Policy Brief

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Research Highlights **Page No.**

NATIONAL RESEARCH PROGRAMME ON PLANTATION DEVELOPMENT (NRPPD)

CENTRE FOR DEVELOPMENT STUDIES

NATIONAL RESEARCH PROGRAMME ON PLANTATION DEVELOPMENT (NRPPD)
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In-house Research

Performance of Self Help Groups (SHGs) of Small Tea Growers (STGs) (Prof. Thiagu Ranganathan & Dr. Sachu Sara Sabu)

Aim of the Study

The study aimed to evaluate the performance of Self-Help Groups (SHGs) and their role in improving the livelihoods and sustainability of Small Tea Growers (STGs) in the Nilgiris district of Tamil Nadu.

Specifically, it sought to:

- Analyse the socio-economic profile and livelihood characteristics of small tea growers
- Examine the economics of tea cultivation, including yield, cost structure, wages, and profitability
- Assess the role of SHGs and identify the determinants of machinery adoption among small tea growers.

Methodology

- The present study is based on primary data collected from Small Tea Growers (STGs) in the Nilgiris district of Tamil Nadu in the year 2023.
- A structured survey schedule was designed in line with the specific objectives of the study to capture comprehensive information on socio-economic characteristics, cultivation practices, institutional participation, and mechanisation.

Sample Design Total sample - **438 respondents** Three major tea-growing blocks: **Kotagiri** (138), **Coonoor** (161), & **Kundha** (139) Among the total respondents, **351 are tea growers**, of which **347** own tea land & **24** cultivated tea on leased-in land.	**Multi-stage Sampling** **Stage 1: Nilgiris District** (Purposive Selection) **Stage 2: Kotagiri, Coonoor & Kundha** (Tea concentration & active SHGs) **Stage 3: Respondent Selection** (Representative Sampling)

Performance of Self Help Groups (SHGs) of Small Tea Growers (STGs) (Prof. Thiagu Ranganathan & Dr. Sachu Sara Sabu)

Findings

- Tea cultivation remains the primary livelihood for 73 percent of households, indicating high dependence on a single income source and vulnerability to price and cost fluctuations.
- Despite being profitable, tea cultivation faces increasing pressure from rising labour and input costs, particularly fertiliser and plucking wages, which significantly affect margins.
- Labour-intensive operations, especially plucking, account for a major share of total costs, with clear gender wage disparities and increasing labour scarcity in certain blocks.
- Mechanisation levels remain low, with only about 17 percent of growers adopting machines for plucking, reflecting continued reliance on manual labour.
- Adoption of machinery is strongly driven by rising labour costs and institutional support, with SHG membership increasing adoption probability by about 10 percent.
- Significant regional disparities exist, with Kundha showing higher productivity, profitability, wage rates, and mechanisation compared to Kotagiri and Coonoor.
- Self-Help Groups (SHGs) play a crucial role in aggregation and marketing, with over 96 percent of growers benefiting from collective leaf collection and improved market access.
- However, SHGs face key challenges, including low access to training (less than 18 percent), uneven leadership participation, and continued dependence on intermediaries.
- Gender roles remain highly segmented, with women concentrated in labour-intensive tasks, though decision-making within households is largely joint, indicating gradual progress towards gender inclusivity.

Performance of Self Help Groups (SHGs) of Small Tea Growers (STGs) (Prof. Thiagu Ranganathan & Dr. Sachu Sara Sabu)

Policy Recommendations

- **Strengthen SHGs** by improving governance, leadership participation, managerial capacity, and member engagement so that they can evolve beyond leaf collection into comprehensive producer institutions.
- **Expand training and extension services** on scientific cultivation, quality improvement, financial management, and business planning to improve productivity and strengthen institutional performance.
- **Promote mechanisation** through financial incentives, custom hiring centres, and easier access to labour-saving machinery to address rising labour scarcity and increasing wage costs.
- **Enhance market efficiency** by strengthening SHG-based collective marketing, improving price transparency, and reducing dependence on intermediaries to increase growers' share in the value chain.
- **Encourage youth participation** in tea cultivation through skill development, entrepreneurship support, and technology-oriented interventions to address the ageing farming population.
- **Promote gender-inclusive development** by recognising women's central role in tea production, ensuring equal access to training, mechanisation, leadership positions, and institutional decision-making within SHGs.
- **Adopt location-specific development strategies.** Significant differences across Kotagiri, Coonoor, and Kundha in SHG performance, mechanisation, labour availability, and institutional participation indicate that a uniform policy approach may not be effective. Future interventions should be tailored to local socio-economic conditions, labour markets, terrain, and institutional capacities to maximise their impact.

