, pesticides, policies, trade, value chain.

INTRODUCTION

Small cardamom (*Elettaria cardamomum* (L.) Maton), often referred to as "Queen of spices," is renowned as one of the oldest and third most expensive spices globally, following saffron and vanilla. Belonging to the Zingiberaceae family, it

finds its origin and natural habitat in the evergreen forests of the Western Ghats of South India. Thriving in shaded, cool climates between 600 and 1400 meters above sea level requires annual rainfall ranging from 1300 to 4000 mm and temperatures between 10 and 31.5°C (Murugan et al., 2000; Ashokkumar, et al., 2021).

Small cardamom is typically cultivated as an under-crop beneath forest trees in the hilly regions of the Western Ghats states such as Kerala, Karnataka, and Tamil Nadu. The dried, matured fruits or capsules of cardamom are esteemed for their delicate aroma, pleasant flavour, and culinary versatility. Widely used in Indian cuisine since ancient times, a significant portion of India's cardamom production is domestically consumed. It serves as a key flavouring agent in culinary and confectionery preparations and plays a pivotal role in traditional Middle Eastern beverages like "Gahwa," where it is paired with coffee.

Beyond culinary uses, cardamom holds medicinal significance, aiding in digestion and serving as a remedy for indigestion and flatulence in Ayurvedic medicine. Its oil and extracts are extensively utilized in flavouring processed foods, pharmaceuticals, perfumes, cosmetics, and incense (Ashokkumar et al., 2020). The global demand for cardamom has surged, expanding its applications to include industrial sectors such as modern medicine and perfumery (Kuruvilla et al., 2022).

The future viability of India's cardamom industry hinges on addressing challenges such as drought, deforestation, pest outbreaks, chemical residues, irrigation management, and market competitiveness. Enhancing traceability and adopting innovative crop management technologies. Through strategic market exploitation, recent productivity gains must translate into economic benefits, particularly for farmers.

Given these complexities, the sustainable development of commercial cardamom agriculture necessitates a comprehensive analysis of the industry's production, economics, domestic marketing dynamics, international trade regulations, and value chain enhancements. This holistic approach is essential for ensuring the competitiveness, efficiency, and sustainability of Kerala's small cardamom production and marketing.

MATERIALS AND METHODS

Study area, Type and Sources of Data

Primary data was collected from the Idukki district of Kerala State. Sample farmers and market intermediaries were randomly selected from Udumbanchola, Peerumade and Devikulam Taluks. Data from market intermediaries were also collected from Bodinayakanur and Cumbum in Tamil Nadu.

The study was based on both primary and secondary data. The data on arrivals and prices of small cardamom were collected from the publications and websites of the Spices Board (2021). The data on the international trade of cardamom was collected from the Directorate General of Commerce Intelligence and Statistics (DGCI&S) (www.dgciskol.gov.in.), Ministry of Commerce (www.commerce.gov.in), Spices Board (www.indianspices.com), Directorate of Arecanut and Spices Development (www.dasd.gov.in), World Integrated Trade Solutions (wits.org), and International Trade Centre (intracen.org) and International Pepper Community (IPC, 2020).

Sampling Design

The primary data were collected from randomly selected farmers and market intermediaries. The sample consisted of 180 farmers, 12 auctioneers and 50 dealers (30 village traders and 20 wholesalers) from the Idukki district and, 5 exporters from Kerala. Post-stratification of the sample farmers into small and large holdings was also done based on the size of the land holdings. Out of the180 farmers, 108 were selected from Udumbanchola Taluk (Nedumkandam and Kattappana blocks), 36 each were selected from Peerumade Taluk (Azhutha block) and Devikulam Taluk (Devikulam block) based on probability proportionate sampling, using the shares of these Taluks in total area under cardamom in Idukki district as the selection criteria. The 50 sample dealers were distributed as 30, 10 and 10 for Udumbanchola, Peerumade and Devikulam Taluks respectively. The data was collected from 10 dealers (7 village/small traders, 3 wholesalers) and two exporters from Bodinaykanur and Cumbum in Tamil Nadu.

RESULTS

1. Constraints in production

The rising cost of cultivation

The average cost of cultivation of small cardamom in the sample farms was estimated as ₹5,94,666 per hectare. In the establishment cost of cardamom, about 37 percent was incurred for human labour,

while manures and fertilizers accounted for 31 percent and plant protection chemicals shared 21 percent. In the operation-wise maintenance cost in the yielding phase, one-third was incurred for applying plant protection chemicals, followed by 19 percent share for FYM and other organic manures. Harvesting was found to be a highly labour-intensive operation requiring around 14 percent of the operational cost. The average cost of production for 180 sample farms was estimated as ₹581 per kg of small cardamom. The production cost was higher during the yield stabilizing period (8-15 years) than the high yielding period (3-7 years). The cost of production was found to decrease with the increase in the size of the farm, and the average cost of production in small and marginal holdings ranged between ₹700-900/kg. The total cost of cultivation and cost of production of small cardamom indicated the need for a considerable initial investment and working capital expenditure for the cultivation of the crop. The intensive use of chemical inputs, labour requirement throughout the year, labour-intensive harvesting, and post-harvest operations are the major factors contributing to the high cost of cultivation. The cost of plant protection chemicals has also increased considerably over the years.

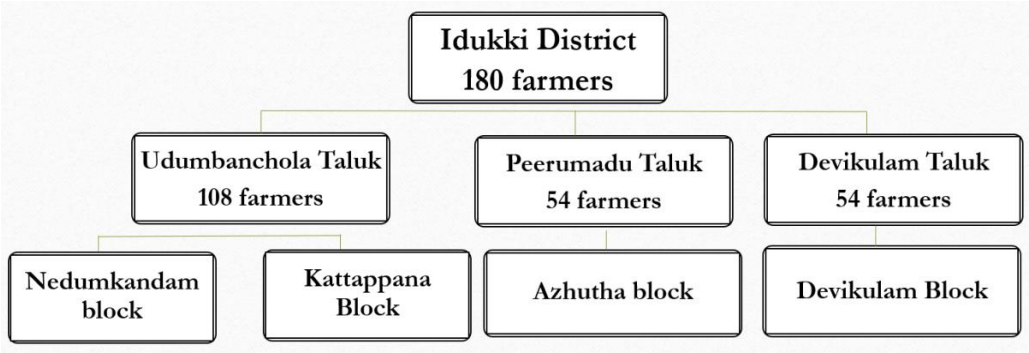

Figure 1. Sampling design for Cardamom farmers

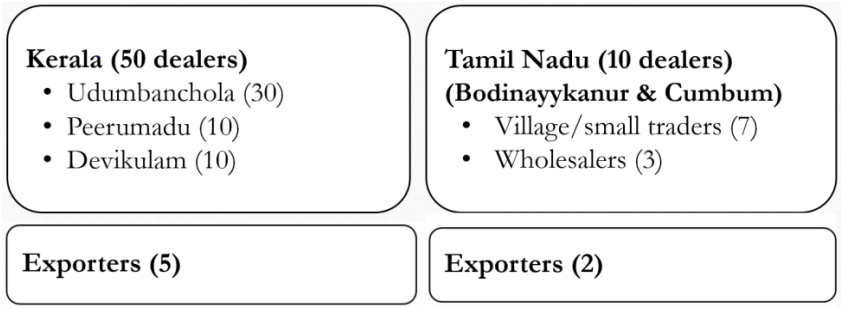

Figure 2. Sampling design for market intermediaries and exporters

Reducing profitability of cultivation

Because of the increasing cost of inputs over the years, the net revenue from cardamom is also showing a decline in recent years. The volatility in auction prices also results in considerable income variability for the cardamom growers. Even though the prices of cardamom have increased over the years, i.e., by about 56 percent from 2013 to 2021, the prices of chemicals inputs and labor wages have also increased concomitantly. The cost of Fipronil 5% SC has increased by 104 percent, while that of Quinalphos 25% EC and Cypermethrin 25% EC have increased by 59 and 68 percent respectively during the above period. The price of Chlorpyriphos has increased by more than 40 percent during the above period. Although the price of small cardamom increased by 74, 59 and 91 percent respectively during 2016, 2018 and 2019 when compared with the preceding year, the price declined by 49 and 32 percent in 2020 and 2021 when compared with the preceding year. There has been an indiscriminate use of plant protection chemicals which is pushing up the cost, especially because of the intensive mode of cultivation in the small and marginal holdings. The farmers resort to plant protection activities mainly based on the recommendations of the pesticide shop dealers or agents from the pesticide

companies. In addition to increasing the cost of cultivation, unscientific cultivation practices are also causing the negative externalities of rising environmental costs and sustainability issues. Many of the plant protection chemicals and fertilizers used in small cardamom were found to be excessively priced. There is much variation in the prices of bio-inputs and the prices charged by the private input dealers for organic/bio-inputs were found to be considerably higher than that of the public sector. However, the availability of the bio-inputs from the public sector institutions was found to be very limited.