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In-house Publications

Vinoj Abraham & Sachu Sara Sabu (2026), Rethinking Kerala's Farming Systems: Diversification through Fruit Crops, Kerala Karshakan, February 2026, Volume 13, Issue 09.

The article examines the need to diversify Kerala's farming systems by promoting fruit crops within homesteads and plantation-based intercropping systems. It argues that the state's increasing dependence on monoculture plantation crops has heightened farmers' vulnerability to market fluctuations, climate risks, and ecological stress. Drawing on recent evidence, the article demonstrates that fruit-based diversified farming systems can improve farm incomes, strengthen nutritional security, enhance biodiversity, and increase climate resilience.

It recommends policy measures including promotion of homestead orchards, expansion of fruit-based intercropping, investment in post-harvest infrastructure and value addition, strengthening Farmer Producer Organisations (FPOs), and reforms in land-use and plantation policies to facilitate crop diversification. The article concludes that fruit crop diversification offers a sustainable pathway for revitalising Kerala's agricultural economy and improving the resilience of smallholder farming systems.

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External Research Articles

Economic Factors Influencing the Price of Rubber for Forecasting Rubber Prices Using the Box-Jenkins Technique

RUBBER

Tachochalalai, S., Yakean, S., Suwannatippayachot, S., Supanyo, P., Pommi, C., & Pugatekaew, K. (2026)

POLICY IMPLICATIONS

Policymakers should closely monitor crude oil prices, trade flows, and exchange rate movements as part of rubber market stabilization strategies. Strengthening market information systems and disseminating timely price forecasts can help farmers, traders, and processors make informed production and marketing decisions. Efforts should also focus on improving value addition in the rubber sector through downstream processing industries, thereby reducing dependence on volatile international commodity markets. The adoption of reliable forecasting tools can further support price risk management and improve income stability for rubber producers.

Aim of the paper

The study examines the macroeconomic factors affecting rubber concentrated latex prices in Thailand and develops a forecasting model for predicting rubber prices. The objective is to identify the key economic variables influencing rubber prices and to apply the Box-Jenkins technique to forecast future price movements, thereby supporting better decision-making among market participants.

Findings

The study finds that crude oil prices, exchange rates, imports and exports of rubber products significantly influence rubber concentrated latex prices in Thailand. Among these factors, crude oil prices and exports of rubber products have the strongest positive impact on rubber prices. The analysis shows that macroeconomic variables explain about 66.3 percent of the variation in rubber prices. The study also demonstrates that the Box-Jenkins (1,1,0) forecasting model provides highly accurate price predictions, with forecast results indicating relatively stable rubber prices during the forecast period. The findings suggest that monitoring key economic indicators can help reduce uncertainty and improve risk management in the rubber sector.

Method of Study

The study used monthly data on rubber concentrated latex prices and selected macroeconomic variables from January 2011 to December 2024, along with daily rubber price data from January 2017 to March 2025. Data were collected from the Rubber Authority of Thailand, the Rubber Intelligence Unit, and Investing.com. Pearson's correlation analysis and multiple regression models were employed to identify the factors influencing rubber prices. The Box-Jenkins (ARIMA) forecasting technique was then applied to predict future rubber price movements and evaluate forecasting accuracy.

Reference

Tachochalalai, S., Yakean, S., Suwannatippayachot, S., Supanyo, P., Pommi, C., & Pugatekaew, K. (2026). Economic factors influencing the price of rubber for forecasting rubber prices using the Box-Jenkins technique. Research on World Agricultural Economy, 7(1); 400–413.

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https://doi.org/10.36956/rwae.v7i1.2464

NATIONAL RESEARCH PROGRAMME ON PLANTATION DEVELOPMENT (NRPPD)
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External Research Articles

Sunk Costs, Path Dependencies and Non-farm Employment among Smallholder Rubber Farmers

RUBBER

Min, S., Yang, M., Jia, Q., & Waibel, H. (2026)

POLICY IMPLICATIONS

Policies should promote livelihood diversification among rubber-growing households through training in alternative crops, livestock activities, and nonfarm employment skills. Strengthening farmer organizations, labour cooperatives, and community networks can improve access to information, employment opportunities, and support systems. Investments in rural transportation infrastructure are also essential to reduce mobility constraints and improve access to non-farm labour markets. Targeted interventions should focus particularly on households that are highly dependent on rubber cultivation, socially isolated, and located in remote areas, as these groups face the greatest barriers to livelihood transition.

Aim of the paper

The study examines how sunk costs and path dependencies in rubber cultivation influence the participation of smallholder rubber farmers in non-farm employment. It aims to understand why rubber farmers continue to exhibit low levels of non-farm employment despite prolonged periods of low rubber prices and to identify the factors that constrain livelihood diversification.

Findings

The study finds that both sunk costs and path dependencies significantly reduce the likelihood of smallholder rubber farmers participating in non-farm employment. Large investments in rubber cultivation and long years of engagement in rubber farming create a "lock-in" effect that discourages farmers from shifting to alternative livelihood opportunities. The analysis also reveals a significant interaction effect, whereby stronger path dependencies intensify the negative impact of sunk costs on non-farm employment decisions. These effects are particularly pronounced among households that rely solely on rubber cultivation, have weak social networks, and live in villages with poor transportation infrastructure. The study concludes that low non-farm employment among rubber farmers is not merely a response to market conditions but is reinforced by long-term economic and behavioural constraints.

Method of Study

The study uses a balanced panel dataset of 612 rubber-growing households from Xishuangbanna (XSBN), Yunnan Province, China, collected through three survey rounds conducted in 2013, 2015, and 2019. A Mundlak-adjusted Random Effects Logit Model was employed to estimate the effects of sunk costs and path dependencies on nonfarm employment. Heterogeneity analyses were conducted based on livelihood diversification, social networks, and road infrastructure.

Reference

Min, S., Yang, M., Jia, Q., & Waibel, H. (2026). Sunk costs and path dependencies in rubber cultivation: Implications for non-farm employment among smallholder rubber farmers. Forest Policy and Economics, 184, 103723.

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https://doi.org/10.1016/j.forpol.2026.103723

NATIONAL RESEARCH PROGRAMME ON PLANTATION DEVELOPMENT (NRPPD)
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External Research Articles

Teatime Tales: A Deep Dive into the social sustainability of the tea garden ecosystem

TEA

Basak, A., & Verma, S. K. (2026)

POLICY IMPLICATIONS

Policies should prioritise worker-centred approaches that improve occupational health, workplace safety, and social well-being in tea plantations. Provision of protective equipment, sanitation facilities, and accessible healthcare services should be strengthened to reduce health risks faced by workers. Training programmes should be introduced to improve workers' skills, awareness of labour rights, and safe handling of agricultural inputs. Special attention should be given to addressing gender inequalities through equal opportunities, income autonomy, and greater participation of women in decision-making processes.

Aim of the paper

The study examines the working conditions, ergonomic risks, gender-based challenges, and social sustainability issues faced by workers in small and medium-sized tea gardens in Assam, India. It aims to understand how labour conditions, workplace practices, and socio-economic factors influence the health, well-being, and quality of life of tea garden workers through the lens of social sustainability.

Findings

The study finds that tea garden workers face multiple social sustainability challenges, including hazardous working conditions, inadequate healthcare facilities, poor sanitation, low wages, and limited opportunities for skill development. Women workers experience additional burdens due to gendered divisions of labour, lower decision-making power, and restricted control over income. The research highlights significant ergonomic concerns such as repetitive work, heavy load carrying, prolonged standing, exposure to chemicals without protective equipment, and musculoskeletal health problems. The findings further reveal that workers have limited awareness of their rights and little influence over organisational decisions.

Method of Study

The study adopts a qualitative research approach combining direct workplace observations, semi-structured interviews, and thematic analysis. Data were collected from workers and stakeholders in small and medium-sized tea gardens in Assam. The findings were analysed using the five principles of social sustainability proposed by Missimer et al. (2017), focusing on health, influence, competence, impartial treatment, and meaning-making. The study also incorporates an ergonomic and human factors perspective to assess workplace challenges and labour conditions.

Reference

Basak, A., & Verma, S. K. (2026). Teatime Tales: A Deep Dive into the social sustainability of the tea garden ecosystem. International Journal of Industrial Ergonomics, 111, 103841.

Read more

https://doi.org/10.1016/j.ergon.2025.103841

Exploring the dynamics between Tea yield and Wages in Sivasagar District Assam: The Toda – Yamamoto Approach

TEA

Jain, G., & Sharma, B. (2026)

POLICY IMPLICATIONS

Adopt a balanced policy approach that simultaneously promotes tea productivity growth and ensures fair, timely wage payments to workers. Improve unsafe working conditions to reduce working hours and provide safety equipment to boost worker motivation and productivity. Address persistent gender wage gaps: women constitute over 50% of the workforce yet earn far below the minimum needed for basic living costs. The Government and NGOs should collaborate to tackle wage theft, irregular payments and poor labour administration in tea estates. Although support seasonal and temporary workers with off-season income security schemes.