Poor quality of inputs

The quality of many chemical inputs was also reported to be inferior by many farmers. Most of the biocontrol agents and biofertilizers supplied by private input dealers had a lesser viable count or were of inferior quality. The number of government agencies supplying bio-inputs was very few in Idukki District. The pesticide/fertilizer shops were also selling bio-inputs, and most often the technical knowledge of these dealers in handling as well as the use of these products were very limited, often storing it in open space or along with fertilizers, which seriously affected the viability of these inputs and efficacy in the field. The existing system of quality control and sampling of these inputs from the markets are not adequate.

Indebtedness of farmers

Many of the farmers were indebted to institutional agencies and money lenders or non-institutional agencies. Out of the 180 farmers; it was found that about 67 farmers had borrowed money from commercial banks, while 27 were borrowers from cooperative banks. Eleven of the farmers were borrowers from non-institutional sources, including relatives and traders, because of which most of them were forced to sell their produce to these traders after harvest at relatively low prices. The loan amounts ranged from ₹30,000 to ₹60 lakhs, and the average loan amount was found to be ₹7,62,000. It was also found that more than 50 percent of indebted farmers had taken short-term loans to meet the cultivation expenses. These loans were to be repaid within a period of one year, which indicated the immediate cash needs of the farmers after the harvesting season.

Reduction in subsidies disbursed by Spices Board

The provision of replanting subsidies by the Spices Board has substantially reduced in recent years and there is considerable backlog or delay in the provision of replanting subsidies to growers. With an actual total establishment cost ₹5,43,155 per hectare, the subsidy of ₹70,000 and ₹1,57,500 provided by the Spices Board for general and Scheduled Caste farmers at the rate of 33 percent and 75 percent of the cost of establishment per hectare, is considerably low. Small-scale farmers cannot afford to replant the entire area of a cardamom plantation since there will be a gestation period of one and a half years. Only gap filling is practiced by many small farmers and the over-aged plants are usually provided after removing the excess rhizomes and clumps during March- April. Even though the resultant capsules for next year might be smaller in size, according to the farmers it is more economical than replanting.

Scarcity of labour

Cardamom is a highly labour-intensive crop and the harvesting operations require skilled labour. Human labour accounts for about 37 percent and 51 percent of the establishment and maintenance costs respectively. Due to the Covid pandemic, there were restrictions in the movement of women laborers from Tamil Nadu, which have affected the harvesting of cardamom across plantations. As the North Indian and local laborers were not as skilled as the traditional cardamom pickers, the quantity, as well as the quality of cardamom harvested, has been adversely affected. Recently the working hours of laborers have been fixed from 8 am to 2.30-3.00 pm, instead of 4 pm. Every extra hour of employment requires a payment of Rs.50 to Rs.100, which is an additional expense for the farmers. Even though the laborers from Tamil Nadu are paid up to Rs. 700 in certain areas, this amount is collected by the agents who bring them to work, who in turn deduct their commission charges. Due to the pandemic, the transportation charges of laborers in jeeps from Tamil Nadu have been raised due to the restriction in the number of travelers in a vehicle. The increased wage rates for laborers from Tamil Nadu have eventually led to a demand for increased wages by the local laborers as well.

Recommended interventions for overcoming constraints in production

Provision of replanting subsidy

The Government of Kerala through the Department of Agriculture and Farmers' Welfare should disburse replanting subsidies, especially to small and marginal cardamom farmers, as the subsidies disbursed by Spices Board have considerably reduced in recent years. Immediate steps should be

taken through the Krishi Bhavans for the proper management of small cardamom plantations, and the farmers also need to be encouraged to adopt replanting of the senile plants and plantations. Reducing per unit cost of production by improving productivity can help to improve the trade competitiveness of small cardamom. The process for availing subsidy should be made paperless since most of the farmers have to spend too much time to avail the subsidy.

Provision of input subsidy for recommended plant protection chemicals and organic inputs fertilizers

As inputs, including plant protection chemicals, manures, other organic inputs, and fertilizers account for about 45 to 50 percent of the input cost incurred in the cultivation of cardamom, farmers need to be provided subsidies for these inputs through the Department of Agriculture and Farmers' Welfare, and the quality of these inputs should be strictly monitored by the Department.

Controlling the prices of chemical inputs

The prices of all inputs used in small cardamom, including the plant protection chemicals and fertilizers, need to be effectively controlled. The bio-inputs are being sold at different prices without any standard rate and hence the scope for the unification of prices needs to be explored. Ceiling prices for inputs need to be announced by the government(https://ecostat.kerala.gov.in/storage/publications/664.pdf).

Ensuring the quality of inputs

The use of the chemicals in small cardamom cultivation should only be based on extension advisory services of the state and central Government development departments or Krishi Vigyan Kendra or research institutions. Many new inputs which are sold in the market with the claim of organic products, including biocontrol agents were reported to be of poor quality. The Government should ensure that proper labelling of inputs and proper scrutiny for quality are strictly carried out. Input shops were also found selling inputs they claimed were organic without any quality specifications. Even if spurious products are seized, the labels and packages are altered and marketed again, which calls for stringent actions. The quality of biocontrol agents should be ensured, and farmers should be taught about the usage of such biocontrol agents. There should be a supply of bio-inputs through government agencies. Many brands of biofertilizers, manures, etc., are mushrooming in the markets claiming high levels of natural nutrients and minerals. So, a specific quality check mechanism is to be enforced to ensure the quality of such materials. Many farmers still depend on pesticide dealers to get information regarding identification and choice of chemicals for pest management. This highlights the need for refocusing the information dissemination system and a system of effective monitoring.

2. Constraints in marketing and auctions

Lack of transparency in price setting

Cardamom is characterised by an oligopoly market controlled by traders from Tamil Nadu and North Indian buyers. Even though the concentration of market power has decreased in recent years, there is still domination by buyers in the market. The village traders and dealers usually consider the auction prices as the base prices. Still, the small growers claimed that the base prices were often manipulated, and the traders or dealers paid to the farmers only after deducting about Rs. 75 to Rs.100 from the auction price. However, according to the traders, they were grading the produce after purchasing from the producers. Even though the transparency in the auction process has increased over the years, the price-setting process is still not apparent.

Repooling in auctions

The process of repooling in the auction in which the auctioneers or dealers resell the commodity which they have already purchased from producers in earlier auctions to other dealers or traders was found to be adversely affecting the producers. The repooling creates artificial demand in the market and increases the price, which benefits only the traders, not the producers. The traders argued that after buying from auctions they were grading and then only they repool the graded cardamom which fetches them higher prices. The aggregate quantity of small cardamom which has been e-auctioned in Kerala and Tamil Nadu has always been higher than the production. The excess of quantity auctioned overproduction varied from 1874 tonnes in 2012-13 to as high as 9290 tonnes in 2015-16. This discrepancy could not be attributed to storage as the feasibility of storage is also limited in the case of cardamom. This difference could mostly be attributed to the repooling by auctioneers or dealers. There is also overlap in the role of the participants as almost all the auctioneers are also traders, and, in addition, most of them have exporter's licenses. The same auction agency acts as

the seller as well as the buyer of cardamom. It was alleged by many farmers that the process of re-pooling was diminishing the demand. According to the farmers the dealers were buying cardamom at comparatively lower prices and were selling at a higher price by repooling, thus reaping most of the benefits from price movements.