Aim of the paper

The study investigates about the dynamic causal relationship between tea yield (labour productivity) and wages of tea garden workers in Sivasagar district of Assam. Despite Assam contributing over 52% of India's total tea production and the industry employing more than 6.86 lakh workers the direction of influence between productivity and worker wages has remained empirically unexplored. The study aims to provide evidence-based guidance to policymakers on balancing industrial profitability with the welfare of tea garden workers.

Findings

The findings show that the Tea yield significantly Granger-causes wages (Wald χ^2 = 8.343, p = 0.039). Higher productivity strengthens tea estate profitability, enabling management to provide better wage structures for workers. Wages strongly Granger-cause tea yield (Wald χ^2 = 28.150, p = 0.000). Although Better wages can improve workers nutritional intake and financial stability which in turn boost labour productivity. Both tea yield and wage series are integrated of order I (1) which is non-stationary at levels and with intercept and trend under both categories namely with intercept but stationary at first difference which is confirmed by the Phillips-Perron test at 1%, 5% and 10% significance levels.

Method of Study

The study used annual data on tea yield (kg/ha) and average daily wages (₹) of plantation workers in Sivasagar District, Assam collected from the (OGD) Platform. Stationarity was assessed using the Phillips-Perron (PP) test. The Toda-Yamamoto (1995) Granger non-causality procedure was then applied using a Vector Autoregressive (VAR) model estimated via the Seemingly Unrelated Regression (SUR) technique. Optimal lag length (k = 2) was selected using AIC and FPE criteria, and the augmented VAR of order 3 (p = k + d max) was used to test causality by the Wald test with χ^2 distribution.

Reference

Jain, G., & Sharma, B. (2026). Exploring the Dynamics Between Tea Yield and Wages in Sivasagar District, Assam: The Toda-Yamamoto Approach. Indian Journal of Agricultural Research, 60(4), 621-626:.

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https://indianjournals.com/article/ijar2-60-4-020

Smallholder coffee farmers' preferences for partnership scheme attributes: a case of geographical indication coffee in Semende, Indonesia

COFFEE

Hanapi, S., Khaliqi, M., Alfayanti, A., Malau, L. R. E., Laksono, P., Hutapea, Y., Permadi, D. B., & Ulya, N. A. (2026)

POLICY IMPLICATIONS

Policies should promote the adoption of labour-saving pruning methods such as cyclic and rock-n-roll pruning, particularly in regions facing labour shortages. Extension programmes should provide training on high-density planting systems and improved canopy management practices to enhance productivity and profitability. Research and development efforts should continue to refine location-specific pruning techniques suitable for different coffee-growing regions. Supporting the adoption of efficient production practices can help reduce cultivation costs, improve labour productivity, and strengthen the long-term sustainability of India's coffee sector.

Aim of the paper

The study evaluates the impact of modified pruning methods and planting systems on the growth, yield, labour use efficiency, and economic performance of Arabica coffee (cv. Chandragiri) in India. The objective is to identify cultivation practices that can improve productivity while reducing labour requirements and production costs in coffee plantations.

Findings

The study finds that modified pruning methods, particularly cyclic and rock-n-roll pruning combined with high-density planting systems, significantly improve coffee productivity and labour efficiency. The hedge-row planting system with cyclic pruning recorded the highest clean coffee yield of 1,316 kg per hectare, compared with 797 kg per hectare under the traditional pruning and planting system. Modified pruning methods also reduced labour requirements by about 22–55 percent, helping to address labour shortages in coffee plantations. Economic analysis shows that the hedge-row system with cyclic pruning generated the highest net returns and a benefit-cost ratio of 1:2. The results indicate that modified pruning and planting systems can increase productivity, reduce production costs, and improve profitability without compromising yield.

Method of Study

The study was conducted at the Central Coffee Research Institute, Karnataka, India, over nine consecutive years from 2010 to 2018. A Randomized Complete Block Design (RCBD) with seven treatment combinations and three replications was used. Different planting systems and pruning methods were evaluated for their effects on growth parameters, clean coffee yield, labour use efficiency, and economic returns. Statistical analyses included Analysis of Variance (ANOVA) and correlation analysis to examine relationships between growth characteristics and yield performance.

Reference

Hanapi, S., Khaliqi, M., Alfayanti, A., Malau, L. R. E., Laksono, P., Hutapea, Y., Permadi, D. B., & Ulya, N. A. (2026). Smallholder coffee farmers' preferences for partnership scheme attributes: A case of geographical indication coffee in Semende, Indonesia. Cogent Food & Agriculture, 12(1), 2616069.

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https://doi.org/10.1016/j.scienta.2020.109764

NATIONAL RESEARCH PROGRAMME ON PLANTATION DEVELOPMENT (NRPPD)
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External Research Articles

Situating climate change narrative for conceptualizing adaptation strategies: a case study of coffee growers in South India

COFFEE

Ogra, A. (2022)

POLICY IMPLICATIONS

Climate adaptation policies for coffee-growing regions should recognize farmers' lived experiences and locally situated knowledge alongside scientific climate information. Adaptation measures that overlook farmer agency and trust are unlikely to succeed. The Rainfall Insurance Scheme (RISC) should be redesigned through transparent, participatory rainfall measurement and index calibration. Strengthening local extension services, community-based weather advisories, and farmer–scientist collaboration can bridge scientific assessments with local knowledge, improving the relevance, trust, and effectiveness of climate adaptation strategies.

Aim of the paper

This paper argues that adaptation strategies must be grounded in everyday lived experience rather than abstract climate science, using coffee growers in South India as a case study of how farmers understand and respond to rainfall variability, their primary climate risk. Drawing on Donna Haraway's framework of situated knowledge, the study examined growers' decision-making around rainfall insurance and irrigation systems, reconceptualizing adaptation not as a purely technical adjustment but as a process rooted in agency and trust.

Findings

The study found that 63% of growers preferred sprinkler irrigation only to avoid both Rainfall Insurance Scheme for Coffee (RISC) and rain-gun technology to preserve their own agency over rainfall-based decisions. Only 2% of growers opted for insurance alone and just 7% chose both RISC and irrigation. Rain-gun irrigation and RISC reconfigure growers' relationship with rainfall is transferring the agency of knowledge from the grower to a distant opaque scientific system. Although in a situated context climate change for south Indian coffee growers is fundamentally an issue of agency and trust not of scientific information deficit.

Method of Study

This study was based on fieldwork conducted across two states (Karnataka and Tamil Nadu) covering four districts, eight taluks and forty-one villages in the coffee-growing Western Ghats over a seven-month period between 2011 and 2015. Data were collected through a three-phase longitudinal design using ethnographic fieldwork, semi-structured interviews, a structured grower survey, scenario analysis and a situated knowledge framework. A total of 82 coffee growers participated in in-depth interviews 62 growers responded to the structured survey and an additional 54 interviews were conducted with stakeholders and traders..

Reference

Ogra, A. (2022). Situating climate change narrative for conceptualizing adaptation strategies: a case study of coffee growers in South India. Regional Environmental Change, 22(2), 72.

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https://link.springer.com/article/10.1007/s10113-022-01919-x

NATIONAL RESEARCH PROGRAMME ON PLANTATION DEVELOPMENT (NRPPD)
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External Research Articles

Convergence of Climate Change Relevant Decisions and Bounded Livelihood Choices of Smallholder Black Pepper Farmers in Kerala, India

SPICES

Smija, P. K., Gopinath, P. P., Rose, C. D. N., & Stephen, R. (2026)

POLICY IMPLICATIONS

Policies should encourage diversified black pepper farming systems that integrate complementary crops such as cardamom, coconut, arecanut, and other tree spices to reduce farmers' exposure to climatic and market risks. Extension services should promote organic farming practices and support the conservation of locally adapted pepper varieties that enhance resilience to environmental stress. Greater institutional efforts are needed to validate and disseminate improved climate-resilient technologies so that farmers can make informed adoption decisions. Strengthening farmer producer organizations, market linkages, and climate advisory services can further improve adaptive capacity and livelihood sustainability among black pepper growers. Policymakers should also promote region-specific climate adaptation strategies that reflect local ecological conditions and farmer preferences.

Aim of the paper

The study investigates the climate adaptation strategies adopted by smallholder black pepper farmers in Kerala and examines how farmers prioritize different climate-resilient livelihood choices. It aims to identify the combinations of adaptation practices that farmers consider most effective for sustaining black pepper cultivation under conditions of climate variability, environmental stress, and market uncertainty.