Delay in payment

The delay in payment by the auctioneers to the farmers for the pooled cardamom was the second major problem in auctions. According to the Cardamom Licensing and Marketing Amendment Rules, 2014: "Auctioneer shall pay the growers whose cardamom is pooled; the applicable sale value of the cardamom sold in an auction within ten days from the date of the auction. If the auctioneer defaults to make payment as per the terms and conditions of the license, the Board shall invoke the Bank Guarantee of the auctioneer forthwith for arranging settlement of amount due to growers and take steps for suspension and/or cancellation of the license". Even after the amendment, the majority of farmers were selling their produce to village traders for receiving immediate payment. There were reports by farmers that when cardamom was sold through some of the auction agencies, there was a delay in payment for two to three weeks. However, some of the farmers even reported a delay in payment of up to 30 days. The delay in payment on the part of the auctioneers was attributed to the delay in payment of the proceeds by the traders or dealers who purchase from auctions. Small and marginal farmers found this as a burden and were usually reluctant to sell cardamom through auctions.

Discrimination in favour of trader lots over producer lots

Farmers who participate in the auctions complained that the actual benefits of the auction process were not received by the producers. Cardamom sold by the farmers are being labelled as P (Planters) and the produce sold by Traders is labelled as T**.** Farmers complained that their lots were not getting auctioned at the time when potential buyers were active in the auction process. According to them, inferior quality cardamom was being purposefully sold by the end of the day to reduce the closing price which eventually affect the opening price the next day. This could not be fully established with the auction data but the average auction price was found to decrease steadily from the beginning of the auction till the end. The practice of depicting T and P during the bidding process reveals to the buyer whether the lot is from a trader or a farmer, which could be avoided in the auction process.

Less time for auction

The number of auctioneers has increased in recent years, and, at present, there are 12 auctioneers. Because of the increase in the number of auctioneers, two auctioneers are allotted per day for auctioning. As only three or three and a half hours are allotted for an auctioneer, the time allotted per bid is very low. If the auctions last for three hours and 30 minutes and it is assumed that there are 275 bids, the time allotted per bid is only 45 seconds. Even though the auction process will be completed quickly, the farmers, as well as the auctioneers, have felt that the price determination will not be effective as well as efficient.

High price spread

The share of the farmers in the price paid by the consumers is low for small cardamom, which means that the price spread is very high. It indicates that the farmers are positioned low in the value chain and a considerable share in the price paid by the consumers is gained by the market intermediaries. The retail price of cardamom during 2021 varied from 2000 to 3000 rupees per kg. The price spread in various marketing channels of cardamom ranged from 25 percent to 69 percent, which means that the producer's share in consumer's rupee for small cardamom ranged between 75 percent and 31 percent.

Correct estimation of production

With a substantial increase in productivity, as also revealed by the primary survey, the estimation of area, productivity, and the consequent production of small cardamom by the Spices Board also need to be carried out more systematically and realistically, which at present is possibly getting underreported.

Simultaneous sales through multiple modes

Recently, multiple modes of sales including online auction are widely practiced which are having a mixed opinion among the farmers. There is uncertainty in this process as no bond amount is taken from the auctioneers as a guarantee for the online process which makes most of the farmers reluctant to sell through the online systems. Multiple auctions simultaneously on the day of e-auction are also a major concern for the farmers.

Recommended interventions for overcoming constraints in marketing and auction

Limiting the quantity pooled by licensed dealers and auctioneers

All the quantity that is pooled by the dealers or traders cannot be categorized as repooling as some many small traders or dealers are buying directly from many small farmers who cannot pool to auctioneers. Since auction agencies are allowed to purchase from auctions, proper monitoring of the amount of the produce and documentation of the origin of the produce can limit the process of repooling. The maximum quantity of cardamom that can be pooled, as well as repooled by the licensed dealers and auctioneers in the e-auction, should be effectively monitored as well as limited to reduce the effect of repooling on price. The possibility of introducing a transparent online pooling system should be explored.

Improving the transparency in price determination process

The price determination in the auction process should be made more transparent. The pricing mechanism should be properly linked to the size and colour of the capsules or quality characteristics, for which, the use of technology in deciding the proportion of different sized capsules in the samples and colour of capsules needs to be explored. The use of various ICT tools for price determination and online auctions also should be tried. The price determination process should be standardized, and the standard price should be fixed based on some valid criteria rather than leaving the entire decision to the traders.

Increasing the time for auctions

More time should be allotted for each auctioneer and the time allotted per lot or bid also needs to be sufficiently increased so that there will be a better price discovery in the auction process.

The practice of revealing the identity of the lots needs to be removed

The practice of depicting T and P during the bidding process could be avoided in the auction process. The lots need to be randomly auctioned during the auction process.

Delay in payment of proceeds need to be avoided

Monitoring of online as well as other modes of sales

E-auction should be monitored with a single auction at a time.

Strengthening domestic trade

As the demand for cardamom is increasing in the domestic market, internal trade must be strengthened for supporting the growth in consumption. The retail sales of cardamom should be increased in Tier-2 and Tier-3 by developing proper linkages with the production base.

3. Constraints related to prices

Price volatility

Price fluctuations in the small cardamom market pose significant challenges to its marketing. These fluctuations exhibit cyclical and seasonal patterns in both Indian and international markets, contributing to increased volatility, particularly on an annual basis. This volatility has profound implications for cardamom cultivation in Kerala, intensifying income uncertainty for the sector. Notably, domestic price volatility tends to exceed that of international prices, indicating greater variability in Indian market prices. Small cardamom, as a perennial crop, demands substantial initial investment and features extended gestation periods, long economic lifespan, and significant harvesting costs relative to operational expenses.

Recent years have witnessed notable increases in both maximum and minimum prices, widening price ranges and exacerbating uncertainty for farmers regarding their earnings. Cointegration analysis underscores that reforms have enhanced price signal transmission between international and domestic markets, resulting in heightened market integration. The uncertainties stemming from international market price fluctuations influence domestic prices through these transmitted signals.

The direct impact of small cardamom price volatility on producer households manifests primarily through income instability, compelling producers to mitigate this instability through dis-saving or external borrowing. This income variability, and consequent dis-saving, influences farm household investment decisions. Fluctuations in cardamom profitability alter the economic calculus for producers, affecting their input utilization and replanting decisions. During adverse price shocks, producers economize inputs and reduce replanting efforts. Conversely, positive volatility prompts expanded cultivation areas and intensified management practices, potentially leading to input overuse.

Crop diversification emerges as a coping mechanism against price volatility, diminishing price risk but also reducing production and marketable surplus. Consequently, changes in crop

profitability prompt farmers to lease or sell their lands, impacting household incomes. Declines in farm employment drive diversification into off-farm and non-farm activities, further influencing household income variability and potentially exacerbating poverty cycles.

Moreover, heightened price volatility can misguide farmers, leading to increased cultivation areas and oversupply, precipitating market gluts and price declines. Supply response analysis highlights that farmers respond to price increases by intensifying input use, including fertilizers, pesticides, and capital investments, to boost production. Over the long term, sustained price increases stimulate expanded cultivation areas in response to heightened demand.

In essence, the dynamic interplay of price volatility, income instability, and coping mechanisms like crop diversification profoundly shapes the economic landscape of small cardamom cultivation in Kerala, influencing farmers' livelihoods, investment decisions, and overall welfare.

Lack of awareness and poor use of the warehouse receipts as negotiable instruments for availing loans

Many of the small and marginal farmers were selling to village traders for immediate payment for meeting the working capital requirements for raising the crop. Even though banks provide loans or finance against the physical warehouse receipt as well as electronic-Negotiable Warehouse Receipt (eNWR) issued by the Central Warehousing Corporation (CWC) and State Warehousing Corporation (SWC), the cardamom farmers were not found utilizing this facility. Their awareness of this credit facility was found to be very minimal. The nature of price fluctuations of cardamom also makes the decisions on storage and sales difficult.