Key Findings

The study finds that farmers strongly prefer adaptation strategies that combine organic farming practices, diversified cropping systems, and the conservation of climate-resilient local pepper varieties. The most preferred resilience strategy consists of organic cultivation, cultivation of multiple high-yielding varieties along with selected landraces, and a three-tier diversified cropping system integrating cardamom, tree spices, arecanut, and coconut. Farmers perceive organic farming as an effective long-term strategy for improving sustainability despite higher maintenance costs. The findings also reveal limited acceptance of grafted pepper plants due to uncertainty regarding their performance and lack of institutional validation. Diversified farming systems are widely preferred because they reduce both climatic and market risks by creating multiple sources of income.

Method of Study

The study adopted a mixed-methods research design in the major black pepper-growing districts of Idukki and Wayanad, Kerala. A random sample of 198 smallholder farmers owning five acres or less was selected, of which 150 valid responses were used for analysis. Data were collected during 2022–23 and 2023–24 through structured interviews and Best–Worst Scaling (BWS) choice experiments. Conditional logistic regression and attribute-level preference analysis were employed to evaluate farmers' preferences for different climate adaptation strategies and livelihood choices.

Reference

Smija, P. K., Gopinath, P. P., Rose, C. D. N., & Stephen, R. (2026). Convergence of climate change relevant decisions and bounded livelihood choices (CCRDs) of smallholder black pepper farmers in Kerala, India. Regional Environmental Change, 26, 102.

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https://doi.org/10.1007/s10113-026-02584-0

NATIONAL RESEARCH PROGRAMME ON PLANTATION DEVELOPMENT (NRPPD)
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External Research Articles

Climate Resilience of Large Cardamom Cultivars in Sikkim Himalaya: Insights from Participatory MCDM and Indigenous Knowledge of the Lepcha Community

SPICES

Lepcha, J., Gaira, K. S., Kafley, N. S., Bhujel, D., Joshi, R., & Rawat, S (2026)

POLICY IMPLICATIONS

Policies should promote the cultivation of climate-resilient large cardamom cultivars such as Seremna to enhance the adaptive capacity of himalayan farming systems. Extension programmes should strengthen farmer awareness regarding cultivar selection, climate adaptation, and disease management practices. Indigenous knowledge systems should be formally incorporated into agricultural research and climate adaptation planning, as they provide valuable insights into locally adapted farming strategies. Research institutions and government agencies should support participatory varietal evaluation and conservation of locally adapted cardamom germplasm. Strengthening climate-resilient agroforestry systems can further improve livelihood security, biodiversity conservation, and the long-term sustainability of cardamom cultivation in the Eastern Himalayas.

Aim of the paper

The study evaluates the climate resilience of six large cardamom cultivars cultivated in the Sikkim Himalaya by integrating Indigenous Knowledge (IK) of the Lepcha community with a Multi-Criteria Decision-Making (MCDM) approach using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). The objective is to identify climate-resilient cardamom cultivars that can support sustainable production and livelihood security under changing climatic conditions.

Key Findings

The study finds that Seremna is the most climate-resilient large cardamom cultivar, achieving the highest resilience score (Closeness Coefficient = 0.94) among the six cultivars evaluated. Seremna performs consistently well in productivity, climate adaptability, environmental tolerance, disease and pest resistance, and lifespan. Dzongu Golsey and Sawney exhibit moderate resilience and are suitable for cultivation in areas facing moderate climate risks. In contrast, Ramsey, Varlangey, and Ramla show lower resilience and are more vulnerable to climate variability and disease outbreaks. The study highlights that climate adaptability is considered the most important resilience criterion by farmers, followed by productivity and environmental tolerance.

Method of Study

The study was conducted in the Dzongu region of Mangan District, Sikkim, involving 100 large cardamom farmers from major cardamom-growing villages. Participatory Rural Appraisal (PRA) tools, Focus Group Discussions (FGDs), household surveys, and expert consultations were used to identify six cardamom cultivars and five climate resilience criteria: productivity, disease and pest resistance, lifespan, climate adaptability, and environmental tolerance. The criteria were weighted using community-based ranking methods and analysed using the TOPSIS model to determine the overall resilience ranking of each cultivar.

Reference

Lepcha, J., Gaira, K. S., Kafley, N. S., Bhujel, D., Joshi, R., & Rawat, S. (2026). Climate resilience of large cardamom cultivars in Sikkim Himalaya: Insights from participatory MCDM and indigenous knowledge of the Lepcha community. Agroforestry Systems, 100, 17.

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