Absence of a market intelligence system

There is no provision of market intelligence to cardamom farmers in terms of price forecasts and the right time for harvest, period of storage, time of sales; etc. There is a need for correct estimation of supply, and demand from different sectors, and stocks of small cardamom.

Suggestions to overcome issues related to prices

A workable price stabilization mechanism and price stabilization fund for overcoming price volatility

Given the escalating volatility in cardamom prices, it is imperative to establish a price stabilization mechanism aimed at mitigating this volatility. This mechanism should be designed to address the fluctuating incomes of farmers, with tailored strategies based on farm size. Price stabilization efforts should be anchored in the variability of cultivation costs and auction prices.

Enhancing farmers' resilience to market fluctuations is crucial, necessitating capacity-building initiatives. A dedicated price stabilization fund should be instituted, funded through periodic contributions from farmers and auctioneers. Contributions would be triggered when prices breach predefined thresholds within a price band derived from average prices over the past 3 to 5 years. Government contributions would augment the fund when prices dip below the lower band, while contributions from farmers and auctioneers would supplement the fund during periods of price escalation beyond the upper band.

A system of price deficiency payment

As implemented in the case of natural rubber, it can be considered for cardamom. It should be based on the difference between the decided base price arrived based on the cost of production and the actual price in the market. If the actual price falls below the base price, the small cardamom farmers should be paid the difference. For deciding the base price, as the cost of production should be the basis, there is a need to estimate the cost of cultivation on a real-time basis. The farmer must report the details of the quantity pooled for auctions, which should be certified by the officer from the Spices Board or Department of Agriculture.

Market intelligence and advisory services, including price forecasting

Accurate estimation of small cardamom demand, availability, and gaps is essential. Access to reliable and comprehensive marketing information is crucial for enhancing operational efficiency and pricing accuracy within the marketing system. Establishing a robust marketing and information network system is imperative to provide real-time data supporting planning, purchasing, inventory management, planting, harvesting, and storage. Utilizing ICT-enabled services can facilitate the dissemination of timely agricultural advisories, weather forecasts, financial services, and agricultural market information, including short-term price forecasts, to empower farmers in making informed production and marketing decisions. Monitoring domestic and

international prices, forecasting future trends, and providing short-term price predictions are pivotal for informed decision-making processes.

Timely information support regarding price dynamics, state-level input/output data monitoring, interstate trade insights, and import/export statistics is essential for formulating effective policies concerning small cardamom. Empowering farmers through enhanced information access enables them to optimize resource utilization and profitability effectively. Exploring the establishment of a state-level domestic and export market intelligence cell and developing a reliable price discovery mechanism are additional steps necessary to strengthen the small cardamom market framework.

Encouraging availing finance against warehouse receipts

This credit facility offers liquidity support to the farmers by stocking cardamom during the harvesting season, which enables them to avoid distress sales and gain from any price rise in the future. Similarly, traders and processors can stock cardamom when the prices are relatively lower during the harvesting season and gain from the price rise in the offseason. This facility could be availed by individual farmers, groups of farmers including Self Help Groups (SHGs) and Joint Liability Groups (JLG), Farmer Producer Organizations (FPOs), firms, companies, processing units etc.

Setting a base price or minimum price in auctions

With the rising cost of cultivation and high cost of production, at present, farmers must get more than ₹1000 per kg for realizing a reasonable profit. The possibility for announcing a base price in auctions during every season based on real-time estimation of the cost of production as well as the quality of the produce, jointly by the producers, officials from the Spices Board and the Department of Agriculture, auctioneers, and exporters need to be explored.

Formation of farmer producer organizations (FPOs) of small cardamom farmers

In addition to the FPOs formed by the Spices Board, the Department of Agriculture must encourage the formation of FPOs, which could enable the farmers with better bargaining power through collective marketing, storage, and value addition. This would also help the farmers to move in the value chain.

4. Constraints in international trade

Decreasing export competitiveness

One of the significant factors that affected the small cardamom exports from India was the increase in domestic demand, which has limited the supply of the spice to the international market. The quantity of export of small cardamom from India has declined with the increase in the average domestic price, The effect of increased domestic demand and price could be witnessed from the decline in the export intensity of production and decreasing market shares in the international market. The values of the export competitiveness measure *viz.,* Nominal Protection Coefficient (NPC) and Effective Protection Coefficient (EPC) indicated a higher price of cardamom in the domestic market as compared to the international market, suggesting the inefficiency of the Indian cardamom as an export competitive crop and that India was non-competitive in the export of small cardamom. This could rightly be attributed to the high cost of cultivation, increasing domestic demand, and stiff competition from Guatemalan cardamom. The high cost incurred for plant protection chemicals, fertilizers, and manures, and higher wage rates increased the cost of cultivation of small cardamom in India, which in turn pushed up the price of the commodity. The Domestic Resource Cost Ratio (DRCR), which measures the efficiency of production of small cardamom was found to be less than one (0.67), indicating India's comparative advantage in producing the commodity, as it implied the efficient utilization of domestic resources. The DRCR value of less than one indicated that the cost of domestic resources for producing a unit quantity of cardamom was less than the net foreign exchange earned through its export. The analysis of the export competitiveness of small cardamom using the Policy Analysis Matrix (PAM) revealed that the commodity was less competitive in the international market, but the country had a comparative advantage in production. India lost its competitiveness in small cardamom export as the commodity became more concentrated in the domestic market and its share in the world export declined drastically due to the stiff competition from Guatemala, which offered cardamom at a much lower price. India was less competitive in small cardamom export in spite of having a comparative advantage in production. Even though out-priced by Guatemala in the international market, the Indian cardamom was in great demand in importing countries because of the intrinsic quality characteristics.

Increasing competition from Guatemala

There is increased competition from Guatemala, which has out priced India in the international

market. The highest share of cardamom imports to Saudi Arabia was from Guatemala, and whenever there has been an increase in Guatemala's share, the share of India has decreased. Even though India gained a considerable market share in new markets *viz*., the U.K., Iran, and Bangladesh, it lost some of the traditional export markets *viz.,* Saudi Arabia, Kuwait, U.A.E., and Qatar. This could be due to the higher price of Indian cardamom, the increase in the supply of low-priced cardamom from Guatemala, and also the quality issues faced by Indian cardamom about the presence of pesticide residues. In the case of Guatemala, which is the major competitor for India in the international market, the country has the benefit of disposing its entire production to the international market at a very low price, as cardamom is grown in open conditions in Guatemala, entailing a low cost of production and a negligible domestic consumption.

Increased instability in trade

The quantity, value, and unit value of cardamom exports from India exhibit high instability, and it was found to be the highest in recent periods for export unit value. This instability in unit value increases the uncertainty in export earnings and causes the domestic prices to be volatile, making the farmers' income highly variable.

High commodity concentration

The Indian export earnings from cardamom were still concentrated in a few products as shown by the high values of the concentration indices, and small cardamom was mostly exported in the form of cardamom, neither crushed nor ground.

High export market concentration

Cardamom exports from India were getting increasingly concentrated in a few export markets over the years. Increased dependence on a few export markets makes India vulnerable to shocks and price fluctuations in these markets. In recent years, UAE, Saudi Arabia, and Kuwait accounted for about 70 percent share of total cardamom exports from India. In TE 2009-10, nearly 61 percent of India's small cardamom export was to Saudi Arabia, and it reduced to 30 percent in TE 2019-20. The export quantity, as well as value of small cardamom exports from India to Saudi Arabia, has decreased in TE 2020-21 to 9.6 percent and 11 percent respectively. Consequently, UAE became the major export market for Indian cardamom in TE 2020-21 and accounted for about 29 percent of the quantity and 31 percent of the value of small cardamom exported from India.

Rising Non-Tariff Measures (NTMs)

In the fiscal year 2019-20, the proportion of cardamom exports from India to Saudi Arabia declined sharply, nearly halving to 30 percent. This decline was primarily attributed to issues related to pesticide residues, specifically exceeding Maximum Residue Limits (MRLs) in Indian cardamom exports. Consequently, India's share of imports to Saudi Arabia in 2019 plummeted to as low as 1.28 percent by quantity and 0.82 percent by value. Following concerted efforts by the Government of India, this share has marginally improved to approximately 5 percent. Countries in the Middle East constitute significant importers of Indian cardamom but also impose the highest number of Non-Tariff Measures (NTMs) on these imports. Despite facing the highest number of NTMs, particularly Sanitary and Phytosanitary (SPS) measures, Indian exports managed to meet the import requirements of the UAE, which emerged as the largest importer of Indian cardamom in 2020. Conversely, exports to Saudi Arabia remained minimal, largely due to the stringent NTMs imposed by the Saudi authorities. Across all countries, except the USA, over 90 percent of NTMs affecting Indian cardamom fell under the category of SPS measures. In contrast, about 25 percent of NTMs in the USA were categorized as Technical Barriers to Trade (TBT).

Threat from low price imports

The changes in tariff policy because of the multilateral and regional trade agreements have led to growing low priced imports. Because of the difficulties in the implementation of the rules of origin, there were reports that cardamom was getting rerouted through other countries. The inefficiency of Indian small cardamom as an import substitute also led to the import of cheap Guatemalan cardamom into India, which was being mixed with the Indian cardamom and sold at higher rates.

Suggestions to overcome constraints in international trade

Measures to improve the export competitiveness

The major factor affecting the domestic prices of small cardamom was found to be the export unit value, and hence, increasing exports are inevitable for ensuring better prices for cardamom farmers.But an exorbitant increase in domestic prices of small cardamom will further erode the export competitiveness in the international market. Efforts should be taken to improve trade competitiveness, especially by taking efforts to

reduce the cost of cultivation and improving the efficiency in cultivation. Reducing the cost of production and improving the quality could improve the competitiveness of Indian small cardamom in the international market. Good Agricultural Practices (GAP) and providing replanting subsidies at a reasonable rate to the farmers help in increasing the yield and reducing the cost of production and thereby reducing the price of the commodity.

Solving SPS and TBT issues

Quality issues, especially the sanitary and phytosanitary issues arising out of the non-judicious use of agro-chemicals and artificial coloring have adversely affected the exports of small cardamom from India. The tolerance limits for residues, i.e., the MRL-related issues in cardamom from India, have adversely affected the cardamom exports from India to Saudi Arabia in recent years. Even though the prices of cardamom from India are high, it is increasingly in demand in the export market because of its intrinsic quality characteristics. However, the pesticide residues in small cardamom from India have adversely affected the exports from India. Good Agricultural Practices (GAP), formulation of effective organic inputs, and effective ban on toxic chemicals at the national level could reduce the usage of toxic chemical inputs without affecting the yield and resolve the SPS and TBT issues.

Encouraging product diversification

Cardamom is mostly exported as the whole cardamom and hence, to reduce the risks in the exports of cardamom, India has to diversify into the export of more cardamom products. The value addition of cardamom should be encouraged based on the demand in the international markets (WTO, 2012).

Diversifying into a greater number of export markets

Along with product diversification of cardamom, India should strive for diversification of export markets. More than 60 per cent of the exports of cardamom from India are to UAE and Saudi Arabia. Hence, to reduce the risk in exporting, instead of concentrating on a single market or few markets, India has to identify a greater number of markets for small cardamom exports (Decreux & Spies, 2016).

Strengthening position in stable markets with suitable policies

According to the findings from Markov chain analysis, there is a decreasing probability of retaining market share in major countries over time, except Saudi Arabia. While India managed to gain substantial market share in new markets such as the U.K., Iran, and Bangladesh, it experienced losses in traditional export markets like Kuwait, U.A.E., and Qatar. These shifts can be attributed to higher prices of Indian cardamom, increased availability of lower-cost cardamom from Guatemala, and quality issues related to pesticide residues in Indian cardamom.

India's export market in Saudi Arabia, historically stable until 2017-18, has also been affected. To regain lost market share in Saudi Arabia and other stable markets, addressing pesticide residue concerns and developing tailored country-specific policies are essential.

Guatemala, India, and the UAE are identified as having the highest export potential for cardamom globally. Despite this, India has realized less than half of its potential exports, leaving approximately 134.6 million US dollars untapped. Key markets with untapped potential for Indian cardamom exports include the UAE, Saudi Arabia, and Bangladesh. Among these, Saudi Arabia presents the largest unrealized export potential, valued at an additional 20.8 million US dollars, followed by Bangladesh and the UAE with 20.4 million US dollars and 19.6 million US dollars, respectively. Specifically, Saudi Arabia exhibits the highest absolute difference between potential and actual exports in value terms, indicating significant room for growth, equivalent to 51.7 percent of its total potential. The UAE and Bangladesh follow with 45.4 percent and 87.3 percent of their respective export potential remaining untapped.

Policies on export promotion to enter non-traditional markets

India must develop strategies for entering non-traditional and potential markets. Cardamom exports from India are getting diversified to the UK and USA as well Asian countries like Japan and Bangladesh, for which the country needs to formulate specific policies for promoting the exports to these markets.

Measures to control imports

Despite crop-specific variations, changes in tariff policy of the plantation crops including cardamom because of various trade agreements have led to an increase in imports. The rules of origin need to be strictly monitored and followed as cardamom is getting rerouted through other countries. An

essential prerequisite for sustainable policy interventions is the creation and effective monitoring of trade databases, including crop-specific RTA-wise tariff policies, as well as imports.

5. Constraints in the value chain

Lack of coordination among multiple institutions

There is amultiplicity of institutions involved at various levels for small cardamom in Kerala which is lacking in anintegrated/system approach in the sector.

Low position of farmers in the value chain

The high price spread or low farmer's share in consumer's rupee showed that farmers are positioned low in the value chain. It also shows that the price of the commodity was getting added up as the commodity moved up in the value chain, without much value addition.

Suggestions for improvements in the value chain

Need for a system approach and coordination in the operation of various institutions

The various institutions involved in the value chain of small cardamom need to follow a system approach, and carry out the activities in coordination. The Department of Agriculture, needs to take a better role in the value chain of small cardamom.

Formation of FPOs and linking or encouraging tie-ups between producers/producer groups/FPOs and consumer groups

Strengthening value chain for cardamom and forging market linkages is an important priority to ensure sustainable enhancements in farmers' income. In this regard, collective marketing assumes importance as moving up the value chain is difficult for farmers individually and could be made possible by collective marketing and integration of activities by the formation of farmer producer companies. The management of the FPOs needs to be transparent, competent, and business-oriented. Producer groups/FPOs need to be encouraged to enter into tie-ups with consumer groups which can also be facilitated through social networks.

6. Pesticide residue issues

Detection of pesticide residues

The market samples of cardamom were detected with multiple residues of pesticides like Chlorpyriphos, Ethion, Profenophos, Quinalphos, Alpha Cypermethrin, Bifenthrin, Lambda-cyhalothrin, Carbendazim, Difenoconazole, Hexaconazole, Imidacloprid, Metalaxyl, Methomyl, Propiconazole, Tebuconazole and Thiamethoxam. Among these pesticides, a maximum residue of 5.61 ppm of Ethion, followed by 3.63 ppm of Quinalphos, 3.61 ppm of Metalaxyl, 2.95 ppm of Profenophos, 2.63 ppm of Methomyl, 1.68 ppm of Alpha Cypermethrin and 1.27 ppm of Bifenthrin were detected from the analysed cardamom samples. Many pesticides which have not been recommended for spices have been detected in samples of cardamom (Murugan et al., 2017; Kuruvila et al., 2022).

Lower number of pesticides with label claims for cardamom

Most of the pesticides used in cardamom have no label claim for cardamom. Hence, the Food Safety and Standards Authority of India (FSSAI) has given MRL values only for three pesticides in cardamom (Murugan et al., 2017; Kuruvila et al., 2022)

Problems with MRLs for different chemicals

The Maximum Residue Limits (MRLs) fixed for different chemicals in spices are very low in India as compared to other countries. Since cardamom is not directly consumed or preferred as food, the MRL values of most of the pesticides used in cardamom have not been assessed or reported. The MRLs available for spices in India are much lower when compared to other countries as only a very limited number of pesticides are recommended in spices in India. In the case of cardamom, this disparity is a major restriction for exports from India. If the MRLs are fixed in India following CODEX standards, the country could raise the quality and thus utilize the potential in the export market.

Rejection of cardamom in international trade due to pesticide residues

The detection of a higher amount of pesticide residue has become a serious constraint for the international trade of small cardamom. Haphazard use of pesticides has resulted in high levels of harvest time residues of pesticides in cardamom, resulting in the rejection of consignments by the importing countries. As all the importing countries of cardamom are tightening the monitoring of pesticide residues, it demands a good plan of action to produce good quality produce. The irrational use of pesticides has resulted in high levels of harvest time residues of pesticides in cardamom which is being rejected by the hitherto importing countries, which in turn would have a major say in foreign

exchange revenues of the state. The cardamom exports from India have failed to meet the quality norms, and as a result, the demand for small cardamom in Saudi Arabia has declined (Devi, 2009; Devi, 2010; Devi et al., 2017).

Other implications of excessive use of pesticides

The increased use of pesticides can affect the biodiversity in Idukki and also cause leaching, eutrophication, and contamination of water bodies as well as the groundwater table. The direct exposure to chemicals as well consumption of food with pesticide residues also affects the health of people. It will also affect the soil quality, especially on leased lands, as the extent of chemical fertilizers use is high since such farmers' primary focusis short-term profit maximization. The indiscriminate use of plant protection chemicals is also wiping out the populations of natural enemies leading to pest outbreaks and resurgence. Unscientific use of high levels of pesticides in cardamom plantations is hazardous to human health, the environment and may result in several social problems in the fragile ecosystems of the Cardamom Hill Reserves (Shetty et al., 2008; Sreedharan et al., 2014; Murugan et al., 2017). Pesticides, pesticide residues, and the related negative externalities will be major problems for the long-term sustainability of the Indian cardamom ecosystem and trade.

Unscientific and questionable practices

The study found that cardamom farmers were more inclined to suggestions and recommendations from pesticide companies or input dealers. The farmers follow many unscientific practices in Cardamom (Kuruvila et al., 2022) Field sanitation using sodium bicarbonate and hydrogen peroxide was reported to be effective in controlling certain diseases, and was found to be a cheaper alternative. However this practice may affect the soil microflora and fauna, and the effect of this practice has to be researched (Murugan et al., 2017). Improper recommendations also cause additional economic burdens for farmers.

Suggestions to overcome pesticide residue issues

Sustainable production

The plant protection formulations are prerequisites for cultivating cardamom at optimum productivity. The use of plant protection chemicals for cardamom should be aimed to achieve sustainability in the system through an approach of inclusive Integrated Pest Management (IPM), application and promotion of bio-control agents, and judicious application of plant protection formulations. The adverse impact of pesticides on human beings and the environment should be reduced as low as possible. This can be achieved through a coordinated approach, including effective governance, training, review, and monitoring. There should be regular monitoring for early detection of pests and appropriate responsible management of pests should be followed. Effective, easy, and economical IPM package for pest and disease management, leaving minimal or no residues at final harvest should be developed. A consortium of registered cardamom farmers for the adoption of IPM packages should be formed and uniform adoption of IPM with recommended plant protection chemicals and other inputs among registered farmers should also be ensured. Model demonstration cardamom plots also need to be established and the use of nanotechnology, sensors &etc. in plant protection and breeding stress-tolerant varieties should be attempted.

Increasing the awareness of farmers on pests, pesticides, and pesticide use

Farmers should be trained and informed about the proper usage of chemicals. Farmers should be encouraged to use only recommended pesticides or safe botanicals and bioagents. Most of the farmers were willing to use safe and green-labelled chemicals. However, the high cost of these chemicals makes them apply old-generation molecules since they are cheaper alternatives. Granting subsidies for safer environment-friendly molecules will increase the usage of those chemicals. Excessive use of chemical pesticides should be avoided and spraying should be carried out only as per recommendations, strictly following the dose and waiting period. Most of the recommendations for pest control are given to the farmers by the pesticide shop owners or input dealers, and farmers are unaware of the exact usage and waiting period for various chemicals. These often lead to pesticide residue formation in cardamom as the chemicals are even used a few days before harvesting. The repeated spraying of the same pesticides between spraying and plucking, blanket sprays, and cocktail applications of pesticides should be avoided. They should be made aware of the chemical composition rather than the trade name. The farmers should be trained and informed about the mode of action, time, and method of application of chemicals so that judicious application of pesticides will be followed, which can also reduce the cost of cultivation, as 30 to 40 percent of the total cost is incurred on plant protection chemicals (Devi, 2010; Kuruvila et al., 2022). It will also reduce the resurgence of pests

and reduce the ecological externalities. Farmers are widely applying heavy doses of chemicals in a prophylactic manner rather than curative with less adoption of IPM strategies. The farmers also need to be made aware of the quality issues and required standards of cardamom. Proper technical assistance should be given at the right time to cardamom farmers. Expert systems should be developed exclusively for cardamom to provide online recommendations on plant protection. The pests and diseases should be forecasted and prophylactic monthly recommendations should be provided based on these forecasts.

Conducting evaluations of newer low-dose pesticides and registering them for use in cardamom

Most of the new-generation pesticide molecules are costly, though these chemicals are said to increase the period of application and eventually reduce the overall number of applications. The efficiency of these chemicals on cardamom crops is not thoroughly researched, and more research or evaluations should be initiated on the efficacy of new-generation molecules in cardamom, and then these chemicals should be registered for use.

Screening the existing population of insets for resistance to insecticides

The existing population of insects in the cardamom ecosystem should be screened for resistance to insecticides. The use of all traditional hazardous chemical pesticides which have developed resistance owing to the continuous use in cardamom should be discontinued.

Strict prohibition of banned pesticides which are brought from neighboring states for use in cardamom

The use of banned pesticides in cardamom which are brought from neighbouring states, especially Tamil Nadu, need to be strictly prohibited.

Fixation of MRLs for a greater number of pesticides for use in cardamom

The Central Insecticides Board and Registration Committee (CIBRC) should be requested for fixation of MRLs for a greater number of pesticides through FSSAI. The Codex MRLs also need to be fixed for more pesticides in cardamom through Codex Committee for Pesticide Residues (CCPR), by following appropriate procedures.

Encouraging Good Agricultural Practice (GAP)

It is high time to intervene in the cultivation practices of cardamom by adopting GAP from planting up to harvest including decontamination practices for minimizing the level of pesticide residues.GAP in the use of pesticides includes the nationally authorized safe uses of pesticides under actual conditions necessary for effective and reliable pest control. It encompasses a range of pesticide applications up to the highest authorized use, applied in a manner that leaves a residue that is the smallest amount practicable. Good Manufacturing Practices (GMPs) also need to be followed during curing, storage and handling of cardamom

Controlling the aggressive selling practices by pesticide dealers

Most of the pesticide companies were found adopting aggressive marketing strategies to promote their products for use in cardamom. Similarly, traders and retailers were the main points of contact for the cardamom farmers. They provided inputs to farmers on a credit basis and often encouraged and promoted only certain products of their choice. The sale of spurious and low-quality chemicals which don't yield expected or promised results was also reported by farmers (Devi et al., 2021; Kuruvila et al., 2022). Hence strict and regular monitoring and checking are required on the quality, promotion, pricing, and sales of plant protection chemicals, especially in Idukki.Training the dealers on the use and misuse of pesticides for the management of pests and diseases in cardamom need to be initiated.

Establishment of a pesticide residue laboratory in Idukki

A pesticide residue laboratory needs to be set up under Kerala Agricultural University at Cardamom Research Station Pampadumpara which could provide the monitoring facility for pesticide residues in lots brought for auction. Cardamom should also be graded according to the level of pesticide residues and pesticide-free cardamom should be ensured better prices.

Ensuring premium price for pesticide residue-free cardamom

All the lots which are brought for the auction should be tested for pesticide residues and the pricing should be linked to findings of the pesticide residue report. Premium price must be ensured for pesticide residue-free cardamom and exports of such cardamom should be promoted.

Developing a traceability system

A traceability system which covers all stakeholders in the cardamom export supply chain including planters and farmers, dealers, auctioneers, Kerala Agricultural University (nodal agency), Department of Agriculture Development and Farmer's Welfare, accredited laboratories, Spices Board, phytosanitary certification agencies, local self-governments, exporters etc. through a centralized web-based monitoring software need to be developed. This will help in better information pass-through along the value chain, which will in turn aid the buyers/consumers in assessing food safety, and will provide a better price advantage for farmers who produce quality cardamom.

Model Plantations and promotion of organic practices

Organic practices should be encouraged in cardamom production. Spices Board and KAU should form model plantations following organic practices which could bring a change in the perspective of the farmers.

7. Climate change issues

Extreme variations in climatic elements

The mean surface air temperature in the Cardamom Hills was found to be increasing. But the minimum temperature was found to be increasing at a faster rate than the maximum temperature, and therefore the temperature in the Cardamom Hills showed a typical asymmetric nature. The months of April, March, and May have contributed more to the variability in daytime temperature levels. High variability in monthly and seasonal rainfall was also found in the Cardamom Hills (Murugan et al., 2012; 2017; 2022). The extreme rainfall events occurred during the recent decades on seasonal and monthly scales. The asymmetrical nature of changes in surface air temperature is more important for crop phenology, physiology, and yield.All the above along with relative and other humidities, have had significant implications on water resources, structure, and functions of forest trees as well as on cardamom yield, either directly or indirectly affecting the overall sustainability of cardamom production systems in Cardamom hills.

Increasing incidence of pests and diseases

Incidence and intensity of pests and diseases will be more in the coming years due to the changing climate. Minor insect pests and diseases may attain the status of major insect pests and diseases, while at the same time, the emergence of new ones can be expected. Chemical use efficiency in the hot spots is more likely to be lowered due to climate change and intense rainfall.

Increasing deforestation

There is increasing deforestation in the Cardamom Hills and even in non-traditional areas where cardamom cultivation is expanding in Idukki. Because of deforestation, there is increasing degradation of the soil and the environment, besides the increased prevalence of pests and diseases. This will, in turn, increase the cost of production by increasing the cost incurred on irrigation and plant protection.

Crop diversification

It cannot be a solution on a long-term basis if the aim is long-term sustainability of the cardamom ecosystem. The crop diversification in CHR will not support cardamom farmers on a long-term basis as the climatic requirements of alternate crops like black pepper and coffee are different for different phenological events. Crop diversification or intercropping with coffee and black pepper will adversely affect all crops on a long-term basis, which could also result in the degradation of forests, as what has happened in lower Palani Hills of Tamil Nadu.

Increasing risk in cardamom cultivation

The above developments will increase the physical and biological risks in cardamom cultivation.

Suggestions to overcome climate change issues

Need for improved risk management practices

There is a need for improved risk management practices in cardamom hot spots to attain agricultural and environmental sustainability. A realistic crop insurance model which should be based on real-time data on weather parameters, cost of cultivation, and average net returns needs to be developed. Localized crop damages due to extreme weather events also need special attention in the cardamom insurance model. There will be many localized calamities that will not be recorded by the weather stations. There are many pests and diseases for cardamom which are developed in a congenial climate in the cardamom ecosystem. The climatological peculiarities in a hilly terrain need to be properly considered for a realistic crop insurance model. Season-wise rainfall needs to be considered and the stage of crop or whether the crop season is peak or the crop is in resting stage all need to be

considered while formulating the insurance policy. As the establishment and maintenance costs incurred per hectare of cardamom are very high and the loss of income per hectare will also be considerably high, the insurance claim provided should be sufficient enough to cover the loss.

Prevention of deforestation

As cardamom and cardamom forests are inseparable, deforestation in the CHR should be effectively prevented (Murugan et al., 2023).

8. Deregulation of cardamom trade

Advantages of deregulation in cardamom trade

(a) The farmers need the Cardamom Registration (CR) Certificate for growing as well as selling cardamom. Nowadays the certificate is granted permanently to farmers with land rights or *pattayam*. Many farmers who are having problem with *pattayam* cannot obtain the CR and hence cannot take cardamom and sell it to auctioneers. They are forced to sell to village traders or the village traders procure from farmers. This problem is also faced by growers who are having cultivation in leased lands. If cardamom trade is deregulated these farmers will be able to sell openly and hence will be benefitted.

(b) Farmers will have the freedom to sell to any buyer of their choice.

(c) Farmers may get immediate payment for their product.

(d) The farmers will be exempted from paying the commission to auctioneers.

Disadvantages of deregulation in cardamom trade

(a) Cardamom is a very high-value crop and marketing system is oligopsonistic in nature with few buyers or traders. These channels have developed over many years. The payment to the farmers is secured as the trade is happening under the strict supervision of the Spices Board. The entry of functionaries in cardamom marketing and trade in the form of dealers or auctioneers or exporters is also effectively monitored and controlled by licensing. Once decontrolled many with vested interests may enter the business and destroy the credibility of the marketing system. In the existing regulated system of marketing, there are no unknown or unidentified buyers as all of them need to register with the Spices Board. The producers don't have to worry about the identity of the buyers and hence the risk for the farmers is also very less.

(b) The trade of cardamom has been happening on a credit basis and the payment for the sellers are made with a delay. Even if deregulated, this delay in payment of proceeds may remain or even increase.

(c) Cardamom is a commodity that is facing a lot of volatility in prices, and even though the present marketing system has issues, deregulating the trade will completely expose it to price fluctuations which will be very intense and repercussions of which will be extreme. Similar issues have happened after the liberalization and allowing of 100 percent free sale quota for coffee during the early 1990s. Even though initially prices increased, the prices became highly volatile in the subsequent years.

(d) After the passing of the recent farm bills, many online marketing firms involved in trade of small cardamom were initiated. There are reports that these online firms have delayed the payment of sale proceeds to farmers by more than 45 days. As these firms are not under the control of the Spices Board, their activities cannot be effectively monitored and they cannot be penalized if they default in payment of sale proceeds. The regulated marketing system ensures the payment of sale proceeds to farmers within ten days after deducting one percent commission and the GST. This happens to be the responsibility of the auctioneers, not the farmers and hence, it is the best for the farmers as there is no risk for them.

(e) For increasing internal consumption as well as protecting the interests of the cardamom farmers, the present regulated system of marketing should be continued.

Role of the Government of Kerala

(a) Considering the economic, social, and ecological significance of small cardamom in Kerala, the Government of Kerala, through the Department of Agriculture and Farmers' welfare must take a proactive role in the cardamom sector by providing support for research and development of the industry. As the cultivation of small cardamom is mostly confined only to a small geographical region in Kerala, it should be protected and sustained by providing sufficient support and timely incentives for planting materials, inputs, low-cost technology, irrigation structures, and spraying equipments. The sanction process for availing of the subsidies should be made paperless since most farmers are at present spending too much time on this process.

(b) The awareness, perception, and capacity of farmers on sustainable cardamom production should be increased by conducting seminars and

training programmes on pesticide and fertilizer usage, soil and water conservation, soil protection, and other conservation practices through the Department of Agriculture and Farmers' welfare. Farmers should be trained and informed about the proper usage of chemicals and, encouraged to use only recommended pesticides or safe botanicals and bioagents.

(c) The use of the chemicals in small cardamom cultivation should only be based on extension advisory services of the state and central government development departments or research institutions including Kerala Agricultural University. Many pesticides which have not been recommended for spices have been detected from samples of cardamom. Many farmers still depend on pesticide dealers for getting information regarding the choice of chemicals for pest management. This highlights the need for refocusing the information dissemination system and effective monitoring. Providing soil testing-based recommendations for individual farmers can help in reducing the excessive use of fertilizers. Government should ensure free soil testing for farmers, at least based on the size of the landholdings. Currently, the government alternatives are the least effective for farmers as there are delays in obtaining the analyzed results. Expert systems should be developed exclusively for cardamom to provide online recommendations on plant protection and crop management. The pests and diseases should be forecasted and prophylactic monthly recommendations should be provided on the basis of these forecasts. The use of banned pesticides in cardamom which are brought from neighboring states, especially Tamil Nadu, need to be strictly prohibited.

(d) The quality of the inputs used in cardamom should be effectively monitored, and the prices of inputs also need to be effectively controlled. The bio-inputs are being sold at different prices, hence the scope for the unification of prices should be explored and ceiling prices for inputs need to be announced by the government. The Government should ensure that proper labelling of inputs and proper scrutiny for quality are strictly carried out. The input shops were also found selling inputs claiming them as organic without any quality specifications. Many brands of biofertilizers, manures, etc., are being sold in the market claiming high levels of natural nutrients and minerals. So, specific quality check mechanism is to be enforced to ensure the quality of such materials. The farmers should be taught about the usage of biocontrol agents and the supply of bio-inputs should also be made through government agencies. There is a need to control the aggressive selling practices of pesticide dealers. Strict and regular monitoring and checking are required on the quality, promotion, pricing, and sales of plant protection chemicals, especially in Idukki. Training the dealers on the use and misuse of pesticides for the management of pests and diseases in cardamom need to be initiated.

(e) The use of plant protection chemicals for cardamom should be aimed to achieve sustainability in the system through an approach of inclusive Integrated Pest Management (IPM), application and promotion of bio-control agents, and judicious application of plant protection formulations, which can be achieved through a coordinated approach, including effective governance, training, review, and monitoring. There should be regular monitoring for early detection of pests and appropriate responsible management of pests should be followed. Effective, easy, and economical IPM package for pest and disease management, leaving minimal or no residues at final harvest, should be developed. A consortium of registered cardamom farmers for the adoption of IPM package should be formed and uniform adoption of IPM with recommended plant protection chemicals and other inputs among registered farmers should also be ensured. Granting subsidies for safer environment-friendly molecules will definitely increase the usage of those chemicals.

(f) Community action should be facilitated among the small and marginal cardamom growers at grass-root level by forming FPOs.The Department of Agriculture must encourage the formation of FPOs, which could enable the farmers with better bargaining power through collective marketing, storage, and value addition, which would also help the farmers to move up in the value chain. The management of the FPOs needs to be transparent, competent, and business-oriented. FPOs need to be encouraged to enter into tie-ups with consumer groups which can also be facilitated through social networks. Strengthening the value chain of cardamom and forging market linkages should be the priorities to ensure sustainable enhancements in farmers' income. The various institutions involved in the value chain of small cardamom need to follow a system approach and carry out the activities in coordination. The Department of Agriculture needs to take a better role in the value chain of small cardamom.

(g) There should be an exclusive division or wing under the Department of Agriculture to deal with

the marketing of agricultural commodities. The Department of Agriculture in Kerala is presently involved in various developmental activities in agriculture. Because of this, adequate attention is not being paid to developing value chains, particularly activities such as brand building, certification, and strengthening of market infrastructure and market functions. With their busy schedules and responsibilities, the officers of the Department of Agriculture find little time to assist in the marketing of agricultural commodities. The agricultural marketing activities in Kerala State should be strengthened by establishing a separate wing/division to facilitate marketing, with sufficient number of officers in each district. This wing should be part of the Department of agriculture so that there will be proper linkages between production and marketing interventions in the State.

(h) There is a need to make realistic estimations of the demand or consumption, availability or supply, and demand-supply gap of small cardamom. The availability and dissemination of complete and accurate marketing information are crucial to achieving operational and pricing efficiency in the marketing system. Real-time data to assist in planning, purchasing, controlling inventory, planting, and storage need to be provided by developing a Marketing and Information Network System. Through ICT-enabled services, disseminating timely information on agricultural advisories, including weather forecasts, financial services and agricultural marketing including short-term price forecasts to farmers will improve their ability to make informed decisions with regard to production and marketing. The monitoring of domestic and international prices, assessment of future trends/ forecasts, short-term forecasts, etc. are important in decision making. Timely information support on prices behavior, monitoring of input/ output data at the state level, interstate trade information, import/export, etc. are important for framing policies for small cardamom. This information empowers farmers as they are better informed and prepared to utilize their resources efficiently. The possibility of establishing a State Domestic and Export Market Intelligence Cell must be explored and a reliable price discovery mechanism needs to be developed.

(i) Even though out-priced by Guatemala in the international market, the Indian cardamom is in great demand in importing countries because of the intrinsic quality characteristics. The major factor affecting the domestic prices of small cardamom was found to be the export unit value and hence, increasing exports are inevitable for ensuring better prices for cardamom farmers. But, an exorbitant increase in domestic prices of small cardamom will further erode the export competitiveness in the international market. Efforts should be taken to improve trade competitiveness, especially by taking efforts to reduce the cost of cultivation and improve the efficiency of cultivation. Improving the quality of production could also improve the competitiveness of Indian small cardamom in the international market. Following Good Agricultural Practices (GAP) and providing replanting subsidies at a reasonable rate to the farmers will help in increasing the yield and reducing the cost of production. The quality issues, especially the sanitary and phytosanitary issues arising out of the non-judicious use of agrochemicals and artificial colouring have adversely affected the exports of small cardamom from India. The tolerance limits for residues, i.e., the MRL-related issues in cardamom from India, have adversely affected the cardamom exports from India to Saudi Arabia. Even though the prices of cardamom from India are high, it is increasingly in demand in the export market because of its intrinsic quality characteristics. However, the pesticide residues in small cardamom from India have adversely affected the exports from India. Good Agricultural Practices (GAP), formulation of effective organic inputs, and an effective ban on toxic chemicals at the national level could reduce the usage of toxic chemical inputs and resolve the SPS issues.

(j) Developing a traceability system that covers all stakeholders in the cardamom export supply chain including planters and farmers, dealers, auctioneers, Kerala Agricultural University (nodal agency), Department of Agriculture Development and Farmer's Welfare, accredited laboratories, Spices Board, phytosanitary certification agencies, local self-governments, exporters etc. through a centralized web-based monitoring software need to be developed. This will help in better information pass-through along the value chain, which will in turn aid the buyers/consumers to assess food safety and will provide a better price advantage for farmers who produce quality cardamom. The farmers also need to be made aware of the quality issues and required standards of cardamom.

(k) A realistic crop insurance model which should be based on real-time data on weather parameters, cost of cultivation, and average net returns need to be developed. There will be many localized calamities that will not be recorded by the weather stations and such damages due to extreme weather

events also need special attention in the cardamom insurance model. There are many pests and diseases for cardamom which are developed in a congenial climate in the cardamom ecosystem. The climatological peculiarities in a hilly terrain need to be properly considered for a realistic crop insurance model. Season-wise rainfall needs to be considered and the stage of crop or whether the crop season is peak or the crop is in resting stage all need to be considered while formulating the insurance policy. As the establishment and maintenance costs incurred per hectare of cardamom are very high and the loss of income per hectare will also be considerably high, the insurance claim provided should be sufficient enough to cover the loss.

(l) A well-developed sectoral innovation system of cardamom in the state wherein effectively coordinated research and developmental activities with favorable policy outcomes and participatory farmer initiatives would undoubtedly place the cardamom sector of the state in the forefront position among plantation crops.

CONCLUSION

Incidence and intensity of pests and diseases will be more in the coming years due to the changing climate. Minor insect pests and diseases may attain the status of major insect pests and diseases, while at the same time, the emergence of new ones can be expected. Pesticide use on cardamom will be more in the seasons to come. Good agricultural practices as well as organic farming practices including good post-harvest practices must be encouraged among growers. As cardamom and cardamom forests are inseparable, deforestation in the CHR should be effectively prevented. Considering the complexities involved in the marketing and trade of small cardamom, which has evolved and corrected over time, it is strongly recommended that the trade of cardamom, which is a high-value crop with considerable price volatility, should not be deregulated. Instead, multiple modes of marketing as envisaged in the cardamom licensing and Marketing Amendment Rules should be encouraged under the strict supervision and monitoring of the Spices Board. Prevention of severe shade removal on a regular basis and deforestation of the CHR forests must be reduced or prevented as cardamom and cardamom forests are inseparable for their successful coexistence as well as their long term sustainability.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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